FINAL
Stream and Wetland Mitigation Plan
UT to Town Creek Restoration Project - Option A

Stanly County, North Carolina
NCEEP Project ID No. 94648, Contract No. 003277
Yadkin Pee-Dee River Basin: 03040105060-040
USACE Action ID No: SAW-2013-01280

Prepared for:

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program (NCEEP)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III 12.22.14

December 2014

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DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

December 17, 2014

Regulatory Division

Re: NCIRT Review and USACE Approval of the UT to Town Creek Stream and Wetland Mitigation Plan; SAW-2013-01280; NCEEP Project # 94648

Mr. Tim Baumgartner
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Ecosystem Enhancement Program (NCEEP) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the UT to Town Creek Stream and Wetland Mitigation Plan, which closed on October 31, 2014. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several minor issues were identified, as described in the attached comment memo, which must be addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) Application for Nationwide permit approval of the project along with a copy of this letter. Issues identified above must be addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed. Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-846-2564.

Sincerely,

TUGWELL.TODD.JASON.1048429293
2014.12.17 12:37:53 -05'00'

Todd Tugwell
Special Projects Manager

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
CESAW-RG-R/Elliott

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Tugwell December 2, 2014

MEMORANDUM FOR RECORD

SUBJECT: UT to Town Creek - NCIRT Comments During 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCEEP Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCEEP Project Name: UT to Town Creek Stream and Wetland Restoration Project, Stanly County, NC

USACE AID#: SAW-2013-01280
NCEEP #: 94648

30-Day Comment Deadline: 31 October, 2014

Todd Bowers, USEPA, 17 Oct, 2014:

1. The applicant has omitted the Credit Release Schedule for wetland and stream credit units.
2. Recommend a 7-year monitoring period for vegetation in those areas where forest wetlands (headwater or bottomland hardwoods) are being established. This is per guidance dated October 10, 2008 titled Revised Credit Release Schedule for Forested Wetlands and in accordance with 33 CFR Part 332, Compensatory Mitigation for Losses of Aquatic Resources.
3. While I agree completely with the amount of extra credit generated by the extra buffer widths along Reaches 1-3, I would like some clarity on how the extra width was calculated. Was it from perpendicular lines from valley centerline, top of bank, or stream beltwidth. I recommend the use of beltwidth for sinuous streams such as this to determine buffer width averages.
4. Recommend a figure or map showing the areas where upland, riparian, and forested wetland plantings will occur. Vegetation plots established for monitoring should adequately cover each of these different vegetation communities.
5. Page 3-8: Error in footnotes for Reach 2 in Table 3.4. Need to add footnotes 3 and 4 where appropriate.

6. Page 7-23: Existing conditions state that "wetlands are extremely impaired" yet they scored High to Medium per the NCWAM evaluations. Can the applicant please provide clarity in this situation?
7. Page 7-30 and 31: Stream buffer vegetation refers to Table 7.6. This should be corrected to Table 7.7.
8. Page 7-32: Table 7.7 in Constructed Wetlands the latin name for sweetflag is shown as Nyssa sylvatica. This should be corrected to Acorus calumus.

Travis Wilson, NCWRC, 30 October, 2014:

1. While WRC agrees with the incorporation of the two wetland BMPs into the plan, the design as shown as well as the steep topography on reach 7 give concern that these will function more like traditional storm water retention basins and likely require routine maintenance. The design and location of these BMPs should be such that little to no maintenance is required.

Ginny Baker, NCDWR, 31 October, 2014:

1. Notate on Figure 6 that area upstream of Reach 4, 5, and 7 is non-credited preservation as noted on pg 7-5 in Notes section.
2. Wetland indicator status listed on pages 7-31 and 7-32 should be updated to current National Wetland Plant List for the EMP region for 2014 which does not have "+" and "-" designations. Please correct the following: Liriodendron tulipifera to FACU, Quercus phellos to FAC, Alnus serrulata to OBL, Sambucus Canadensis to Sambucus nigra FAC, Nyssa sylvatica to FAC, Hibiscus moscheutos to FACW, Elymus virginicus to FACW, Tripsacum dactyloides to FACW, Coreopsis lanceolata to FACU, Dichanthelium clandestinum to FAC. http://rsgisias.crrel.usace.army.mil/nwpl_static/viewer.html#
3. DWR will require in our permit conditions that a monitoring gage be placed at the head of and lower end near the confluence for all intermittent streams that are to be restored with Priority 1 techniques that will raise the stream bed and potentially reduce base flow. Reach 7.
4. A vegetation monitoring plot should be added (or moved into) the enhancement area.
5. DWR recommends using burlap, or more natural light weight core fiber material that would degrade quicker rather than geo-tech fabric for soil lifts and grade control/cross vanes etc.
6. DWR recommends leaving some of the stumpage on site rather than complete removal during grading process to promote regrowth.
7. DWR recommends the use of "screenings" from rock quarry for use in riffle pools and backfilling cross vanes, etc. This material fills the gap between #57 stone and sand/soil mediums.

Todd Tugwell, USACE, 2 December, 2014:

1. The mitigation plan indicates 5 years of monitoring for both streams and wetlands, however we have moved to 7 years of monitoring for both per the NCEEP guidance from 2011, and earlier for forested wetlands. Please updated the plan to meet current

monitoring timeframes or provide justification as to why only 5 years of monitoring is proposed.

2. The plan indicates that areas proposed for wetland creation will have to be graded to expose buried hydric soils, however it is not clear how much grading is required, only that it may be more than 12 inches. Please note that extensive grading to create wetlands can result in soils that are compacted and have low vegetation growth, which is one of the reasons for the lower ratio for wetland creation.
3. Table 7.5 appears to be incorrectly referenced in the discussion on page 7-24 as table 7.4. This table shows current hydroperiods generally above 20% on the restoration areas on site, yet the proposed performance standard is only 9%. Please consider a higher performance standard for restoration areas, supported by the reference condition and existing conditions on the site.
4. Buffer widths on the site are proposed to be wider than the standard 50 feet, and additional credit is requested based on draft guidance put out for public notice by the District in 2010. We have agreed to increased credit for wider buffers in certain situations; however several requirements have generally applied to this. To begin with, additional credits should not be provided in areas where the wider buffers are also generating wetland credit, which appears to be the case on parts of this site. Additionally, based on comments received from the public notice, we have revised the draft tables associated with wider buffers, which can be supplied to the provider upon request. The modified tables do not provide for extra credit until the buffer is a minimum of 75' in width (in piedmont and coastal counties), additionally the percent increase in credit is greater than in the draft guidance used by the providers. Also, the calculations provided in Figure 8 are not sufficient to determine how the increases were determined (e.g., how average floodplain widths were determined). Finally, there are some segments within these reaches that appear to be at or below 50 feet in width that were averaged into the segment and now are receiving additional credit. (see stations 22+00 to 23+00, and 36+30). If additional credits will be requested for wider buffers, please coordinate with the District to determine the requirements for this.
5. We do not object to increased stream credit from the construction of BMPs on two of the tributaries; however, it is not clear if these BMPs will result in the loss of existing jurisdictional stream, or whether a channel will be maintained through the BMP. How are these structures proposed to benefit the project, and how was it determined how many credits should result from the addition of these structures?

Todd J Tugwell

TUGWELL.TODD.JASON.1048429293
2014.12.02 13:41:05 -05'00'

Todd Tugwell
Special Projects Manager
Regulatory Division

Michael Baker INTERNATIONAL

Michael Baker Engineering, Inc.
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Office: 704.665.2200 | Fax: 704.665.2201

December 23, 2014

Lin Xu, Permit Coordinator and Harry Tsomides, Project Manager
NC Department of Environment and Natural Resources
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Task 3: Response Letter to NCIRT 30-day review comments for the UT to Town Creek Restoration Site – Option A, Stanly County
Yadkin Cataloging Unit 03040105
NCEEP Project ID No. 94648; NCDENR Contract No.# 003277
USACE Action ID No.: SAW-2013-01280
Baker Project No.: 120857

Dear Mr. Xu and Mr. Tsomides:

Please find enclosed the Final Mitigation Plan and our responses to the NCIRT review comments dated December 2, 2014 regarding the UT to Town Creek Restoration Site – Option A Project, located in Stanly County, NC. We have revised Final Draft Mitigation Plan documents in response to the referenced review comments and USACE mitigation plan approval letter dated December 17, 2014. Each comment/response has been grouped per the NCIRT reviewer and is outlined below.

<u>Todd Bowers, USEPA, 17 Oct, 2014:</u>

1. The applicant has omitted the Credit Release Schedule for wetland and stream credit units.

   Response: Though the Credit Release Schedule was not required as an inclusionary item for the previous NCEEP Mitigation Plan Document, Version 1.0 (2010a) which was outlined in the RFP #16-00283, we understand this is a requirement of the recent Mitigation Plan Templates. Therefore, we have revised the Mitigation Plan to include the Credit Release Schedule (Section 2). It is located in Table 2.1 on page 2-2.

2. Recommend a 7-year monitoring period for vegetation in those areas where forest wetlands (headwater or bottomland hardwoods) are being established. This is per guidance dated October 10, 2008 titled Revised Credit Release Schedule for Forested Wetlands and in accordance with 33 CFR Part 332, Compensatory Mitigation for Losses of Aquatic Resources.

   Response: *This project was included under the May 13, 2013 letter from NCEEP to the NCIRT in entitled "EEP sites-seven year monitoring". As described in that letter, the described projects were not contracted for seven years of monitoring under the relevant RFPs. Based on that letter, Baker plans to conduct post-restoration monitoring for wetland related mitigation work for five years as contracted. However, as stated in the*

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May 13, 2013 letter from NCEEP to the NCIRT, "In the fourth year of monitoring, EEP will decide if the specific site may qualify for close out after five successful monitoring years. For those, EEP will submit to the IRT for early closure. For any site that EEP does not think meet early closeout criteria, EEP will contract out to complete the final two years" of monitoring (NCEEP, 2013). A copy of the letter has been included in Appendix K for reference and clarification for the monitoring period rationale has been included in Sections 2.2, 9.3, 10.0 and 10.3 of the Mitigation Plan.

3. While I agree completely with the amount of extra credit generated by the extra buffer widths along Reaches 1-3, I would like some clarity on how the extra width was calculated. Was it from perpendicular lines from valley centerline, top of bank, or stream beltwidth. I recommend the use of beltwidth for sinuous streams such as this to determine buffer width averages.

Response: *Average additional buffer widths were calculated from the top of bank to the easement boundary along the proposed restoration alignment at fifty foot intervals.*

4. Recommend a figure or map showing the areas where upland, riparian, and forested wetland plantings will occur. Vegetation plots established for monitoring should adequately cover each of these different vegetation communities.

Response: *Riparian, upland, wetland planting areas have been added to Figure 7 – Proposed Monitoring Device Locations and are also depicted in sheets 24 – 27 of the plan set. Vegetation plot locations have been strategically placed to include an adequate mix of the vegetative communities. See Figure 7 for reference.*

5. Page 3-8: Error in footnotes for Reach 2 in Table 3.4. Need to add footnotes 3 and 4 where appropriate.

Response: *References to footnotes have been revised to reflect the appropriate citation for Reach 2. Upon review of the footnote references within this table it was noted that Reach 4, 5, 6, and 7 also had citation errors. These errors have also been corrected. Please note that due to plan revisions this table is now referred to as Table 4.4 and is located on pages 4-8 and 4-9.*

6. Page 7-23: Existing conditions state that "wetlands are extremely impaired" yet they scored High to Medium per the NCWAM evaluations. Can the applicant please provide clarity in this situation?

Response: *Overall wetland ratings ranged from Low to High, with Wetlands 3 and 5 receiving a Low rating, Wetlands 2, 4, 6, and 7 receiving a Medium rating, and only Wetland 1 receiving a High rating. Within the project area, the extent of the impairments to each wetland varies. The ratings/conditions relate to the cattle's propensity to use the wetland area in question as a wallowing area and/or evidence that the wetland has been historically ditched. Consequently Wetland 1 was able to achieve a High rating because it is located where cattle do not have access and does not have evidence of ditching. Impairments to Wetland 1 are predominantly caused by frequent bush-hogging and rutting from heavy equipment access.*

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7. Page 7-30 and 31: Stream buffer vegetation refers to Table 7.6. This should be corrected to Table 7.7.

   Response: *References to the buffer vegetation table have been revised; however, due to plan revisions this table is now referred to as Table 8.7 and is located on pages 8-31 through 8-32.*

8. Page 7-32: Table 7.7 in Constructed Wetlands the latin name for sweetflag is shown as Nyssa sylvatica. This should be corrected to Acorus calumus.

   Response: *The latin name for sweetflag has been corrected to Acornus calamus; however, due to plan revisions this table is now referred to as Table 8.7 and sweetflag is referenced on page 8-32.*

<u>Travis Wilson, NCWRC, 30 October, 2014:</u>

9. While WRC agrees with the incorporation of the two wetland BMPs into the plan, the design as shown as well as the steep topography on reach 7 give concern that these will function more like traditional storm water retention basins and likely require routine maintenance. The design and location of these BMPs should be such that little to no maintenance is required.

   Response: *Baker understands that routine maintenance for water quality features can be a concern; therefore, both constructed wetlands have been designed and located to minimize long term maintenance needs by:*
   1. *Extending the conservation easement and buffer plantings approximately 30 feet beyond the footprint of each BMP to allow the buffer vegetation to act as pre-treatment feature for both suspended sediment and nutrient loads,*
   2. *Implementing permanent fencing outside the easement to ensure permanent livestock exclusion, and*
   3. *Providing a stable outlet mechanism/spillway for the BMPs to draw down so as to maintain downstream stream functions while maintaining a storage capacity only to support the permanent pool.*

   In addition, Baker will be providing post-construction monitoring and maintenance, as needed, during the monitoring years thereby facilitating the wetland vegetation to become established and functioning as intended prior to project closeout.

<u>Ginny Baker, NCDWR, 31 October, 2014:</u>

1. Notate on Figure 6 that area upstream of Reach 4, 5, and 7 is non-credited preservation as noted on pg 7-5 in Notes section.

   Response: *As requested, a notation has been added to Figure 6 to stipulate that the areas upstream of the proposed design on Reaches 4, 5, and 7, will include enhancement plantings and be included as part of the conservation easement and permanently fenced, but are not being sought for mitigation credit.*

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2. Wetland indicator status listed on pages 7-31 and 7-32 should be updated to current National Wetland Plant List for the EMP region for 2014 which does not have "+" and "-" designations. Please correct the following: Liriodendron tulipifera to FACU, Quercus phellos to FAC, Alnus serrulata to OBL, Sambucus Canadensis to Sambucus nigra FAC, Nyssa sylvatica to FAC, Hibiscus moscheutos to FACW, Elymus virginicus to FACW, Tripsacum dactyloides to FACW, Coreopsis lanceolata to FACU, Dichanthelium clandestinum to FAC. http://rsgisias.crrel.usace.army.mil/nwp1 static/viewer.html#

   Response: *The Proposed Vegetation Plantings Table has been updated to reflect the current National Wetland Plant List for the Eastern Mountains and Piedmont 2014 Regional Wetland Plant List. Please note that due to plan revisions this table is now referred to as Table 8.7 and is located on pages 8-31 through 8-32.*

3. DWR will require in our permit conditions that a monitoring gage be placed at the head of and lower end near the confluence for all intermittent streams that are to be restored with Priority 1 techniques that will raise the stream bed and potentially reduce base flow. Reach 7.

   Response: *Baker will install a groundwater monitoring well, within the thalweg (bottom) of the downstream portion of the restored intermittent reaches (Reach 6 and 7). In addition, a monitoring gage (pressure transducer) will be installed towards the downstream portion of each restored intermittent reach to document base flow. The devices will be inspected on a quarterly/semi-annual basis to document surface hydrology and provide a basis for evaluating general flow response to rainfall events and surface runoff during various water tables levels throughout the monitoring period. See Figure 7 for the approximate location of the additional devices. References to the implementation of these devices has also been included in Section 10.1.1 on page 10-2.*

4. A vegetation monitoring plot should be added (or moved into) the enhancement area.

   Response: *A vegetation monitoring plot has been relocated to the wetland enhancement area of Wetland 3 as suggested. See Figure 7.*

5. DWR recommends using burlap, or more natural light weight core fiber material that would degrade quicker rather than geo-tech fabric for soil lifts and grade control/cross vanes etc.

   Response: *Baker acknowledges this recommendation and will work with the construction contractor to investigate the feasibility of incorporating this application. It has been our experience that non-woven geotextile fabric is more appropriate and effective at capturing finer material which helps seal/maintain structure integrity longer than burlap/coir fiber material.*

6. DWR recommends leaving some of the stumpage on site rather than complete removal during grading process to promote regrowth.

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Response: *Baker acknowledges this recommendation and will work with the contractor to incorporate this suggestion when feasible during the construction process.*

7. DWR recommends the use of "screenings" from rock quarry for use in riffle pools and backfilling cross vanes, etc. This material fills the gap between #57 stone and sand/soil mediums.

Response: *Baker intends to use suitable on-site stream bed material consisting of fine to medium gravels to back fill and/or top dress riffles and stream structures.*

Todd Tuqwell, USA CE, 2 December, 2014:

1. The mitigation plan indicates 5 years of monitoring for both streams and wetlands, however we have moved to 7 years of monitoring for both per the NCEEP guidance from 2011, and earlier for forested wetlands. Please update the plan to meet current.

Response: *Please see comment response to question 2 under the heading of "Todd Bowers, USEPA, 17 Oct, 2014".*

This letter serves as the formal response to NCIRT comments and shall be submitted in conjunction with the Preconstruction Notification (PCN) for Nationwide Permit (NWP) 27 application approval.

If you have any questions concerning the Final Mitigation Plan, please contact me at 704-665-2206 or via email at ksuggs@mbakerintl.com. With this submittal, we have included six (6) hard copies of the Final Mitigation Plan with NCIRT comments, four (4) copies of the completed PCN, and three (3) CDs with electronic copies of the documents. We look forward to the NWP 27 authorization.

Sincerely,

Kristi Suggs, Project Manager
Michael Baker Engineering, Inc.

Enclosures: Final Mitigation Plan Documents, 401/404 PCN permit application for UT to Town Creek Restoration Site – Option A Project.

FINAL
Stream and Wetland Mitigation Plan
UT to Town Creek Restoration Project – Option A

Stanly County, North Carolina
NCEEP Project ID No. 94648, Contract No. 003277
Yadkin Pee-Dee River Basin: 03040105060-040
USACE Action ID No: SAW-2013-01280

Prepared for:

Ecosystem Enhancement PROGRAM

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program (NCEEP)
1652 Mail Service Center
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Prepared by:

Baker

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December 2014

EXECUTIVE SUMMARY

Michael Baker Engineering, Inc., (Baker) proposes to restore 5,597 linear feet (LF) and enhance 791 LF (444 LF of Enhancement I and 347 LF of Enhancement II) of stream along an Unnamed Tributary (UT) to Town Creek and three additional unnamed tributaries and to restore, enhance, and create 5.12 acres of wetland. Mitigation credit will not be sought for wetland enhancement. In addition, Baker proposes to construct two stormwater wetland best management practices (BMPs) upstream of the mitigation areas and extend riparian buffers along UT to Town Creek in excess of the 50-foot requirement. Additional stream mitigation credit is being sought for the inclusion of the proposed stormwater BMPs and the extended riparian buffer width within the conservation easement.

UT to Town Creek Restoration Site – Option A (Project) is located in Stanly County, approximately 1.7 miles west of the Town of New London, within cataloging unit 03040105, and NC Division of Water Resources (NCDWR) sub-basin 03-07-13 of the Yadkin Pee-Dee River Basin (see Figure 1). The Project is located in a North Carolina Ecosystem Enhancement Program (NCEEP) - Targeted Local Watershed (HUC 03040105060-040), and will involve stream restoration and enhancement and wetland restoration, creation, and enhancement along UT to Town Creek and several of its tributaries. A recorded conservation easement consisting of 25.1 acres will protect all stream reaches, wetlands, constructed wetland BMPs, and riparian buffers in perpetuity. The available hydrology and soil data indicate that there is excellent potential for the restoration of a productive stream and wetland ecosystem.

Based on both the River Basin Restoration Priorities (RBRP) document for the Lower Yadkin – Pee Dee River Basin (NCEEP, 2009) and the Yadkin-Pee Dee River Basinwide Water Quality Plan (NCDENR, 2008), many streams in the Rocky River Watershed (HUC 03040105) are documented as impaired or impacted due to habitat degradation. Stressors identified in the plan include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. As stated in the Basinwide Plan, the watershed naturally consists of erodible soils; therefore, increasing the system's vulnerability to the aforementioned stressors. Activities within the Project area have further promoted erosion and habitat degradation, through the clearing of the upland areas and the riparian zone for pasture grazing, straightening of stream channels and filling in the floodplain to maximize pasture acreage. Additionally, cattle have had access to the all reaches within the Project area for multiple years, and their activities have exacerbated the existing erosion and instability issues.

The Project's stream and wetland components are listed and described in detail in Tables ES-1 and ES-2. The goals for the Project are as follows:

- Improve aquatic and terrestrial habitat through increasing dissolved oxygen concentrations, reduction in nutrient and sediment loading, improving substrate and in-stream cover, and reduction of in-stream water temperature;
- Improve both aquatic and riparian aesthetics;
- Create geomorphically stable conditions along UT to Town Creek and its tributaries through the Project area;
- Prevent cattle from accessing the Project area thereby protecting riparian and wetland vegetation and reducing excessive bank erosion;
- Restore historical wetlands, create new wetlands, and enhance/preserve existing wetlands to improve terrestrial habitat and reduce sediment and nutrient loading to UT to Town Creek and the Little Long Creek Watershed.

To accomplish these goals, the Project will pursue the following objectives:

- Restore, enhance, create, and protect riparian wetlands and buffers to reduce nutrient and pollutant loading by particle settling, vegetation filtering and nutrient uptake;
- Construct wetland BMPs on the upstream extent of Reaches 4 and 7 to improve water quality by capturing and retaining stormwater run-off from the adjacent cattle pastures to allow for the biological removal of nutrient pollutant loads and for sediment to settle out of the water column;
- Restore existing incised, eroding, and channelized streams by creating stable channels with access to their geomorphic floodplains;
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and areas of water re-aeration, and reducing bank erosion;
- Control invasive species vegetation within the Project reaches;
- Establish native stream bank, riparian floodplain, and wetland vegetation, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, shade the stream to decrease water temperature, and provide improved wildlife habitat quality.

Table ES-1 UT to Town Creek Site Project Overview (Streams).
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Reach	Design Approach	Existing Reach Length (LF)	Design Reach Length (LF)	SMU Credit Ratio	Potential SMUs	Stationing	Comment
UT to Town Creek[1]							
1	R-PI	1,181	1,192	1:1	1,192/ 1,273[2]	10+00 to 21+92	Restoration will follow a Rosgen Priority Level I approach in order to provide an adequate floodplain connection and restore appropriate dimension, pattern, and profile.
2	R-PI	1,672	1,833	1:1	1,783/ 1,926[2]	21+92 to 40+26	Restoration will follow a Rosgen Priority Level I approach in order to provide an adequate floodplain connection and restore appropriate dimension, pattern, and profile. Fifty LF of stream have been reserved for a culvert crossing.
3	R-PI/PII	721	803	1:1	803/ 884[2]	40+26 to 48+29	Restoration will follow Rosgen Priority Level I and II approaches in order to provide an adequate floodplain and restore appropriate dimension, pattern, and profile.

Table ES-1 UT to Town Creek Site Project Overview (Streams). UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Reach	**Design Approach**	**Existing Reach Length (LF)**	**Design Reach Length (LF)**	**SMU Credit Ratio**	**Potential SMUs**	**Stationing**	**Comment**
UT to Town Creek[1]							
4	EI	404	444	1:1[3]	444	10+00 to 14+45	Stream Enhancement I is proposed for this reach. Work will include bank sloping, installation of in-stream structures, vegetation planting in the riparian zone, and permanent fencing. A stormwater wetland BMP will be constructed immediately upstream of this reach.
5	EII	324	347	2.5:1	138	10+00 to 13+47	Enhancement II applications will involve control of invasive species vegetation, re-establishment of a buffer, structure installation, and permanent fencing installed outside the easement.
6	R-PI	1,349	1,370	1:1	1,350	14+45 to 28+15	Restoration will follow Rosgen Priority Level I approach in order to provide an adequate floodplain connection and restore appropriate dimension, pattern, and profile. Twenty LF of stream have been reserved for a culvert crossing.
7	R-PI/PII	386	399	1:1	399	10+00 to 14+00	Restoration work will involve a combination of raising the streambed along the reach, installing in-stream structures, and grading a narrow bankfull bench where necessary to provide a floodplain connection. A stormwater wetland BMP will be constructed immediately upstream of this reach.
Total		6,037	6,388		6,109/ 6,414[2]		

Note:
1. Permanent fencing will be installed outside the recorded conservation easement to ensure permanent livestock exclusion from project area.
2. Mitigation credit total accounting for additional riparian buffer width.
3. 1:1 credit ratio is being sought for this enhancement reach because of improved water quality from upstream constructed stormwater wetland BMP (NCIRT, 2013)

Table ES-2 UT to Town Creek Site Project Overview (Wetlands). UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648				
Design Approach	**Area (AC)**	**WMU Credit Ratio**	**Potential WMUs**	**Comment**
UT to Town Creek[1]				
R	2.56	1:1	2.56	Wetland restoration will include site grading, wetland vegetation planting, and cattle exclusion to restore wetland hydrology and function.
C	1.56	3:1	0.52	Wetland creation will include the removal of a depositional sediment layer, site grading, wetland vegetation planting, and cattle exclusion.
E	1.00	-	-	Wetland enhancement will include wetland vegetation planting and cattle exclusion to allow areas of hydric soils to become fully functioning wetlands.
Total	5.12		3.08	
Note: 1. Permanent fencing will be installed outside the recorded conservation easement to ensure permanent livestock exclusion from the project area.				

This document is consistent with the requirements of the federal rule for compensatory mitigation Project sites as described in the 2011 Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14). Specifically the document addresses the following requirements of the federal rule:

(2) *Objectives.* A description of the resource type(s) and amount(s) that will be provided, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project will address the needs of the watershed, ecoregion, physiographic province, or other geographic area of interest.

(3) *Site selection.* A description of the factors considered during the site selection process. This should include consideration of watershed needs, onsite alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site. (See § 332.3(d).)

(4) *Site protection instrument.* A description of the legal arrangements and instrument, including site ownership, that will be used to ensure the long-term protection of the compensatory mitigation project site (see § 332.7(a)).

(5) *Baseline information.* A description of the ecological characteristics of the proposed compensatory mitigation project site and in the case of an application for a DA permit, the impact site. This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s) or the geographic coordinates for those site(s), and other site characteristics appropriate to the type of resource proposed as compensation. The baseline information should also include a delineation of waters of the United States on the proposed compensatory mitigation project site. A prospective permittee planning to secure credits from an approved mitigation bank or in-lieu fee program only needs to provide baseline information about the impact site, not the mitigation bank or in-lieu fee project site.

(6) *Determination of credits.* A description of the number of credits to be provided, including a brief explanation of the rationale for this determination. (See § 332.3(f).)

(7) *Mitigation work plan.* Detailed written specifications and work descriptions for the compensatory mitigation project, including, but not limited to, the geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water, including connections to existing waters and uplands; methods for establishing the desired plant community; plans to control invasive plant species; the proposed grading plan, including elevations and slopes of the substrate; soil management; and erosion control measures. For stream compensatory mitigation projects, the mitigation work plan may also include other relevant information, such as plan form geometry, channel form (e.g. typical channel cross-sections), watershed size, design discharge, and riparian area plantings.

(8) *Maintenance plan.* A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.

(9) *Performance standards.* Ecologically-based standards that will be used to determine whether the compensatory mitigation project is achieving its objectives. (See § 332.5.)

(10) *Monitoring requirements.* A description of parameters to be monitored in order to determine if the compensatory mitigation project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting on monitoring results to the district engineer must be included. (See § 332.6.)

(11) *Long-term management plan.* A description of how the compensatory mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the party responsible for long-term management. (See § 332.7(d).)

(12) *Adaptive management plan.* A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. (See § 332.7(c).)

(13) *Financial assurances.* A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards (see § 332.3(n)).

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1 PROJECT SITE IDENTIFICATION AND LOCATION

1.1 Directions to Project Site

The Project is located in Stanly County in the Piedmont Region of North Carolina, approximately 1.7 miles west of the Town of New London, as shown in Figure 1.

To reach the site from Charlotte, take Independence Blvd (US-74) east to Albemarle Rd. (NC-27 E). Travel 36 miles on Albemarle Rd. (NC-27), and turn left on US-52 N. After 6.7 miles, turn left on Austin Rd. and continue onto Henderson Rd. After 1.5 miles, turn right at Old Salisbury Rd. Continue on Old Salisbury Rd. for approximately 1.0 miles and the Project site is on the left accessed via a dirt farm road.

To reach the site from Raleigh, take I-40 West toward Sanford/Wake Forest. Take Exit 293 (I-440/US-64 W/US-1) toward Sanford/Wake Forest. Keep left at the fork toward US-1 S/US-64 W. Take Exit 293A for US-1 S/US-64 W toward Sanford/Asheboro. Keep left at the fork toward US-1 S/US-64 W. Continue on US-1 S/US-64 W towards Apex/Sanford/Asheboro. Take exit 98B to merge onto US-64 W towards Pittsboro/Asheboro. After 62 miles, turn left onto Connector Rd. Turn right onto NC 49 S. After 25.4 miles, take a slight left onto NC-8 S. After 3.9 miles, turn right on W. Gold St and continue Steakhouse Rd. After 1.3 miles turn left onto Old Salisbury Rd. Continue on Old Salisbury Rd. for approximately 0.4 miles and the Project site is on the right accessed via a dirt farm road.

1.2 USGS Hydrologic Unit Code and NCDWR River Basin Designations

The Project is in the US Geological Survey (USGS) Hydrologic Unit Code 03040105 and North Carolina Division of Water Resources (NCDWR) sub-basin 03-07-13, as shown in Figure 1. The Project watershed is shown in Figure 2.

1.3 Project Vicinity Map

As stated previously, the Project is located in Stanly County and the Project vicinity map is included as Figure 1.

1.4 Project Components and Structure

Distinct Project reaches and wetland areas are summarized by the following tables. Table 1.1 and Table 1.2 show the same data presented in the Executive Summary (ES-1 and ES-2).

Additional stream mitigation units (SMUs) are proposed for Reaches 1, 2, and 3, as much of the riparian buffer width exceeds the 50-foot minimum requirement for mitigation. The additional SMUs are being proposed based on discussions with the NC Interagency Review Team (NCIRT) at a meeting held on September 10, 2013. During this meeting, Baker proposed the use of the USACE's draft document for Regulatory Guidance for the Calculation of Stream and Buffer Mitigation Credit for Buffer Widths Different From Standard Minimum Widths (2010) to offset the project's loss of proposed stream credits due to the jurisdictional determination (JD) verification. The NCIRT agreed that this could potentially be a viable option and should be presented in the mitigation plan for consideration. Therefore this approach is being followed and SMUs were calculated based on this regulatory guidance. The document is included in Appendix G along with calculations that support the additional SMUs proposed in the following tables. Figure 8 graphically illustrates the additional riparian buffer offered and summarizes the calculations supporting the additional SMUs.

For reference, additional supporting documentation that documents the appropriate use of this approach is provided from the Beaverdam Creek Project (NCEEP Project ID 92217) that was successfully approved and closed out in January 2013 with use of this same guidance. At the close-out review, the project was experiencing a shortage of credits due to a post-construction sewerline installation by the City of

Charlotte and buffer widths in absence of the required 50-ft minimum. Baker, working as a sub-consultant to River Works, Inc., used the guidance document and calculated the final stream credit determination for the Beaverdam Creek Project where buffer widths varied. A copy of the Beaverdam Creek Approved Closeout Report is included in Appendix G.

Table 1.1 Restoration Approaches and Potential SMU Credits.
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Reach	Design Approach	Existing Reach Length (LF)	Design Reach Length (LF)	SMU Credit Ratio	Potential SMUs	Stationing	Comment
UT to Town Creek[1]							
1	R-PI	1,181	1,192	1:1	1,192/ 1,273[2]	10+00 to 21+92	Restoration will follow a Rosgen Priority Level I approach in order to provide an adequate floodplain connection and restore appropriate dimension, pattern, and profile.
2	R-PI	1,672	1,833	1:1	1,783/ 1,926[2]	21+92 to 40+26	Restoration will follow a Rosgen Priority Level I approach in order to provide an adequate floodplain connection and restore appropriate dimension, pattern, and profile. Fifty LF of stream have been reserved for a culvert crossing.
3	R-PI/PII	721	803	1:1	803/ 884[2]	40+26 to 48+29	Restoration will follow Rosgen Priority Level I and II approaches in order to provide an adequate floodplain and restore appropriate dimension, pattern, and profile.
4	EI	404	444	1:1[3]	444	10+00 to 14+45	Stream Enhancement I is proposed for this reach. Work will include bank sloping, installation of in-stream structures, vegetation planting in the riparian zone, and permanent fencing. A stormwater wetland BMP will be constructed immediately upstream of this reach.
5	EII	324	347	2.5:1	138	10+00 to 13+47	Enhancement II applications will involve control of invasive species vegetation, re-establishment of a buffer, structure installation, and permanent fencing installed outside the easement.
6	R-PI	1,349	1,370	1:1	1,350	14+45 to 28+15	Restoration will follow Rosgen Priority Level I approach in order to provide an adequate floodplain connection and restore appropriate dimension, pattern, and profile. Twenty LF of stream have been reserved for a culvert crossing.

Table 1.1 Restoration Approaches and Potential SMU Credits.
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Reach	Design Approach	Existing Reach Length (LF)	Design Reach Length (LF)	SMU Credit Ratio	Potential SMUs	Stationing	Comment
UT to Town Creek[1]							
7	R-PI/PII	386	399	1:1	399	10+00 to 14+00	Restoration work will involve a combination of raising the streambed along the reach, installing in-stream structures, and grading a narrow bankfull bench where necessary to provide a floodplain connection. A stormwater wetland BMP will be constructed immediately upstream of this reach.
Total		6,037	6,388		6,109/ 6,414 [2]		

Note: 1. Permanent fencing will be installed outside the recorded conservation easement to ensure permanent livestock exclusion from project area.
2. Mitigation credit total accounting for additional riparian buffer width.
3. 1:1 credit ratio is being sought for this enhancement reach because of improved water quality from upstream constructed stormwater wetland BMP (NCIRT, 2013)

Table 1.2 Restoration Approaches and Potential WMU Credits
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Design Approach	Area (AC)	WMU Credit Ratio	Potential WMUs	Comment
UT to Town Creek[1]				
R	2.56	1:1	2.56	Wetland restoration will include site grading, wetland vegetation planting, and cattle exclusion to restore wetland hydrology and function.
C	1.56	3:1	0.52	Wetland creation will include the removal of a depositional sediment layer, site grading, wetland vegetation planting, and cattle exclusion.
E	1.0	-	-	Wetland enhancement will include wetland vegetation planting and cattle exclusion to allow areas of hydric soils to become fully functioning wetlands.
Total	5.12		3.08	

Note: 1. Permanent fencing will be installed outside the recorded conservation easement to ensure permanent livestock exclusion from project area.

2 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the NC Interagency Review Team (NCIRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of stream and wetland credits will be subject to the criteria described in Table 2.1.

2.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NCEEP without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the Final Mitigation Plan
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NCEEP Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

2.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the NCIRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 15% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the NCIRT. As projects approach milestones associated with credit release, the NCEEP will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

The credit release schedules for mitigation credits associated with monitoring activities are based on a five (5) Year monitoring period for stream work and a seven (7) Year monitoring period for riparian wetland work. As stated in the May 13, 2013 letter from NCEEP to the IRT, "In the fourth year of monitoring, EEP will decide if the specific site may qualify to close out after five successful monitoring years. For those, EEP will submit to the IRT for early closure. For any … site that EEP does not think meet early closeout criteria, EEP will contact out to complete the final two years" of monitoring (NCEEP, 2013). A copy of the letter has been included in Appendix K for reference.

Table 2.1 Credit Release Schedule
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Monitoring Year	Credit Release Activity	Interim Release	Total Release
Forested Wetland Credits			
0	Initial Allocation - see requirements above	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%
5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the NCEEP to discontinue hydrologic monitoring after the fifth year, vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval.	10%	100%
Stream Credits			
0	Initial Allocation - see requirements above	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (65%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (75%*)
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70% (85%*)
5	Fifth year monitoring report demonstrates performance standards are being met and project has received closeout approval.	15%	100%

Note: *For stream projects a reserve of 15% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met.

3 WATERSHED CHARACTERIZATION

3.1 Drainage Area, Project Area, and Easement Acreage

The Project is located in Stanly County, approximately 1.7 miles west of the Town of New London and lies within cataloging unit 03040105 and NCDWR sub-basin 03-07-13 of the Yadkin River Basin. Project attributes are summarized in Table 3.1 and site photographs are provided in Appendix A.

The watershed areas for the Project reaches were delineated using 2-foot contour intervals generated from a LiDAR (Light Distance and Ranging) DEM (Digital Elevation Model) obtained from the NC Department of Transportation (NCDOT). The total drainage area of the unnamed tributaries (UTs) and UT to Town Creek at the Project site is determined to be approximately 1.20 square miles. Figure 2 shows the sub-watershed boundaries for the Project area. Table 3.1 summarizes detailed Project component attributes.

Table 3.1 Project Attribute Table
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Project County	Stanly
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Project River Basin	Yadkin
USGS HUC for Project	03040105
Identity Planning Area (LWP, RBRP)	Lower Yadkin RBRP, 2009
WRC Class (Warm Cool Cold)	Warm
% Project Easement Fenced/Demarcated	100%
Observed Beaver Activity	No activity observed

Restoration Component Attribute Table

Parameter	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7
Drainage Area (sq miles)	0.83	0.96	1.20	0.06	0.06	0.18	0.046
Stream Order	1	1	1	-	-	-	-
Existing Length (LF)	1,181	1,672	721	404	324	1,349	386
Restored Length (LF)	1,192	1,833	803	444	347	1,370	399
Perennial (P)/Intermittent (I)	P	P	P	I	I	I	I
Watershed Type (Rural, Urban, etc.)	R	R	R	R	R	R	R
Watershed LULC Distribution							
Rural Residential	6%	1%	0%	1%	2%	0%	0%
Ag-Row Crop	8%	0%	0%	14%	4%	0%	10%
Ag-Livestock	57%	85%	70%	59%	17%	88%	64%
Forested	8%	0%	0%	17%	62%	0%	21%
Other/Open Area	8%	0%	0%	0%	9%	0%	0%
Commercial	10%	0%	0%	0%	0%	0%	0%
Roadway	3%	4%	2%	3%	<1%	0%	0%
Wooded-Livestock	0%	10%	28%	6%	4%	12%	5%
Open Water	0%	0%	0%	0%	<1%	0%	0%
Watershed Impervious Cover (%)	19%	5%	2%	4%	<4%	<1	<1%
NCDWR AU/Index#	13-17-31-1-1						
NCDWQ Classification	C						
303(d) Listed	No						
Stressor	N/A						
Total Acreage of Easement	5.35	8.01	3.79	1.97	1.06	3.55	1.36
Total Vegetated Easement Acreage	4.81	6.97	3.48	1.63	0.94	3.22	1.26
Total Planted Acreage for Restoration	4.81	6.97	3.48	1.63	0.94	3.22	1.26

Table 3.1 Project Attribute Table UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**	**Reach 7**
Rosgen Classification (existing)	E4	E4	E4	B4	B4	B4	B4a
Rosgen Classification (as-built)	B4c	B4c	C4	B4	B4	B4	B4a
Valley Type	VIII	VIII	VIII	II	II	II	II
Valley Slope	0.0092	0.0092	0.0089	0.0230	0.0447	0.0243	0.0495
Valley Slope Range	--	--	--	--	--	--	--
Trout Waters Designation	No						
Protected Species* / Endangered Species**	No Effect* / No Effect**						
Dominant Soil Series[2]							
Series	OaA	OaA	OaA	GoF	GoF	GoF	BaD
Depth	46”	46”	46”	36”	36”	36”	40”
Clay %	10-35%	10-35%	10-35%	5-27%	5-27%	5-27%	10-55
K	0.28	0.28	0.28	0.05	0.05	0.05	0.15-0.24
T	4	4	4	4	4	4	3

* Bald Eagle (*Haliaeetus leucocephalus*) a BGEPA species is listed as occurring in Stanly County; however, suitable habitat is not located within the Project area or within two miles of the Project site.

** Schweinitz’s Sunflower (*Helianthus schweinitzii*) A federally endangered species is listed as occurring within Stanly County and though suitable habitat is present, a field study was conducted and no species were located within the Project area. NCNHP database indicated there are no known populations of these species within two miles of the study area.

(NRCS, 2010a; NCDENR, 2007 & 2008; USFWS, 2012; NCNHP, 2012)

3.2 Surface Water Classification / Water Quality

NCDWR designates surface water classifications for water bodies such as streams, rivers, and lakes, which define best use protection for these waters (e.g., swimming, fishing, and drinking water supply). These classifications carry with them an associated set of water quality standards to protect those uses. All surface waters in North Carolina must at least meet the standards for Class C (fishable/swimmable) waters. The other primary classifications provide additional levels of protection for primary water contact recreation (Class B) and drinking water supplies (WS). Class C waters are protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses suitable for Class C. Classifications and their associated protection rules may also be designed to protect the free flowing nature of a stream or other special characteristics (NCDENR, 2007).

Town Creek is classified by the NCDWR as Class C waters (NCDWR Index No. 13-17-31-1-1) (NCDENR, 2011). Based on North Carolina’s tributary rule, its tributaries would also be considered Class “C” waters (NCDENR, 2007). Neither UT to Town Creek nor Town Creek is specifically monitored for water quality impairments as a part of the Yadkin-Pee Dee Basinwide Plan (NCDENR, 2008). However, Town Creek and its tributaries discharge to Little Long Creek (NCDWR Index No. 13-17-31-1), which is listed on the North Carolina 2010 303(d) List as an impaired water for ecological/biological integrity and on the draft 2012 303(d) list as impaired for aquatic life due to copper concentrations (NCDENR, 2010, 2012).

3.3 Physiography, Geology, and Soils

The UT to Town Creek site is located in the Carolina Slate Belt Level IV Ecoregion. The underlying geology of the Project is described as graywacke, dark greenish-gray sandstone and minor siltstone, composed chiefly of quartz, plagioclase, and lithic fragments in a chlorite and sericite-rich matrix (NCGS, 1985). The topography of the Project reaches is characterized as gently rolling. At the upstream extent of the Project on UT to Town Creek, the elevation is approximately 580 feet above mean sea level (AMSL). Elevation at the southern extent of the Project is approximately 550 feet AMSL.

Soils in the Project area are shown in Figure 3 and described in Table 3.2. Classifications and characteristics were determined using the Natural Resources Conservation Service (NRCS) Soils Data Mart website. Kirksey silt loam and Tarrus channery silt loam soils are listed as Prime Farmland. The Oakboro silt loam is listed as Prime Farmland if it is well drained and either protected from flooding or not frequently flooded during the growing season. Badin channery silt loam of 8-15 percent slopes are listed as Farmland of Statewide Importance (NRCS, 2010b). As part of the Categorical Exclusions for the Project, AD-1006 Prime and Important Farmland Ratings Sheets were completed for the UT to Town Creek site and returned by NRCS on January 3, 2012. See Appendix C for additional information.

Table 3.2 Project Soil Types and Descriptions
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Symbol	Soil Unit Name	Slope	General Characteristics
BaD	Badin channery silt loam	8-15%	Moderately deep, well drained, Piedmont uplands soil, found on hillslopes of ridges.
BaF	Badin channery silt loam	15-45%	Moderately deep, well drained, Piedmont uplands soil, found on hillslopes of ridges.
GoF	Goldston very channery silt loam	15-45%	Shallow, well drained, Piedmont upland soil, found on hillslopes of ridges.
KkB	Kirksey silt loam	0-6%	Deep, moderately well drained, Piedmont upland soil, found on the top of ridges.
OaA	Oakboro silt loam	0-2%	Deep, moderately well drained, Piedmont upland and valley soil, found in floodplains.
TbB	Tarrus channery silt loam	2-8%	Deep, well drained, Piedmont upland soil, found on the top of ridges.

Source: NRCS, 2010a

3.4 Historical Land Use and Development Trends

The land cover within the Project area consists primarily of pasture. The land use in the Project's watershed is approximately 60 percent active agriculture (chicken farms, cropland, and pasture), 34 percent forested, and 6 percent rural residential. Stanly County is within traveling distance of the Charlotte metropolitan area and may be targeted for development in the future. The watershed contains portions of the Town of New London and the City of Albemarle; projected population increase is almost 1,000 residents by 2015 (NCEEP, 2009). However the 2002 Stanly County Land Use Plan, Long-Range Plan Recommendations indicates that the Project area is within an agricultural conservation area. The chief purpose of the conservation area is to protect farmland from rural sprawl today and from urban sprawl in the future (Stanly County Department of Planning and Zoning, 2002). Therefore it's anticipated the Project area will remain rural in the foreseeable future.

3.5 Watershed Planning

UT to Town Creek is a tributary to Town Creek which drains into Little Long Creek located in northeastern Stanly County. NCEEP has identified the 14-digit HUC 03040105060-040, Little Long Creek, as a Targeted Local Watershed within the most recent River Basin Restoration Priorities (RBRP) document for the Lower Yadkin – Pee Dee River Basin (NCEEP, 2009). Little Long Creek (NCDWR Index No. 13-17-31-1), which is listed on the North Carolina 2010 303(d) List as an impaired water for ecological/biological integrity and on the draft 2012 303(d) list as impaired for aquatic life due to copper concentrations (NCDENR, 2010, 2012). The NCDWR 2008 Yadkin – Pee Dee Basin Plan for the Rocky

River Watershed (HUC 03040105) cites habitat degradation in the Little Long Creek watershed due to impervious surfaces (NCDNER, 2008).

3.6 Endangered / Threatened Species

Some populations of plants and animals are declining because of either natural forces or their inability to compete for resources with the encroachment of humans. The North Carolina Natural Heritage Program (NCNHP) and US Fish and Wildlife Service (USFWS) lists of rare and protected animal and plant species contain two federally protected species known to exist in Stanly County (USFWS, 2012 and NCNHP, 2012).

Legal protection for federally listed species, Threatened (T) or Endangered (E) status, is conferred by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1534). This act makes illegal the killing, harming, harassing, or removing of any federally listed animal species from the wild; plants are similarly protected, but only on federal lands. Section 7 of this act requires federal agencies to ensure that actions they fund or authorize do not jeopardize any federally listed species.

Organisms that are listed as Endangered (E), Threatened (T), or Special Concern (FSC) on the NCNHP list of Rare Plant and Animal Species are afforded state protection under the State Endangered Species Act and the North Carolina Plant Protection and Conservation Act of 1979.

Species that the NCNHP and USFWS list under federal protection for Stanly County as of February 28, 2012 are shown in Table 3.3. A brief description of the characteristics and habitat requirements of the federally protected species is included in the following section, along with a conclusion regarding potential Project impacts.

Table 3.3 Federally Protected Species for Stanly County
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Scientific Name	Common Name	Federal Status	Biological Conclusion
Vertebrates			
Haliaeetus leucocephalus	Bald Eagle	BGEPA	No Effect
Vascular Plants			
Helianthus schweinitzii	Schweinitz's sunflower	E	No Effect

Notes: E – Endangered denotes a species in danger of extinction throughout all or a significant portion of its range; BGEPA – Protected by the Bald and Golden Eagle Protection Act

(USFWS, 2012; NCNHP, 2012)

3.6.1 Site Evaluation and Methodology

A pedestrian survey of the Project area was conducted on September 13, 2011 for species listed in Table 3.3. No federally protected species were observed in or adjacent to the Project area during the field survey. A February 28, 2012, search of the NCNHP database indicated there are no known populations of these species within two miles of the Project area.

3.6.2 Federally-Protected Species

Haliaeetus leucocephalus (Bald eagle)

Federal Status: Protected by the Bald and Golden Eagle Protection Act

Animal Family: Accipitridae

Adult bald eagles can be identified by their large white head and short white tail. The body plumage is dark-brown to chocolate-brown in color. In flight, bald eagles can be identified by their flat wing soar. Eagle nests are found in close proximity to water (within 0.5 mile) with a clear flight path to the water, in the largest living tree in an area, and having an open view of the surrounding land. Human disturbance can cause an eagle to abandon otherwise suitable habitat. The breeding season for the bald eagle begins in December or January. Fish are the major food source for bald eagles. Other sources include coots, herons, and wounded ducks. Food may be live or carrion.

Biological Conclusion: No Effect

The Project study area was evaluated for potential bald eagle habitat. No suitable habitat exists for the bald eagle within the Project area. A search of the NCNHP database of rare species and unique habitats, conducted on February 28, 2012, shows no occurrences of this species within two miles of the Project area. Therefore, no impacts to this species are anticipated during the Project construction.

Helianthus schweinitzii (Schweinitz's sunflower)

Federal Status: Endangered

Plant Family: Asteraceae

Federally Listed: May 7, 1991

Schweinitz's sunflower, usually 3 to 6 feet tall, is a perennial herb with one to several fuzzy purple stems growing from a cluster of carrot-like tuberous roots. Leaves are 2 to 7 inches long, 0.4- to 0.8-inch wide, lance-shaped, and usually opposite, with upper leaves alternate. Leaves feel like felt on the underside and rough, like sandpaper, on the upper surface. The edges of the leaves tend to curl under. Flowers are yellow composites, and generally smaller than other sunflowers in North America. Flowering and fruiting occur mid-September to frost. This plant grows in clearings and along the edges of upland woods, thickets and pastures. It is also found along roadsides, powerline clearings, old pastures, and woodland openings. It prefers full sunlight or partial shade, but is intolerant of full shade.

Biological Conclusion: No Effect

Potential habitat for Schweinitz's sunflower occurs along field edges throughout the Project area. The Project area was evaluated for potential Schweinitz's sunflower habitat and an extensive field survey was performed on September 13, 2011. No populations were found within the area of potential impact. The NCNHP website was searched for potential protected species on February 28, 2012. No populations of this species have been reported within one mile of the Project area. Therefore, the proposed Project is not anticipated to result in an adverse impact to this species.

3.6.3 Federal Designated Critical Habitat

The ESA requires the federal government to designate "critical habitat" for any species it lists under the ESA. "Critical habitat" is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. There are no federally designated critical habitat areas within the Project boundaries.

3.6.4 USFWS and NCWRC Notification and FHWA Concurrence

The USFWS and NCWRC were notified of the Project via letter on October 1, 2010. Baker sent a follow-up letter to the USFWS on November 3 informing them that a pedestrian survey for the Schweinitz's sunflower was conducted on September 28, 2010.

No populations of the Schweinitz's sunflower were found within or adjacent to the proposed Project area during the survey. Therefore the proposed Project was found to have no effect on the Schweinitz's sunflower. Concurrence of these findings was acknowledged by the Federal Highway Administration on December 14, 2010 upon receipt of the Final Approval of the Categorical Exclusion documentation for the Project. Correspondence and supporting documentation is included in Appendix D.

3.7 Cultural Resources

Baker sent a letter on October 6, 2011 requesting that the North Carolina State Historic Preservation Office (SHPO) review and comment on the presence of cultural resources within the vicinity of Project. On October 25, 2011, SHPO sent a response which noted that there are no known historic resources which would be affected by the Project. All correspondence on the cultural resources associated with this Project are included in Appendix D.

3.8 Potential Constraints

No fatal flaws have been identified at the time of the submission of this mitigation plan. All farm crossings have been excluded from the easement area. An existing crossing on Reach 2 will be improved and a culverted farm crossing will be installed on Reach 6. There are no existing and/or proposed easements for power and telephone utilities within the conservation easement. Riparian buffer widths will be at least 50 feet in width measured from the top of both banks (100 foot minimum total buffer width, plus stream width) for all of the proposed stream reaches. Though this project is not located in a special flood hazard area, project specific calculations for any increases in the 100-year floodplain elevation were conducted to ensure that adjacent properties would not be negatively affected. In addition, no regulatory factors were determined to pose potential site constraints. Construction access and staging areas have been identified and will be determined during final design.

3.9 Property Ownership and Boundary

A conservation easement was secured for the Project on October 10, 2013. A copy of the recorded easement and survey plat are included in Appendix H.

3.10 Utilities

No utility easements are present within the conservation easement.

3.11 FEMA / Hydrologic Trespass

A review of Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Stanly County and its unincorporated areas (Map Number 3710662100J) indicates the UT to Town Creek site is currently not located within a FEMA-identified flood zone (NCFMP, 2008) and will not require a "No-Rise/No-Impact" certification. However, to confirm that the topography of the site supports the design without the threat of hydrological trespass, project specific analysis and calculations for any increases in the 100-year floodplain elevation were conducted. Results of these calculations verify that any rise in the 100-year floodplain elevation will be contained within the Project site, and should not pose any threat to adjacent landowners or roadways. The HEC-RAS results and the NCEEP Floodplain Checklist are located in Appendix I.

4 PROJECT SITE STREAMS (EXISTING CONDITIONS)

4.1 Existing Conditions Survey

Detailed channel morphology and topography were surveyed with a total station and tied to NC State Plane coordinates. Along with providing detailed topography, this survey included eighteen cross-sections along UT to Town Creek and its tributaries and longitudinal profiles for all reaches. Baker also conducted pebble counts and collected substrate samples to characterize bed material and classify stream reaches. Figure 4 illustrates the locations of cross-section surveys and each Project reach. Surveyed longitudinal profiles and cross-sections are included in Appendix E. A photo log that depicts the existing conditions of the Project site is provided in Appendix A.

These surveys were used to analyze, predict, and confirm the stability of the stream and generate the design parameters. The existing conditions of designated Project reaches that are proposed for stream restoration are described below with Tables 4.1 through 4.4. The tables also provide regional curve data for comparison based on the drainage area (Harman et al, 1999; Walker, 2008). A more detailed discussion of the geomorphic assessment conducted to determine channel stability and channel discharge for Project streams is included in Sections 4.4 through 4.6.

Baker assessed the stream and valley types present and considered their evolutionary stage and likely succession in order to develop a basis for the proposed restoration efforts. The site contains alluvial and colluvial valleys with a wide range of slopes present. Alluvial valleys are associated with alluvial deposits and a wider floodplains, while colluvial valleys have colluvial deposits mixed with some alluvium and floodplains of limited widths. There are Rosgen Ba, B, Bc, E, and F stream types found within the Project reaches. All streams have been impacted by livestock and removal of riparian vegetation. In addition, Reaches 1, 2 and 3 have likely been straightened to enlarge pastures.

4.2 Channel Classification

For organization and analysis purposes, Baker labeled the existing Reaches 1, 2, 3, 4, 5, 6, and 7 (Figure 4). Reach 1 begins at the northernmost Project boundary and continues a distance of approximately 1,181 LF south. Reach 2 begins downstream of Reach 1 and flows south for 1,672 LF. Reach 3 begins downstream of Reach 2 and flows south 721 LF to the southernmost Project boundary. Reach 4 begins west of Reach 5 and flows east for approximately 404 LF to its confluence with Reach 5 and Reach 6. Reach 5 begins to the north of Reach 4 and flows southeast for 324 LF to its confluence with Reach 4 and Reach 6. Reach 6 begins at the confluence of Reach 4 and Reach 5 and continues east for 1,349 LF to its confluence with Reach 2 and Reach 3 on UT to Town Creek. Reach 7 begins to the west of UT to Town Creek and flows east for 386 LF to its confluence with Reach 1 and Reach 2.

Baker conducted a field survey of the Project area to determine the jurisdictional determination of the on-site streams. Based on the NCDWR *Determination of the Origin of Perennial Streams*, UT to Town Creek mainstem (Reaches 1, 2, and 3) was determined to be a perennial stream, while its smaller tributaries (Reaches 4, 5, 6, and 7) were determined to be intermittent. The total current length of existing stream within the Project boundaries for UT to Town Creek and its associated tributaries is 6,037 LF. See Figures 4 and 5 for depictions of the reach locations and their associated jurisdictional determination. NCDWR stream forms are located in Appendix B.

UT to Town Creek is a small stream with a total drainage area of approximately 1.2 square miles at the southernmost Project boundary (Figure 2). Historically, the site has been used for agriculture and cattle grazing. Cleared areas throughout the Project boundaries are currently used for cattle grazing. Most of the stream channels lack woody riparian vegetation. Where riparian vegetation does exist (the upper end of UT to Town Creek) invasive species such as Chinese privet and multiflora rose dominate. Additionally, cattle activities have limited the establishment of native woody vegetation on the stream banks, which has resulted in stream bank degradation and an inadequate riparian buffer throughout the majority of the Project reaches.

Each reach was classified using survey techniques and methodology from the Rosgen Classification system (Rosgen, 1994). Reach 1 on the upstream or northern side of a cattle fence classified as an E4 that is nearly straight and slightly entrenched with a low width-to-depth ratio. This section of Reach 1 has some riparian vegetation, but is mostly dominated by invasive species. Downstream of the fence, Reach 1's width-to-depth ratio increases drastically as result of active lateral erosion. This section of Reach 1 is absent of any woody riparian buffer. Reach 2 is classified as E4 that is slightly entrenched, has a low to moderate width-to-depth ratio, and low sinuosity. Reach 3 is classified as E4 that is slightly entrenched, has a low to moderate width-to-depth ratio, and low sinuosity. Stream banks on Reach 2 and Reach 3 are actively eroding laterally and no woody riparian buffer vegetation exists. Reach 6 is classified as a B4 that is nearly straight, moderately entrenched, with a low width-to-depth ratio. This reach is incised and disconnected from its floodplain at bankfull stage. Again, no woody riparian buffer is present along the banks of this reach. Reach 5 is classified as a B4 that displays moderate meander geometry with a sinuosity of 1.2. The channel is entrenched with a low width-to-depth ratio. Reach 4 is classified as a B4 that is nearly straight and entrenched with a high width-to-depth ratio. Some areas of woody vegetation exist along the stream banks. Reach 7 is classified as a B4a that is slightly entrenched and nearly straight with a low width-to-depth ratio. This reach is absent of any woody riparian buffer.

A modified Wolman pebble count (Rosgen, 1994) was conducted to characterize the bed material. The data show that the UT to Town Creek has an average D_{50} of 32.5 mm, indicating that the dominant bed material in the stream channel is gravel.

Table 4.1 Representative Geomorphic Data for UT to Town Creek Reach 1, Reach 2, and Reach 3
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

	Reach 1 Existing Values[3, 5]		Reach 2 Existing Values[5]		Reach 3 Existing Values[4]	
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Stream Length (ft)	1,181		1,672		721	
Drainage Area, DA (sq mi)	0.83		0.88		1.20	
Stream Type (Rosgen)	E4 (incised)		E4 (incised)		E4 (incised)	
Bankfull Discharge, Qbkf (cfs)	50		55		65	
Bankfull Riffle XSEC Area, Abkf (sq ft)	13.8		14.5		18.0	18.9
Bankfull Mean Velocity, Vbkf (ft/s)	3.6		3.8		3.4	3.6
Bankfull Riffle Width, Wbkf (ft)	9.0	11.9	12.61		9.8	12.7
Bankfull Mean Depth, Dbkf (ft)	1.2	1.5	1.15		1.50	1.8
Width to Depth Ratio, W/D (ft/ft)	5.8	10.3	11.0		5.4	8.6
Width of Floodprone Area, Wfpa (ft)	77.0		81.0		230.3	
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	6.5	8.6	6.4		18.1	23.5
Riffle Max Depth @ bkf, Dmax (ft)	1.8	2.1	1.6		2.9	3.2
Riffle Max Depth Ratio, Dmax/Dbkf (ft/ft)	1.4	1.6	1.4		1.7	2.0
Max Depth @ tob, Dmaxtob (ft)	2.1	2.6	2.0		2.9	3.2
Bank Height Ratio, Dmaxtob/Dmax (ft/ft)	1.2	1.2	1.3		1.0	
Meander Wavelength, Lm (ft)	63	144	100	340	63	199
Meander Wavelength Ratio, Lm/Wbkf (ft/ft)	5.3	16.0	7.9	27.0	5.0	20.3
Radius of Curvature, Rc (ft)	17	77	21	80	34	61
Rc Ratio, Rc/Wbkf (ft/ft)	1.4	8.6	1.7	6.3	1.7	4.9
Belt Width, Wblt (ft)	31	101	60	185	40	65
Meander Width Ratio, Wblt/Wbkf (ft/ft)	2.6	11.2	4.8	14.7	3.1	6.2
Sinuosity, K (Sval/Schan)	1.2		1.2		1.1	

Table 4.1 Representative Geomorphic Data for UT to Town Creek Reach 1, Reach 2, and Reach 3 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648						
	Reach 1 Existing Values[3, 5]		**Reach 2 Existing Values[5]**		**Reach 3 Existing Values[4]**	
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Valley Slope, Sval (ft/ft)	0.0092		0.0092		0.0089	
Channel Slope, Schan (ft/ft)	0.008		0.009		0.008	
Riffle Slope, Srif	0.011	0.056	0.010	0.033	0.014	0.030
Riffle Slope Ratio, Srif/Schan	1.8	6.0	1.0	3.4	3.5	7.5
Pool Slope, Spool (ft/ft)	0.0000	0.0013	0.0000	0.0037	0.0000	0.0018
Pool Slope Ratio, Spool/Schan	0.0	0.1	0.0	0.4	0.0	0.5
Pool Max Depth @ bkf, Dmaxpool (ft)	2.8		2.1		2.6	
Pool Max Depth Ratio, Dmaxpool/Dbkf (ft/ft)	1.8	2.4	1.8		1.4	1.7
Pool Width, Wpool (ft)	10.7		22.2		14.1	
Pool Width Ratio, Wpool/Wbkf (ft/ft)	0.9	1.2	1.8		1.1	1.4
Pool Spacing, Lps (ft)	65.6	206.5	49.0	319.0	38.0	132.0
Pool-Pool Spacing Ratio, Lps/Wbkf (ft/ft)	5.5	23.0	3.9	25.3	3.0	13.5
d16 (mm)	11.3		11.3		1.0	
d35 (mm)	33.0		33.0		11.0	
d50 (mm)	50.0		50.0		15.0	
d84 (mm)	128.0		128.0		64.0	
d95 (mm)	>2048		>2048		150.0	
NC Piedmont Regional Curve (Wbkf)[1]	12.8		13.5		14.7	
NC Piedmont Regional Curve (Dbkf)[1]	1.5		1.6		1.7	
NC Piedmont Regional Curve (Abkf)[1]	18.9		19.6		24.2	
NRCS NC Piedmont Regional Curve (Wbkf)[2]	12.1		12.9		14.2	
NRCS NC Piedmont Regional Curve (Dbkf)[2]	1.1		1.1		1.2	
NRCS NC Piedmont Regional Curve (Abkf)[2]	13.8		14.4		18.2	

Notes:
1. Harman et al, 1999.
2. Unpublished NC Rural Piedmont Curve that is being developed by the NRCS.
3. Reach 1 data based on two riffle cross-sections and one pool cross-section.
4. Reach 3 data based on two riffle cross-sections and one pool cross-section.
5. Stream lengths based on existing conditions stream breaks.

Table 4.2 Representative Geomorphic Data for UT to Town Creek Reach 4, Reach 5, and Reach 6 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648						
	Reach 4 Existing Values[3]		**Reach 5 Existing Values[4,5]**		**Reach 6 Existing Values[4,5]**	
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Stream Length (ft)	404		324		1,349	
Drainage Area, DA (sq mi)	0.08		0.06		0.18	
Stream Type (Rosgen)	B4		B4		B4	
Bankfull Discharge, Qbkf (cfs)	6.0		6.0		14.0	
Bankfull Riffle XSEC Area, Abkf (sq ft)	1.8		2.0		4.7	
Bankfull Mean Velocity, Vbkf (ft/s)	3.3		3.0		3.0	
Bankfull Riffle Width, Wbkf (ft)	6.8		3.9		6.1	

Table 4.2 Representative Geomorphic Data for UT to Town Creek Reach 4, Reach 5, and Reach 6
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

	Reach 4 Existing Values[3]		Reach 5 Existing Values[4,5]		Reach 6 Existing Values[4,5]	
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Bankfull Mean Depth, Dbkf (ft)	0.3		0.5		0.8	
Width to Depth Ratio, W/D (ft/ft)	26.1		7.8		7.8	
Width of Floodprone Area, Wfpa (ft)	10.6		5.5		9.7	
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.6		1.4		1.6	
Riffle Max Depth @ bkf, Dmax (ft)	0.6		0.7		1.3	
Riffle Max Depth Ratio, Dmax/Dbkf (ft/ft)	2.2		1.4		1.7	
Max Depth @ tob, Dmaxtob (ft)	1.4		1.8		2.6	
Bank Height Ratio, Dmaxtob/Dmax (ft/ft)	2.4		2.5		1.9	
Meander Wavelength, Lm (ft)	40	112	28	67	49	141
Meander Wavelength Ratio, Lm/Wbkf (ft/ft)	5.9	16.5	7.2	17.2	8.0	23.2
Radius of Curvature, Rc (ft)	8	29	6	29	8	69
Rc Ratio, Rc/Wbkf (ft/ft)	1.2	4.3	1.5	7.4	1.3	11.4
Belt Width, Wblt (ft)	40	52	44	71	40	65
Meander Width Ratio, Wblt/Wbkf (ft/ft)	5.9	7.7	11.3	18.2	6.6	10.7
Sinuosity, K (Sval/Schan)	1.1		1.2		1.1	
Valley Slope, Sval (ft/ft)	0.0230		0.0447		0.0243	
Channel Slope, Schan (ft/ft)	0.022		0.037		0.023	
Riffle Slope, Srif	-	-	-	-	-	-
Riffle Slope Ratio, Srif/Schan	-	-	-	-	-	-
Pool Slope, Spool (ft/ft)	-	-	-	-	-	-
Pool Slope Ratio, Spool/Schan	-	-	-	-	-	-
Pool Max Depth @ bkf, Dmaxpool (ft)	0.5		1.0		1.4	
Pool Max Depth Ratio, Dmaxpool/Dbkf (ft/ft)	2.0		2.0		1.8	
Pool Width, Wpool (ft)	5.7		7.2		6.2	
Pool Width Ratio, Wpool/Wbkf (ft/ft)	0.8		1.9		1.0	
Pool Spacing, Lps (ft)	21.0	313.0	29.0	181.0	24.0	259.0
Pool-Pool Spacing Ratio, Lps/Wbkf (ft/ft)	3.1	46.2	7.4	46.4	4.0	42.7
d16 (mm)	4.7		8.5		11.3	
d35 (mm)	13.6		12.4		22.6	
d50 (mm)	26.9		17.5		32.0	
d84 (mm)	108.6		50.6		90.	
d95 (mm)	199.0		81.6		150.0	
NC Piedmont Regional Curve (Wbkf)[1]	4.7		4.7		7.1	
NC Piedmont Regional Curve (Dbkf)[1]	0.7		0.7		0.9	

Table 4.2 Representative Geomorphic Data for UT to Town Creek Reach 4, Reach 5, and Reach 6 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648						
	Reach 4 Existing Values[3]		**Reach 5 Existing Values[4,5]**		**Reach 6 Existing Values[4,5]**	
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
NC Piedmont Regional Curve (Abkf)[1]	3.2		3.2		6.7	
NRCS NC Piedmont Regional Curve (Wbkf)[2]	3.9		3.9		6.3	
NRCS NC Piedmont Regional Curve (Dbkf)[2]	0.4		0.4		0.6	
NRCS NC Piedmont Regional Curve (Abkf)[2]	2.0		2.0		4.4	

Notes:
1. Harman et al, 1999.
2. Unpublished NC Rural Piedmont Curve that is being developed by the NRCS.
3. Reaches 4, 5, and 6 were dry during time of survey therefore no pool slopes or riffle slopes were calculated.

Table 4.3 Representative Geomorphic Data for UT to Town Creek Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648		
	Reach 7 Existing Stream Values[3]	
Parameter	**MIN**	**MAX**
Stream Length (ft)	386	
Drainage Area, DA (sq mi)	0.046	
Stream Type (Rosgen)	B4a	
Bankfull Discharge, Qbkf (cfs)	4.7	
Bankfull Riffle XSEC Area, Abkf (sq ft)	1.6	
Bankfull Mean Velocity, Vbkf (ft/s)	3.0	
Bankfull Riffle Width, Wbkf (ft)	5.0	
Bankfull Mean Depth, Dbkf (ft)	0.3	
Width to Depth Ratio, W/D (ft/ft)	15.7	
Width of Floodprone Area, Wfpa (ft)	7.5	
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.5	
Riffle Max Depth @ bkf, Dmax (ft)	0.5	
Riffle Max Depth Ratio, Dmax/Dbkf (ft/ft)	1.4	
Max Depth @ tob, Dmaxtob (ft)	1.2	
Bank Height Ratio, Dmaxtob/Dmax (ft/ft)	2.6	
Meander Wavelength, Lm (ft)	26	101
Meander Wavelength Ratio, Lm/Wbkf (ft/ft)	5.2	20.1
Radius of Curvature, Rc (ft)	7.0	41.0
Rc Ratio, Rc/Wbkf (ft/ft)	1.4	8.2
Belt Width, Wblt (ft)	30.0	48.0
Meander Width Ratio, Wblt/Wbkf (ft/ft)	6.0	9.6
Sinuosity, K (Sval/Schan)	1.1	
Valley Slope, Sval (ft/ft)	0.0495	
Channel Slope, Schan (ft/ft)	0.045	
Riffle Slope, Srif	0.0227	0.0578
Riffle Slope Ratio, Srif/Schan	0.5	1.2
Pool Slope, Spool (ft/ft)	0.0036	0.026
Pool Slope Ratio, Spool/Schan	0.1	0.6
Pool Max Depth @ bkf, Dmaxpool (ft)	1.1	
Pool Max Depth Ratio, Dmaxpool/Dbkf (ft/ft)	3.5	

Table 4.3 Representative Geomorphic Data for UT to Town Creek Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648		
	Reach 7 Existing Stream Values[3]	
Parameter	**MIN**	**MAX**
Pool Width, Wpool (ft)	5.1	
Pool Width Ratio, Wpool/Wbkf (ft/ft)	1.0	
Pool Spacing, Lps (ft)	19.0	259.0
Pool-Pool Spacing Ratio, Lps/Wbkf (ft/ft)	3.8	51.6
d16 (mm)	8.5	
d35 (mm)	12.4	
d50 (mm)	17.5	
d84 (mm)	50.6	
d95 (mm)	81.6	
NC Piedmont Regional Curve (Wbkf)[1]	4.3	
NC Piedmont Regional Curve (Dbkf)[1]	0.6	
NC Piedmont Regional Curve (Abkf)[1]	2.6	
NRCS NC Piedmont Regional Curve (Wbkf)[2]	3.5	
NRCS NC Piedmont Regional Curve (Dbkf)[2]	0.4	
NRCS NC Piedmont Regional Curve (Abkf)[2]	1.6	
Notes: 1. Harman et al, 1999 2. Unpublished NC Rural Piedmont Curve that is being developed by the NRCS		

4.3 Valley Classification

There are two valley types found within the Project area. The valley type found on the mainstem of Project site is a Rosgen Type VIII valley (Rosgen, 1996). Type VIII valleys generally have multiple river terraces that are positioned laterally on broad, low-sloping valleys. Alluvial terraces and floodplains are the predominant depositional features, and these can act as substantial sources of sediment if buffer vegetation is removed or the channel is straightened. The most common stream types encountered in Type VIII valleys are E and C, which have slightly entrenched, meandering channels and developed riffle/pool bedforms. In some instances, D, F, Bc, or G type streams may be found in Type VIII valleys, depending on local conditions.

UT to Town Creek's tributaries are located within a Rosgen Type II valley (Rosgen, 1996). Type II valleys are generally colluvial valleys that are moderately steep with gentle sloping side slopes. Type II valleys usually contain soils developed from parent material, alluvium, and/or colluvium. Over time, the stream tends to migrate to the lowest part of the valley. The Project site valley gradient ranges from approximately 0.0230 ft/ft to 0.0495 ft/ft. Streams found in these valley types in these areas are commonly classified as Rosgen B and A stream types.

4.4 Bankfull Stage and Discharge Verification

Baker used physical, analytical, and empirical methods to verify bankfull discharge of the Project reaches of UT to Town Creek. Physical field measurements were given a slightly higher weight due to their site-specific nature. Subsequent methods were also used to interpret and sometimes adjust field observations.

Bankfull stage was verified using field bankfull indicators. The indicators used included high scour marks, transition in vegetation, and the back of point bars. Bankfull stage was also identified through the use of regional curve information. By comparison of consistent field indicators and regional curves, an accurate estimation of bankfull was identified. Bankfull parameters are summarized in Table 4.1 through 4.3.

In summary, the following steps were taken to estimate bankfull stage and discharge:

1. Identified and performed detailed survey of representative cross-sections with physical bankfull indicators;
2. Conducted internal comparison of the surveyed cross-sections to ensure consistency,
3. Compared values to regional empirical data (regional curves);
4. Applied bankfull areas, widths, and slopes to the WARSSS (2006) Bankfull Velocity/Discharge Estimate spreadsheet to estimate the discharge and to evaluate bankfull parameters;
5. Utilized HEC-RAS to verify and correlate surveyed bankfull stages with estimated discharges along the mainstem of UT Town Creek; and
6. Considered all results and determined the flows that most closely corresponded to bankfull.

4.4.1 Physical Field Measurement

Physical bankfull discharge measurements were not measured in the field, but physical bankfull dimension indicators were surveyed in order to help estimate the discharge. Physical bankfull dimension indicators surveyed during the existing conditions analysis were typically depositional bars, defined breaks in slope at a consistent elevation relative to the water surface, or transitions in bank vegetation. Upon completion of the field survey, data were plotted to check for consistency and correlation with region-specific empirical equations and regional reference data (See Appendix E). These data were analyzed to determine the most likely bankfull stages on all Project reaches. Once bankfull stage was determined using these methods, the bankfull dimensions were analyzed using WARSSS (2006) Bankfull Velocity/Discharge Estimates spreadsheet, HEC-HMS modeling, and HEC-RAS modeling to assess whether a bankfull discharge would produce the same relative particular flow rate as regional curve data.

4.4.2 Bankfull Hydraulic Geometry Relationships (Regional Curves)

Publicly available bankfull regional curves are available for a range of stream types and physiographic provinces. The published NC Rural Piedmont Regional Curve (Harman et al., 1999) and an unpublished NC Piedmont Regional Curve being developed by the Natural Resources Conservation Service (A. Walker, 2008) were used for comparison to other more site-specific means of estimating bankfull discharge. The tributaries on the Project site are small streams; small streams are poorly represented on the regional curves. It has been found that the NC Piedmont Regional Curve Equations may overestimate discharge and channel dimension for smaller streams, such as those present at this site. The unpublished NC Piedmont Regional Curve corresponds more closely to the discharge and channel dimension that were compared with the WARSSS (2006) worksheets. Baker has implemented numerous Projects in small drainages throughout North Carolina, and has produced “mini-curves” specific to these Projects. The growing number of data points on these small streams curves provides supporting evidence for the selection of bankfull indicators that produce smaller dimensions and flow rates than the published regional data.

Tables 4.1 – 4.3 summarize regional curve bankfull parameter estimates for each reach, using the unpublished NRCS NC Rural Piedmont Regional Curve and the published NC Rural Piedmont Regional Curve.

4.4.3 Discharge Analysis

Several methods were used to determine the appropriate reach bankfull discharge including NC Regional Curves, Friction Factor to Relative Roughness Ratio, Manning’s Equation, Manning’s Equation based on stream type, USGS Regression Equations, and HEC-HMS. Regional Curves (both published and unpublished) compare the bankfull discharge of many stable stream reaches to the streams drainage areas. These data are plotted and regressed to calculate a trend in the data. This trend can then be used to determine bankfull discharges based on drainage area for assessment streams. The Friction Factor to Relative Roughness Ratio method calculates discharge by relating hydraulic radius, D84 of a riffle, and shear velocity to flow velocity. The Manning's Equation method calculates discharge by relating hydraulic radius, channel slope, and published Manning's "n" values. The Manning's Equation based on stream type method calculates discharge similar to the Manning's Equation method. However, the Manning's "n" value is chosen based on the Rosgen stream type (Rosgen and Silvey, 2007). USGS Regression Equations utilize estimates of the magnitude and frequency of floods at gaged drainage basins which allows determination of these same parameters in ungaged drainage basins. HEC- HMS calculates discharges by inputs to the models based on site specific topographic information, point precipitation frequency estimates from the NOAA Atlas 14 Albemarle, North Carolina, as well as methods described in the Technical Release 55 (TR-55) manual developed by the NRCS. Baker estimated bankfull flows based on the methods above. See Table 4.4 for a comparison of the results from the above methodologies.

Table 4.4 Discharge Analysis for UT to Town Creek Reach 1 through Reach 7
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Estimating Method	Bankfull Velocity (Ft/Sec)	Bankfull Discharge (cfs)
Reach 1		
NRCS NC Rural Piedmont Regional Curve[1]	4.4	49.9
Friction Factor to Relative Roughness Ratio method[2,3]	3.5	37.7
Manning's "n" from friction factor and relative roughness[2,3]	3.6	40.7
Manning's "n" from stream type[2]	3.5	39.7
USGS Regression Equation 1.5 yr return interval	3.8	52.9
NC Rural Piedmont Regional Curve[4]	6.8	77.2
Baker Estimated	3.6	50.0
Reach 2		
NRCS NC Rural Piedmont Regional Curve[1]	3.7	55.9
Friction Factor to Relative Roughness Ratio method[2,3]	2.5	36.5
Manning's "n" from friction factor and relative roughness[2,3]	2.2	40.0
Manning's "n" from stream type[2]	2.7	33.0
USGS Regression Equation 1.5 yr return interval	4.0	58.4
NC Rural Piedmont Regional Curve[4]	5.7	85.8
HEC-HMS Model	4.4	64.0
Baker Estimated	3.8	55.0
Reach 3		
NRCS NC Rural Piedmont Regional Curve[1]	3.7	66.7
Friction Factor to Relative Roughness Ratio method[2,3]	3.9	70.0
Manning's "n" from friction factor and relative roughness[2,3]	4.3	78.2
Manning's "n" from stream type[2]	2.8	50.5
USGS Regression Equation 1.5 yr return interval	4.0	72.6
NC Rural Piedmont Regional Curve[4]	5.6	100.9
Baker Estimated	3.6	65.0
Reach 4		
NRCS NC Rural Piedmont Regional Curve[1]	3.4	8.9
Friction Factor to Relative Roughness Ratio method[2,3]	3.0	7.7
Manning's "n" from friction factor and relative roughness[2,3]	3.0	7.8
Manning's "n" from stream type[2]	1.7	4.2
USGS Regression Equation 1.5 yr return interval	6.0	4.2

Table 4.4 Discharge Analysis for UT to Town Creek Reach 1 through Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648		
Estimating Method	**Bankfull Velocity (Ft/Sec)**	**Bankfull Discharge (cfs)**
NC Rural Piedmont Regional Curve[4]	6.0	15.7
Baker Estimate	3.0	5.8
Reach 5		
NRCS NC Rural Piedmont Regional Curve[1]	2.3	7.7
Friction Factor to Relative Roughness Ratio method[2,3]	6.9	23.7
Manning's "n" from friction factor and relative roughness[2,3]	6.0	20.4
Manning's "n" from stream type[2]	3.0	10.2
USGS Regression Equation 1.5 yr return interval	2.1	4.2
NC Rural Piedmont Regional Curve[4]	4.0	13.8
Baker Estimate	2.3	7.7
Reach 6		
NRCS NC Rural Piedmont Regional Curve[1]	3.5	16.7
Friction Factor to Relative Roughness Ratio method[2,3]	3.1	14.7
Manning's "n" from friction factor and relative roughness[2,3]	3.9	18.3
Manning's "n" from stream type[2]	2.9	13.7
USGS Regression Equation 1.5 yr return interval	2.8	13.1
NC Rural Piedmont Regional Curve[4]	5.9	27.9
Baker Estimated	3.0	14.0
Reach 7		
NRCS NC Rural Piedmont Regional Curve[1]	3.5	5.7
Friction Factor to Relative Roughness Ratio method[2,3]	2.4	3.8
Manning's "n" from friction factor and relative roughness[2,3]	3.8	6.1
Manning's "n" from stream type[2]	2.3	3.4
USGS Regression Equation 1.5 yr return interval	1.9	3.1
NC Rural Piedmont Regional Curve[4]	6.4	10.3
Baker Estimated	3.0	4.7
Notes: 1. Unpublished NC Rural Piedmont Regional Curve that is being developed by NRCS (A. Walker, 2008) 2. WARSSS, 2006 spreadsheet 3. Estimate based on comparing data from two riffle cross-sections 4. Harman et al, 1999		

4.4.4 HEC-HMS Modeling

A HEC-HMS model was created to verify bankfull flows (1.5-yr storm) on Reach 2 and for the design of the culverts under the existing farm road. The model inputs are based on site specific topographic information, point precipitation frequency estimates from the NOAA Atlas 14 Albemarle, North Carolina location, as well as methods described in the Technical Release 55 (TR-55) manual developed by the NRCS.

4.4.5 HEC-RAS Modeling

An existing condition HEC-RAS model was developed to validate bankfull discharges along Reaches 1, 2, and 3. Cross-sections were cut through existing ground approximately 150 LF apart along the existing length of UT to Town Creek at riffle cross-sections. The cut cross-sections were also supplemented with surveyed riffle cross-sections. Baker used multiple methods to estimate reachwide bankfull discharges as model input. See Table 3.4 above for model methods and discharge estimates. HEC-RAS model results are included in Appendix I. See Figure 4 for cross-section locations.

Model results indicate a close correlation to estimated bankfull maximum depths and cross-sectional areas at surveyed cross-sections. The model indicated that bankfull maximum depth and bankfull cross-section area along Reach 1 was 2.4 ft and 16.7 sq ft respectively as compared to surveyed values of 2.1 ft and 13.8 sq ft. Model calculations for Reach 2 bankfull maximum depth and bankfull cross-sectional area were 1.6 ft and 15.5 sq ft as compared to surveyed values of 1.6 ft and 14.5 sq ft. Model results for Reach 3 bankfull maximum depth and bankfull cross-sectional area were 2.9 ft and 16.6 sq ft as compared to surveyed values of 3.2 ft and 18.0 sq ft. Although there are slight variations in calculated values versus estimated values for both bankfull maximum depth and bankfull cross-sectional area, the differences are minimal and therefore help validate the estimated bankfull discharge values for the mainstem of UT to Town Creek.

4.5 Channel Morphology (Pattern, Dimension, and Profile)

Baker performed general topographic and planimetric surveying of the Project site and produced topographic mapping, based on survey data, in order to create plan set base mapping. Cross-section surveys were also performed to assess the current condition and overall stability of the stream channels. Cross-section locations are shown in Figure 4. The following discussion summarizes the survey results for the existing reaches. The watershed sizes were calculated at the terminus of the each reach and are shown in Figure 2; the existing parameters for dimension, pattern, and profile are summarized in Tables 4.1-4.4.

4.6 Channel Evolution

Channel stability is defined as the ability of a stream to transport incoming flows and sediment loads supplied by the watershed without undergoing significant changes over a geologically short time-scale. A generalized relationship of stream stability was proposed by Lane (1955); it states that the product of sediment load and sediment size is in balance with the product of stream slope and discharge, or stream power. A change in any one of these variables induces physical adjustment of one or more of the other variables to compensate and maintain the proportionality.

Longitudinally, the water and sediment flows delivered to each subsequent section are the result of the watershed and upstream or backwater (downstream) conditions. Water and sediment pass through the channel, which is defined by its shape, material, and vegetative condition. Flow and sediment are either stored or passed through at each section along the reach. The resulting physical changes balance gravity, friction, and the sediment and water being delivered into the system (Leopold et al., 1964).

Observed stream response to induced instability, as described by Simon's (1989) Channel Evolution Model, involve extensive modifications to channel form resulting in profile, cross-sectional, and plan form changes which often take decades or longer to achieve resolution. The Simon (1989) Channel Evolution Model characterizes typical evolution in six steps:

1. Pre-modified,
2. Channelized,
3. Degradation,
4. Degradation and widening,
5. Aggradation and widening,
6. Quasi-equilibrium.

The channel evolution process is initiated once a stable, well-vegetated stream that interacts frequently with its floodplain is disturbed. Channelization, dredging, changes in land use, removal of streamside vegetation, upstream or downstream channel modifications, and/or change in other hydrologic variables result in adjustments in channel morphology to compensate for the new condition(s). Disturbance commonly results in an increase in stream power that can cause degradation, often referred to as channel incision (Lane, 1955). Incision eventually leads to over-steepening of the banks and, when critical bank heights are exceeded, the banks begin to fail and mass wasting of soil and rock leads to channel widening. Incision and widening continue to propagate upstream in the form of a head-cut. Eventually the mass wasting slows, and the stream begins to aggrade. A new, low-flow channel begins to form in the deposited sediment. By the end of the evolutionary process, a stable stream with dimension, pattern, and profile similar to those of undisturbed channels forms in the deposited alluvium. The new channel is at a lower elevation than its original form, with a new floodplain constructed of alluvial material (FISRWG, 1998).

Channels within the Project area have experienced prior channelization and/or additional watershed disturbances. Currently, livestock have access to the stream channels and impacts from this access are further exacerbating channel instability. Channel stability was assessed with the following methods: qualitative and quantitative site observations, site-specific geomorphic facets using detailed topographic data collected for the Project, and sediment analyses. Conclusions reached from these methods were used to define site stability and determine appropriate restoration approaches for all reaches.

UT to Town Creek is a perennial stream in a watershed where historical and current rural land management practices include timber harvesting, pasture conversion, channelization, and livestock grazing. The mainstem channel was divided into three reaches (Reaches 1, 2, and 3) based on tributary confluences. The remaining tributaries were divided into reaches based on drainage area.

Reach 1

Reach 1 is laterally unstable with erosion occurring on both banks. Aquatic habitat is limited and mostly in the form of backwater pools caused by multiple debris jams. The existing buffer vegetation is dominated by Chinese privet and multiflora rose. These conditions continue approximately 750 LF downstream to an existing fence, where there is a transition to no woody riparian vegetation. Reach 1 is currently in the early stages of Simon Evolutionary Model Stage 4 (Simon, 1989) and in a Rosgen Channel Evolution Scenario 5 (Rosgen 2001b). The channel has halted vertical incision due to the presence of bedrock and has started to laterally degrade. The channel will likely transition from an E to an F stream type and further degradation or widening is likely if left unaddressed.

Reach 2

Reach 2 exhibits extremely low banks, a moderate width-to-depth ratio, and bedrock grade control for approximately 460 LF downstream of Reach 1. The channel is laterally unstable with erosion occurring on both banks. The moderate width-to-depth ratio has resulted in lateral bar deposition. Downstream of this section, fine sediment deposition has covered the bedform features and the floodplain, a result of an undersized farm culvert running under the main farm access road. Downstream of the culvert the channel exhibits the same instabilities as the first 460 LF. Reach 2 is currently in the early stages of Simon Evolutionary Model Stage 4 (below farm road) and 5 (above farm road) (Simon, 1989) and in a Rosgen Channel Evolution Scenario 5 (Rosgen 2001b). The channel has halted vertical incision due to the presence of bedrock and has started to laterally degrade and further degradation or widening is likely if left unaddressed.

Reach 3

Reach 3 starts downstream of Reach 2 and displays similar instabilities as Reach 2 with eroding banks and areas of mass wasting caused by hoof shear. However, downstream, the valley slope decreases and a wide flat floodplain develops. Reach 3 is currently in the late stages of Simon Evolutionary Model Stage 3 (Simon, 1989) and in a Rosgen Channel Evolution Scenario 5 (Rosgen 2001b).

Reach 4

Reach 4 carries a high sediment load due to bank erosion from cattle impacts. The stream is unable to carry its sediment load supplied and has formed a braided channel as a result. The channel has a high width-to-depth ratio and is vertically contained with no access to its floodplain. Reach 4 is currently in the early stages of Simon Evolutionary Model Stage 5 (Simon, 1989) and in a Rosgen Channel Evolution Scenario 5 (Rosgen 2001b) due to limited access to its floodplain. Further degradation and/or widening are inevitable without some stream modification.

Reach 5

Reach 5 exhibits extremely high banks and a low width-to-depth ratio. The channel is laterally unstable with areas of massive bank erosion throughout the reach. Animal carcasses litter the banks of this reach. Reach 5 is currently in the late stages of Simon Evolutionary Model Stage 4 (Simon, 1989) and in a Rosgen Channel Evolution Scenario 6 (Rosgen 2001b) due to limited access to its floodplain. Further degradation and/or widening are inevitable without some stream modification.

Reach 6

Reach 6 is currently located against a valley wall and is incised and disconnected from the floodplain at the bankfull stage. Bank stability and water quality on this tributary have been greatly impacted by the heavy cattle traffic through the area. Areas of bank erosion and mass wasting persist throughout the channel. Reach 6 is currently in the late stages of Simon Evolutionary Model Stage 4 (Simon, 1989) and in a Rosgen Channel Evolution Scenario 6 (Rosgen 2001b) since it lacks access to its floodplain; further degradation or widening is inevitable without some stream modification.

Reach 7

Reach 7 is a small, intermittent tributary that joins UT to Town Creek from the right floodplain at the upstream extent of Reach 2. This stream has a high width-to-depth ratio and exhibits several head cuts six inches to a foot in height, and is highly eroded with no woody riparian buffer vegetation. Reach 7 is currently in the late stages of Simon Evolutionary Model Stage 4 (Simon, 1989) and in a Rosgen Channel Evolution Scenario 4 (Rosgen 2001b) due to limited access to its floodplain. Further degradation and/or widening are inevitable without some stream modification.

Table 4.6 summarizes existing channel morphology in the Project area. Data were taken from surveyed cross-sections distributed across the Project area. Table 4.7 summarizes research findings by Rosgen (2001) concerning bank height ratios as an indicator of channel stability.

The Project area consists of channels that are primarily either in an aggrading or degrading phase of the channel evolutionary sequence. As a result, these streams are prime candidates for restoration and enhancement. Stream restoration techniques act to minimize the erosion and geomorphic disturbance required to achieve a new stable state naturally. The proposed restoration and enhancement activities along the tributaries will provide channel types that are appropriate to the valley types and slopes present. In addition to the installation of grade control structures, restoration efforts will include changes to channel dimension, pattern, and profile. This resets the evolutionary cycle; therefore, the structures and measures installed, in conjunction with the planted vegetation buffer, will ensure the continued stability of the streams within the Project area, barring major disturbance in the unprotected areas of the greater watershed.

Table 4.5a Boundary Shear Stress and Stream Power Existing Conditions for Reach 1, Reach 2, and Reach 3 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648			
Parameter	**Reach 1 Existing Conditions[1]**	**Reach 2 Existing Conditions**	**Reach 3 Existing Conditions[2]**
Bankfull Discharge, Q (cfs)	50.0	55.0	65.0
Bankfull Area (square feet)	13.8	14.5	18.0-19.0
Mean Bankfull Velocity (cfs)	3.6	3.8	3.4-3.6
Bankfull Width, W (feet)	9.0-11.9	12.6	9.8-12.7
Bankfull Mean Depth, D (feet)	1.2-1.5	1.2	1.5-1.8
Width to Depth Ratio, w/d (feet/ foot)	5.8-10.3	11.0	5.4-8.6
Wetted Perimeter (feet)	12.0-14.2	14.9	13.5-15.7
Hydraulic Radius, R (feet)	1.0-1.1	1.0	1.2-1.3
Channel Slope (feet/ foot)	0.008	0.009	0.008
Boundary Shear Stress, τ (lbs/ft^2)	0.61-0.71	0.77	0.30-0.33
Subpavement D_{100} (mm)	100	100	50
Largest Moveable Particle (mm) per Modified Shield's Curve	105-119	125	63-68
Critical Depth (feet)	1.1	0.9	0.9
Critical Slope (feet/ foot)	0.0073-0.0097	0.0098	0.0020-0.0024
Stream Power (W/m^2)	32.0-37.7	42.6	15.8-16.7
Notes: 1. Reach 1 based on comparing two riffle cross-sections within reach 2. Reach 3 based on comparing two riffle cross-sections within reach			

Table 4.5b Boundary Shear Stress and Stream Power Existing Conditions for Reach 4, Reach 5, Reach 6 and Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648				
Parameter	**Reach 4 Existing Conditions[1]**	**Reach 5 Existing Conditions[1]**	**Reach 6 Existing Conditions**	**Reach 7 Existing Conditions**
Bankfull Discharge, Q (cfs)	7.7	6.0	14.0	5.7
Bankfull Area (square feet)	2.6	2.0	4.7	1.6
Mean Bankfull Velocity (cfs)	3.3	3.0	3.0	3.0
Bankfull Width, W (feet)	7.5	3.9	6.0	5.0
Bankfull Mean Depth, D (feet)	0.4	0.5	0.8	0.3
Width to Depth Ratio, w/d (feet/ foot)	18.8	7.8	7.8	15.7

Table 4.5b Boundary Shear Stress and Stream Power Existing Conditions for Reach 4, Reach 5, Reach 6 and Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648				
Parameter	**Reach 4 Existing Conditions[1]**	**Reach 5 Existing Conditions[1]**	**Reach 6 Existing Conditions**	**Reach 7 Existing Conditions**
Wetted Perimeter (feet)	13.5	4.9	7.6	5.7
Hydraulic Radius, R (feet)	1.3	0.4	0.6	0.3
Channel Slope (feet/ foot)	0.0215	0.0367	0.0230	0.0446
Boundary Shear Stress, τ (lbs/ft^2)	-	-	0.97	0.65
Subpavement D_{100} (mm)	-	-	90	110
Largest Moveable Particle (mm) per Modified Shield's Curve	-	-	148	105
Critical Depth (feet)	-	-	0.3	0.5
Critical Slope (feet/ foot)	-	-	0.0096	0.0287
Stream Power (W/m^2)	-	-	53.6	38.2
Notes: 1. No sediment sampling was conducted on Reach 4 and Reach 5, therefore, no sediment transport analysis was conducted.				

Table 4.6 Channel Morphology Features and Stability Indicators for Project Reaches UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648			
Parameter	**Reach 1**	**Reach 2**	**Reach 3**
Stream Type	E4	E4	E4
Riparian Vegetation	Upper portion of Reach 1 is thinly forested (invasive) on both sides of the stream with adjacent pasture land. Lower portion of Reach 1 has grazed pasture on the both sides of the channel.	Grazed pasture on the both sides of the channel with spotty trees along the banks.	Grazed pasture on the both sides of the channel with spotty trees along the banks.
Channel Dimension			
Bankfull Area (SF)	13.8	14.5	18.0-18.9
Width/Depth Ratio	5.8-10.3	11.0	5.4-8.6
Channel Pattern			
Meander Width Ratio	2.6-11.2	4.8-14.7	3.5-6.2
Sinuosity	1.2	1.2	1.1
Vertical Stability			
Bank Height Ratio (BHR)	1.2-1.2	1.3	1.0
Entrenchment Ratio (ER)	6.5-8.6	6.4	18.1-23.5
Evolution Scenario (I-II-III …)	E-Gc-F-C-E	E-Gc-F-C-E	E-Gc-F-C-E
Existing Evolution Stage[1]	(IV) Degradation and Widening	(III/IV) Degradation/Aggradation and Widening	(III) Degradation

Table 4.6 Channel Morphology Features and Stability Indicators for Project Reaches UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648			
Parameter	**Reach 4**	**Reach 5**	**Reach 6**
Stream Type	B4	B4	B4
Riparian Vegetation	Grazed pasture on the both sides of the channel with spotty trees along the banks.	Grazed pasture on the both sides of the channel with spotty trees along the banks.	Grazed pasture on the both sides of the channel with spotty trees along the banks.
Channel Dimension			
Bankfull Area (SF)	1.8	2.0	4.7
Width/Depth Ratio	26.1	7.8	7.8
Channel Pattern			
Meander Width Ratio	5.9-7.7	11.3-18.2	6.6-10.7
Sinuosity	1.1	1.2	1.1
Vertical Stability			
Parameter	**Reach 4**	**Reach 5**	**Reach 6**
Bank Height Ratio (BHR)	2.4	2.5	2.0
Entrenchment Ratio (ER)	1.6	1.4	1.6
Evolution Scenario (I-II-III…)	E-Gc-F-C-E	B-G-Fb-B	B-G-Fb-B
Existing Evolution Stage[1]	(IV) Degradation and Widening	(IV) Degradation and Widening	(IV) Degradation and Widening
Parameter	**Reach 7**		
Stream Type	B4a		
Riparian Vegetation	Grazed pasture on the both sides of the channel with spotty trees along the banks.		
Channel Dimension			
Bankfull Area (SF)	1.6		
Width/Depth Ratio	15.7		
Channel Pattern			
Meander Width Ratio	6.0-9.6		
Sinuosity	1.1		
Vertical Stability			
Bank Height Ratio (BHR)	2.6		
Entrenchment Ratio (ER)	1.5		
Evolution Scenario (I-II-III…)	B-G-Fb-B		
Existing Evolution Stage[1]	(IV) Degradation and Widening		
Notes: 1. Simon Channel Evolution Model (Simon, 1989). 2. No sediment sampling was conducted on Reach 7. Therefore, no sediment transport analysis was conducted.			

Table 4.7 Rosgen Channel Stability Assessment UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648	
Stability Rating	**Bank Height Ratio (BHR)**
Stable (low risk of degradation)	1.0 - 1.05
Moderately unstable	1.06 - 1.3
Unstable (high risk of degradation)	1.3 - 1.5
Highly unstable	>1.5
Notes: Rosgen, 2001b.	

4.7 Channel Stability Assessment

Channel stability is defined as the ability of a stream to transport incoming flows and sediment loads supplied by the watershed without undergoing significant changes over a geologically short time-scale. A generalized relationship of stream stability was proposed by Lane (1955); it states that the product of sediment load and sediment size is in balance with the product of stream slope and discharge, or stream power. A change in any one of these variables induces physical adjustment of one or more of the other variables to compensate and maintain the proportionality.

Channels within the Project area are perennial, intermittent, and ephemeral. All the channels have experienced prior channelization or other kinds of watershed disturbance, and are currently impacted by cattle grazing. Channel stability was assessed with the following methods: qualitative and quantitative site observations, site-specific geomorphic facets using detailed topographic data collected for the Project and sediment analyses. Conclusions reached from these methods were used to define site stability and determine appropriate restoration approaches all the reaches.

For further analysis, refer to the tables and discussion in Section 4.6.

4.8 Vegetation Community Type Description and Disturbance History

The habitat within and adjacent to the proposed Project area consists of agricultural areas and Piedmont Alluvial Forest as described by Schafale (2012). The riparian areas ranged from relatively disturbed to very disturbed. Examples of major disturbance include active livestock grazing and mechanical removal of vegetation. Historical aerials in Appendix C reveal that the Project area was forested in 1977, but had been cleared for agricultural purposes by 1984. Photographs of the current Project area are included in Appendix A. A general description of each community follows:

4.8.1 Piedmont Alluvial Forest

This ecological community comprises approximately 10 percent of the Project area along the first 750 LF of Reach 1. This community has been disturbed by agricultural maintenance (bush hogging) which has limited the forested buffer to a narrow 5- to 25-LF wide corridor along top of bank. The canopy is dominated by various bottomland trees such as yellow poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), American elm (*Ulmus americana*), sycamore (*Platinus occidentalus*), and black willow (*Salix nigra*). Understory trees include ironwood (*Carpinus caroliniana)*, persimmon (*Diospyros virginiana*), and red maple (*Acer rubrum*). Woody vine and herbaceous species consisted of poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), blackberry (*Rubus* sp.), false nettle (*Boehmeria cylindrica*), jewelweed (*Impatiens* sp.), tearthumb (*Polygonum sagittatum*), and fescue (*Festuca* sp.). Exotic invasive species found interspersed within the forested buffer include Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and multiflora rose (*Rosa multiflora*). In the lower portion of Reach 1 and all other reaches, no canopy exists along the stream channel and floodplain except for a few black willow trees.

4.8.2 Agriculture Areas

These areas cover approximately 90 percent of the Project area. The pastureland is heavily grazed with livestock granted unrestricted access to the riparian system. The vegetation within these pasture areas is primarily comprised of fescue, spiny pigweed (*Amaranthus spinosus*), smart weed (*Polygonum* sp), Pokeberry (*Phytolacca americana*), spike rush (*Eleocharis* sp.), false nettle (*Boehmeria cylindrical*), buttercup (*Ranunculus* sp.) and Dog Fennel (*Eupatorium capillifolium*). Black willows are sparsely found on the stream banks of these areas.

5 REFERENCE STREAMS

Reference reach surveys are valuable tools for comparison. The morphologic data obtained such as dimension, pattern, and profile can be used as a template for design of a stable stream in a similar valley type with similar bed material. In order to extract the morphological relationships observed in a stable system, dimensionless ratios are developed from the surveyed reference reach. These ratios can be applied to a stream design to allow the designer to 'mimic' the natural, stable form of the target channel type.

While reference reach data can be a useful aid in designing channel dimension, pattern, and profile, there are limitations in smaller stream systems. The flow patterns and channel formation for most reference reach quality streams is often controlled by slope, drainage areas and larger trees and/or other deep rooted vegetation. Some meander geometry parameters, such as radius of curvature, are particularly affected by vegetation control. Pattern ratios observed in reference reaches may not be applicable or are often adjusted in the design criteria to create more conservative designs that are less likely to erode after construction, before the permanent vegetation is established.

For comparison purposes, Baker selected local reference reaches from both the NCDOT database and internal reference data. The data shown on Table 5.1 helped to provide a basis for evaluating the valley slope and topography of the project site and determining the stream systems that may have been present historically and/or how they may have been influenced by changes within the watershed.

The reference sites are examples of a small "Rural Piedmont Stream," and fall within the same climatic, topographical, physiographic and ecological region as the Project site. Three of the sites are located within the Carolina Slate Belt region. These systems often exist as the floodplains of smaller intermittent/perennial streams in which flows tend to be relatively steady, with floods of short duration, and seasonal periods of low flow.

Table 5.1 Reference Reach Parameters Used to Inform Design Ratios
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	UT to Rocky Creek		Spencer Creek Upstream		Richland Creek		Morgan Branch	
	Min	Max	Min	Max	Min	Max	Min	Max
Stream Type	E4b		E4/C4		C4		C4	
Drainage Area – square miles	1.05		0.50		1.00		8.35	
Bankfull Width (w_{bkf}) – feet	12.2		8.7		16.2	16.7	33.2	
Bankfull Mean Depth (d_{bkf}) – feet	1.3		1.2		0.9	0.9	2.3	
Width/Depth Ratio (w/d ratio)	9.1		7.3		18.0	18.6	14.1	
Cross sectional Area (A_{bkf}) – SF	16.3		10.6		15.0	15.5	75.1	
Bankfull Mean Velocity (v_{bkf}) - fps	5.5		N/P		N/P		6.6	
Bankfull Discharge (Q_{bkf}) – cfs	85		N/P		N/P		524.0	
Bankfull Max Depth (d_{mbkf}) - feet	1.8		1.9		1.4	1.5	2.8	
d_{mbkf} / d_{bkf} ratio	1.3		1.6		1.6	1.7	1.2	
Low Bank Height to d_{mbkf} Ratio	1.0		1.0		1.0		1.0	

Table 5.1 Reference Reach Parameters Used to Inform Design Ratios UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648								
Parameter	**UT to Rocky Creek**		**Spencer Creek Upstream**		**Richland Creek**		**Morgan Branch**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Floodprone Area Width (w_{fpa}) – feet	72.4		228.5		50	53	77.5	
Entrenchment Ratio (ER)	6.0		26.3		3.0	3.3	2.3	
Meander length (L_m) – feet	N/A		54.0	196.0	90	94	N/P	
Ratio of meander length to bankfull width (L_m/w_{bkf})	N/A		6.2	22.5	5.5	5.7	N/P	
Radius of curvature (R_c) – feet	N/A		5.4	22.1	14.3	26.1	N/P	
Ratio of radius of curvature to bankfull width (R_c / w_{bkf})	N/A		0.6	2.5	0.9	1.6	N/P	
Belt width (w_{blt}) – feet	N/A		24.0	52	25	40	N/P	
Meander Width Ratio (w_{blt}/W_{bkf})	N/A		2.8	6.0	1.5	2.4	N/P	
Sinuosity (K) Stream Length/ Valley Distance	1.1		1.1		1.2		N/P	
Valley Slope – feet per foot	0.0261		0.0139		0.0136		N/P	
Channel Slope ($s_{channel}$) – feet per foot	0.0235		0.0132		0.0133		0.0070	
Pool Slope (s_{pool}) – feet per foot	0.0	0.0037	0.0001		0.00	0.0014	0.0001	
Ratio of Pool Slope to Average Slope (s_{pool} / $s_{channel}$)	0.0	0.15	0.01		0.00	0.11	0.01	
Maximum Pool Depth (d_{pool}) – feet	2.2		2.5		2.5		4.1	
Ratio of Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	1.6		2.1		2.8		1.8	
Pool Width (w_{pool}) – feet	10.9		8.4		11.1		25.9	
Ratio of Pool Width to Bankfull Width (w_{pool} / w_{bkf})	0.9		1.0		0.7		0.8	
Pool Area (A_{pool}) – square feet	19.3		12.8		20.1		88.9	
Ratio of Pool Area to Bankfull Area (A_{pool}/A_{bkf})	1.2		1.2		1.3		1.2	
Pool-to-Pool Spacing – feet	26.3	81.3	13.0	46.5	37.3	95.8	146.0	277.0
Ratio of Pool-to-Pool Spacing to Bankfull Width ($p\text{-}p/w_{bkf}$)	2.2	6.7	1.5	5.3	2.3	5.8	4.4	8.3
Riffle Slope (s_{riffle}) – feet per foot	0.0606	0.089	0.010	0.067	0.013	0.0413	0.014	0.024
Ratio of Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	2.6	3.8	0.8	5.1	1.0	3.1	2.0	3.4
Particle Size Distribution of Riffle Material								
Material (d_{50})	Coarse Gravel		Medium Gravel		Very Coarse Gravel		Very Fine Gravel	
d_{16} – mm	<0.063		0.06		6.0		N/P	
d_{35} – mm	2.4		3		N/P		1.2	

Table 5.1 Reference Reach Parameters Used to Inform Design Ratios UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648								
Parameter	**UT to Rocky Creek**		**Spencer Creek Upstream**		**Richland Creek**		**Morgan Branch**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
d_{50} – mm	22.6		8.6		45.0		3	
d_{84} – mm	120		77		125.0		77	
d_{95} – mm	256		180		N/P		800	

Notes:
NC Department of Transportation, Reference Reach Database
N/A: Channel had minimal meander geometry - no pattern measured
N/P: Data was not provided in the NCDOT reference reach database
Values in this chart were rounded and may differ slightly from actual values.

5.1 Design Criteria Selection

In addition to reference reach surveys, Baker used data collected from past successful stream mitigation projects and headwater portions of Town Creek to compile common design ratios and confirm upstream sediment supply, respectively.

Design ratios and geomorphic survey data from stable stream reaches were used to develop the design parameters for dimension, pattern, and profile. The specific design parameters and ratios are further described in Section8 can be found in the morphological design table (Table 8.2). On-site data and Project design data were used in this design and these data are summarized in Tables 8.3a to 8.3g.

The existing substrate distributions/ particle sizes within the existing reaches were measured and compared with the upstream supply reach. The results are similar in size/range (medium/coarse gravel), but somewhat atypical of supply because of changes to channel dimensions from cattle impacts/degradation. The proposed design channels (geometry and plan form) are still sized to carry a smaller range of flows (at or less than bankfull discharge) and the gravel bedload to prevent degradation/aggradation. Baker performed visual reconnaissance, bank erosion assessments, and collected sediment samples to support the sediment transport analysis in order to help characterize the flow regime and support the design parameters and channel response prediction.

Surveyed cross-sections and longitudinal profiles from the site, as well as up-stream sediment supply data are included in Appendix E.

6 PROJECT SITE WETLANDS (EXISTING CONDITIONS)

6.1 Jurisdictional Wetlands

The proposed Project area was reviewed for the presence of wetlands and waters of the United States in accordance with the provisions of Executive Order 11990, the Clean Water Act, and subsequent federal regulations. Wetlands have been defined by the USACE as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b) and 40 CFR 230.3 (t)). The areas in the Project boundaries that displayed one or more wetland characteristics were reviewed to determine the presence of wetlands. The wetland characteristics included:

1. Prevalence of hydrophytic vegetation.
2. Permanent or periodic inundation or saturation.
3. Hydric soils.

On June 5, 2007, the USACE and US Environmental Protection Agency (USEPA) issued joint guidance for their field offices for Clean Water Act jurisdictional determinations in response to the United States Supreme Court decision in the consolidated cases of Rapanos v. United States and Carabell v. United States (USEPA and USACE, 2007)[1]. Based on this guidance, the agencies will assert jurisdiction over the following waters:

- Traditional navigable waters (TNWs);
- Wetlands adjacent to TNWs;
- Non- Navigable tributaries of TNWs that are considered relatively permanent waters (RPWs). Such tributaries flow year-round or exhibit continuous flow for at least 3 months; and
- Wetlands that directly abut RPWs.

The agencies will decide jurisdiction over the following waters based on a standardized analysis to determine whether they have a significant nexus with a traditional, navigable water:

- Non- Navigable tributaries that are not relatively permanent waters (non-RPWs);
- Wetlands adjacent to non-RPWs; and
- Wetlands that are adjacent to but do not directly abut an RPW.

The significant nexus analysis is fact-specific and assesses the flow characteristics of a tributary and the functions performed by all its adjacent wetlands to determine if they significantly affect the physical, chemical, and biological integrity of downstream TNWs. A significant nexus exists when a tributary, in combination with its adjacent wetlands, has more than a speculative or insubstantial effect on the physical, chemical, or biological integrity of a TNW.

The USACE and USEPA will apply the significant nexus standard within the limits of jurisdiction specified by the Supreme Court decision in the case of Solid Waste Agency of Northern Cook County (SWANCC) v. US Army Corps of Engineers (USACE). Under the SWANCC decision, the USACE and USEPA cannot regulate isolated wetlands and waters that lack links to interstate commerce sufficient to

[1] Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States. EPA, December 2, 2008. http://www.epa.gov/owow/wetlands/pdf/RapanosGuidance6507.pdf

serve as a basis for jurisdiction under the Clean Water Act. Though isolated wetlands and waters are not regulated by the USACE, within the state of North Carolina isolated wetlands and waters are considered "waters of the state" and are regulated by the NCDWR under the isolated wetlands rules (15A NCAC 2H .1300).

Wetland Impacts

The majority of wetland areas once present on-site have been impacted and manipulated to promote agricultural land uses. At present, former wetland areas contain hydric soils, but lack wetland hydrology and hydrophytic vegetation. Temporary and permanent wetland impacts associated with the restoration activities are considered essential to the success of the overall restoration. These areas total 1.0 acres (AC) and are shown on Figure 5.

Jurisdictional Wetland Findings

Following an in-office review of the National Wetland Inventory (NWI) map, NRCS soil survey, and USGS quadrangle map, Baker personnel delineated jurisdictional wetlands and waters on-site based on the USACE 1987 Wetland Delineation Manual (USACE, 1987) and indicators specified in the Interim Regional Supplement of the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (USACE, 2010). Additional information to further support wetland delineations was found in the *National List of Plant Species that Occur in Wetlands: Southeast (Region 2)* (Reed, 1988). Jurisdictional wetlands were flagged in the field and located using a 2005 Trimble GeoXT, with submeter accuracy.

Based on the "N.C. Wetland Assessment Method" (NC WAM User Manual, 2010), Wetlands 1 -7 are classified as headwater forest wetlands. Classification is based on the investigators best professional judgment regarding the original, naturally occurring wetland type if the site wasn't heavily impacted by cattle grazing. There are approximately 43,560 square feet (1.0 acres) of jurisdictional wetlands located within the project review area. Wetland delineation forms and NC WAM Assessment and Rating forms are located in Appendix B.

On August 3, 2011, Baker met on-site with the USACE's Regulatory Specialist for Stanly County, Steve Kichefski. Jurisdictional areas were verified during this field walk and an updated Jurisdictional Survey Map was resubmitted to the USACE on August 8, 2011, to reflect field changes. Baker received the official JD Notification of Approval on July 17, 2013. A copy of the approved JD is included in Appendix B.

6.2 Hydrological Characterization

Site Hydrology

The presence of hydric soils over much of the Project site is evidence that the site historically supported a stream and wetland ecosystem. As is the case in much of rural North Carolina, local drainage patterns have been altered over the last two centuries to increase drainage and promote agricultural production. The Project reaches have been channelized and straightened to maximize the area for pastureland in support of agricultural and/or livestock production. In additional to channelization, the four larger on-site wetland areas (Wetlands 1, 2, 3 and 7) have ditches to direct drainage towards UT to Town Creek. Channelization and ditching have resulted in more effective site drainage and degraded wetland hydrology. There is approximately one acre of existing wetlands within the Project limits.

Ten automated groundwater wells were installed in the Project area to evaluate current hydrologic conditions on-site, as shown in Figure 5. These wells provide a basis for comparing pre- and post-restoration hydrology on the site. Six wells were initially installed in October 2010. Four wells were installed in March 2011 to capture additional data across the Project site. Water table data was collected from the wells is shown in Figure 6.1. Wells were installed in pasture and floodplain areas targeted for wetland enhancement, restoration, or creation. Wells were installed across a range of elevations and locations to evaluate the range of hydrologic conditions on-site. The wells were installed to a depth of 41 inches below ground surface, and the automated loggers (RDS Ecotone^{TM} CP & WM Series units) were programmed to record water table levels every 12 hours.

Most well locations exhibited similar trends in water table depth throughout the monitoring period that in part reflect seasonal changes in rainfall. In general, the water table levels recorded in the six wells installed in October 2010 were lowest at the beginning (October through December of 2010) and the end (late May 2011) of the monitoring period. In late December 2010, the water table at monitored locations (Well AW2 - AW5) began to rise. Similar to levels observed from October 2010 through December of 2010, the water table levels for wells, AW5, AW4, and AW10 remained at shallower depths and only rose to levels within 12 inches of the ground surface during times of increased precipitation. The water table levels recorded in the four wells installed in late March 2011 (Wells AW7 - AW10) also indicate a similar trend of decreasing water table levels occurring in April 2011. This trend in local water table reflects the lower evapotranspiration losses during the winter and spring of the monitoring period. Water table levels spiked in response to significant rainfall events during this period; however, most monitored locations exhibited a rapid drop in water table depth once rainfall ended. This rapid drop in ground water levels supports the actualization that the site is currently limited in its capacity to maintain historical ground water levels due to channelization.

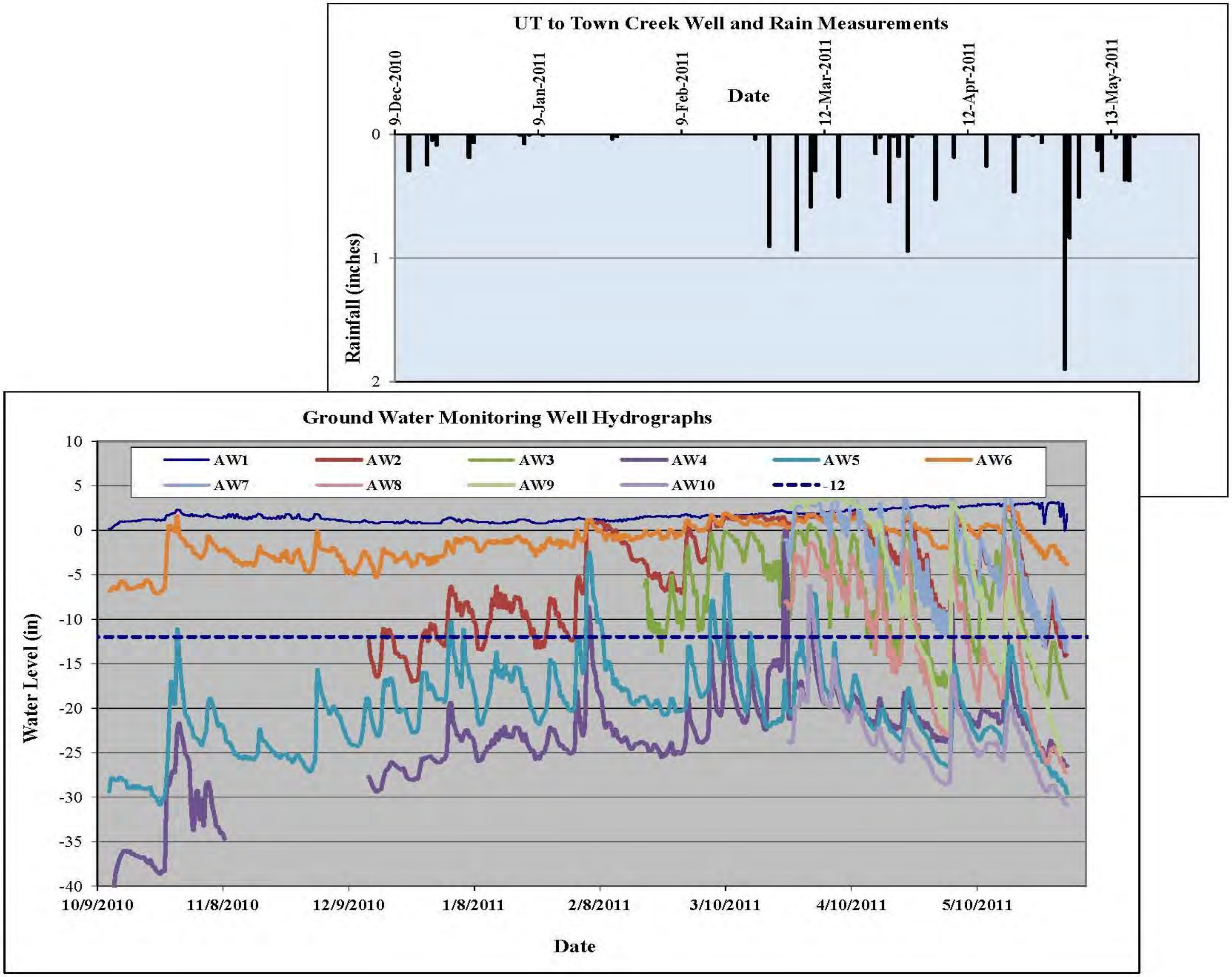
Local water table depths at monitored locations are also influenced by topography, soil properties, and the base flow level of UT to Town Creek. Two of the wetter monitored locations on the site are Wells 1 and 6, which are located within the two on-site reference wetland areas. These areas are located in slight topographic depressions at the toe of slope in the western floodplain of UT to Town Creek (Refer to Figure 5). Although the site has experienced drier than normal conditions during the monitoring period, Wells 1 and 6 remained constantly at or near the surface. Water level fluctuations in response to rainfall events are subtle compared to spikes observed at the other wells. The data indicates these wetter areas receive consistent groundwater flow from adjacent uplands.

Wells 2, 3, 7, and 8 exhibited similar hydrologic trends during the monitoring period. The majority of water levels range from 0 to 12 inches in depth. In general, water levels rapidly rose and fell in response to rainfall events. Well 2 deviated slightly by maintaining elevated water levels during March and April 2011. The deviation suggests that the physical topographic location of Well 2, which is located close to the western valley wall, receives groundwater input from the adjacent uplands in addition to rainfall. Wells 3, 7, and 8 are located further away from uplands.

The water table near Wells 4, 5, and 10 were considerably deeper than most other wells on site during the monitoring period. Water levels generally fluctuated between depths of 15 to 30 inches. These wells are located adjacent to the lower portion of Reach 2 and along Reach 3 of UT to Town Creek where bank heights average 2 to 4 feet compared to 1 to 2 feet along Reach 2 above the farm road crossing. This indicates the channel has downcut further into the soil profile along the lower section subsequently lowers groundwater levels. In addition, topography in the vicinity of Well 5 and 10 suggests the area was partially filled likely a result of agricultural activities. The gap in Well 4 data for most of November and the first half of December 2010 is the result of vandalism. Since reinstallation of the well, no other issues have arisen.

In general, wells located within delineated wetlands continually exhibit water table levels within 12 inches of the ground's surface, while wells located outside of delineated wetlands seem to show a direct response to precipitation events. These responses are especially apparent in the wells located where bank heights along UT to Town Creek are higher and where fill in the floodplain has altered topography.

Figure 6.1 Hydrographs of the Groundwater Monitoring Wells Compared to Local Rainfall on the UT to Town Creek Site.



Climatic Conditions

Stanly County has an average rainfall of 48.71 inches (NRCS, 2002) and a 222-day growing season (defined as the period in which air temperatures are maintained above 28 degrees Fahrenheit at a frequency of 5 years in 10) that begins on March 27 and ends on November 5. Baker collected rainfall data from the nearest automated weather station, located in New London, approximately 1.5 miles southeast of the Project site (CRONOS Database, NEWL – North Stanly Middle School). Monthly precipitation amounts from July 2010 through June 2011 are compared with Stanly County WETS table (NRCS, 2002) average monthly rainfall, in Table 6.1. The data indicate that over the entire year, total rainfall was slightly below normal. Observed rainfall amounts from September 2010 to April 2011 were below average.

Table 6.1 Comparison of Monthly Rainfall Amounts for Project Site and Long-term Averages
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Month-Year	Observed Monthly Precipitation (in)	WETS Table Average Monthly Precipitation (in)	Deviation of Observed from Average (in)
Jun-10	4.1	4.25	-0.15
Jul-10	4.16	5.05	-0.89
Aug-10	7.12	4.12	3.0
Sep-10	3.72	4.43	-0.71
Oct-10	1.87	3.54	-1.67
Nov-10	1.2	3.27	-2.07
Dec-10	2.0	3.3	-1.3
Jan-11	0.17	4.44	-4.27
Feb-11	0.95	3.7	-2.75
Mar-11	4.25	4.98	-0.73
Apr-11	1.55	3.29	-1.74
May-11	4.76	4.34	0.42
Sum	**35.85**	**48.71**	**-12.86**

6.3 Soil Characterization

During wetland delineations, hydric soils were evaluated by Baker using hand auger borings and field indicators specified in the Interim Regional Supplement of the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (USACE, 2010). The majority of the Project site is mapped as Oakboro silt loam and Goldston very channery silt loam. The Oakboro silt loam is a hydric soil that is moderately well drained loamy alluvium found on floodplains. The Goldston very channery silt loam (GoF) is not hydric and consists of well drained soils residuum weathered metavolcanics or argillite located on uplands. Smaller amounts of Badin channery soil loam series (BaD & BaF), Kirksey silt loam (Kkb), and Tarrus channery silt loam (TbB) are present in the Project area (See Figure 3). Soil profiles from the wetland delineation performed by Baker are provided in Appendix B. Hydric field indicators used for wetland delineations were “Depleted Matrix” (indicator F3), “Redox Depressions” (indicator F8), and “Iron-Manganese Masses” (indicator F12) (USACE, 2010).

Additional hydric soil evaluations were performed by licensed soil scientists from Thompson Environmental Consulting (TEC) in conjunction with The Catena Group (Catena). Field investigations included hand auger borings, backhoe pits, and NRCS Soil Survey data for Stanly County (US Department of Agriculture [USDA] 1989). Hydric soil determinations were based upon *Field Indicators of Hydric Soils in the United States - A Guide for Identifying and Delineating Hydric Soils* Version 7.0, (USDA, 2010). While investigations indicated considerable spatial variation in soil profile characteristics across the site, areas proposed for restoration were found to exhibit one or more hydric soil indicator(s). Field indicators used for onsite hydric investigations were "Depleted Below Dark Surface" (indicator A11) and "Piedmont Flood Plain Soils" (indicator F19) (USDA, 2010). The above soil properties indicate that these soils were formed under reducing conditions and that the site once functioned as a wetland system. The *Hydric Soil Investigation Report* with figures, photos and additional data such as descriptions of representative soil unit divisions are included in Appendix B.

6.4 Vegetative Community Types and Disturbance History

Based on information available, from historical aerial photos and USGS topographic maps, the Soil Investigation Report, and discussions with the landowner, UT to Town Creek within the project area has been in its current location and parallel to Old Salisbury Road since 1957 and was predominantly forested at least until 1977. The landowner's father cleared the forested section along UT to Town Creek for pasture prior to 1984. The project site wetlands were present at that time, but the landowner's father did not physically manipulate the wetlands or the floodplain area. However, cattle have had full access to the wetland areas since the forested vegetation was removed for pasture. There are wetland drainage features present on site in wetlands 2, 3, 4 & 7; however, the basis of their origin, man-made or natural is unknown. As outlined in the Soil Investigation Report, an area of overburden in the floodplain adjacent to UT to Town Creek, especially in vicinity of Wetland 5 and Wetland 7, appears to be comprised of alluvial sediments. Deposition of these sediments was likely to have occurred incrementally and over time within the floodplain as the result of historic human activities like forest clearing and/or manipulation of the creek. See Appendix B for the Hydric Soils Investigation Report (TEC, et al., 2011) and Appendix C for historical aerial and USGS maps.

The wetland vegetative community type, prior to its transition from forest land to pasture, was most likely representative of a headwater wetland forests. On-site dominant woody species commonly found in areas subject clearing or logging included red maple (*Acer rubrum*), Sycamore (*Platanus occidentalis*), and Sweetgum (*Liquidambar styraciflua*). Additional species common to this community that are present and dominant on-site include American elm (*Ulmus Americana*), tulip poplar (*Liriodendron tulipifera*), sedges (*Carex* spp.), smart weed (*Polygonum* spp.), and false nettle (*Boehmeria cylindrica*). Additional species dominant to the on-site wetlands include, but are not limited to, rushes (*Juncus* sp.), Arrowhead duck potato (*Sagittaria* sp.), tear thumb (*Polygonum sagittatum*), spikerush (*Eleocharis* sp.), and Chinese privet (*Ligustrum sinese*).

7 REFERENCE WETLANDS

7.1 Reference Wetland Selection

The reference wetlands for the Project are on-site and include Wetland 2 and 7. Wetland 2 and 7 are both located in a topographic depression and within the floodplain of UT Town Creek at the toe of slope. Though the reference areas have experienced disturbance, including past timber harvest and extensive cattle grazing, both wetlands are indicative of headwater forested wetlands in reference to their geomorphic location, hydrologic characteristics, and dominant woody vegetation. Drainage features from each wetland abut UT to Town Creek and wetland soils are characteristically hydric. Wetland hydrology is dominated by ground water seeps and overland flow, but also experience overbank flooding from receiving tributaries. See Figure 5 for a depiction of their locations.

These sites were chosen to serve as an on-site reference wetlands primarily for the comparison of hydrologic data during unusually wet or dry years and not as a means of evaluating hydrologic success criteria. The plant community of these sites has been disturbed in the past; therefore, the sites will not be used as an ecological reference site.

7.2 Hydrological Characterization

Automated recording wells were installed within the reference sites during October 2010. The wells were programmed to record groundwater levels every 12 hours to a maximum depth of 41 inches. Groundwater levels at both wells have remained above a depth of 12 inches for the entire duration of the monitoring period (October 2010 to May 2011). Therefore, groundwater levels were above a depth of 12 inches for the final 26 consecutive days (12 percent) of the 2010 growing season and the first 67 consecutive days (30 percent) of the 2011 growing season. The wetter conditions may be due in part to topography. These areas are located in slight topographic depressions at the toe slope of hillsides in areas that receive significant seepage from the adjacent uplands.

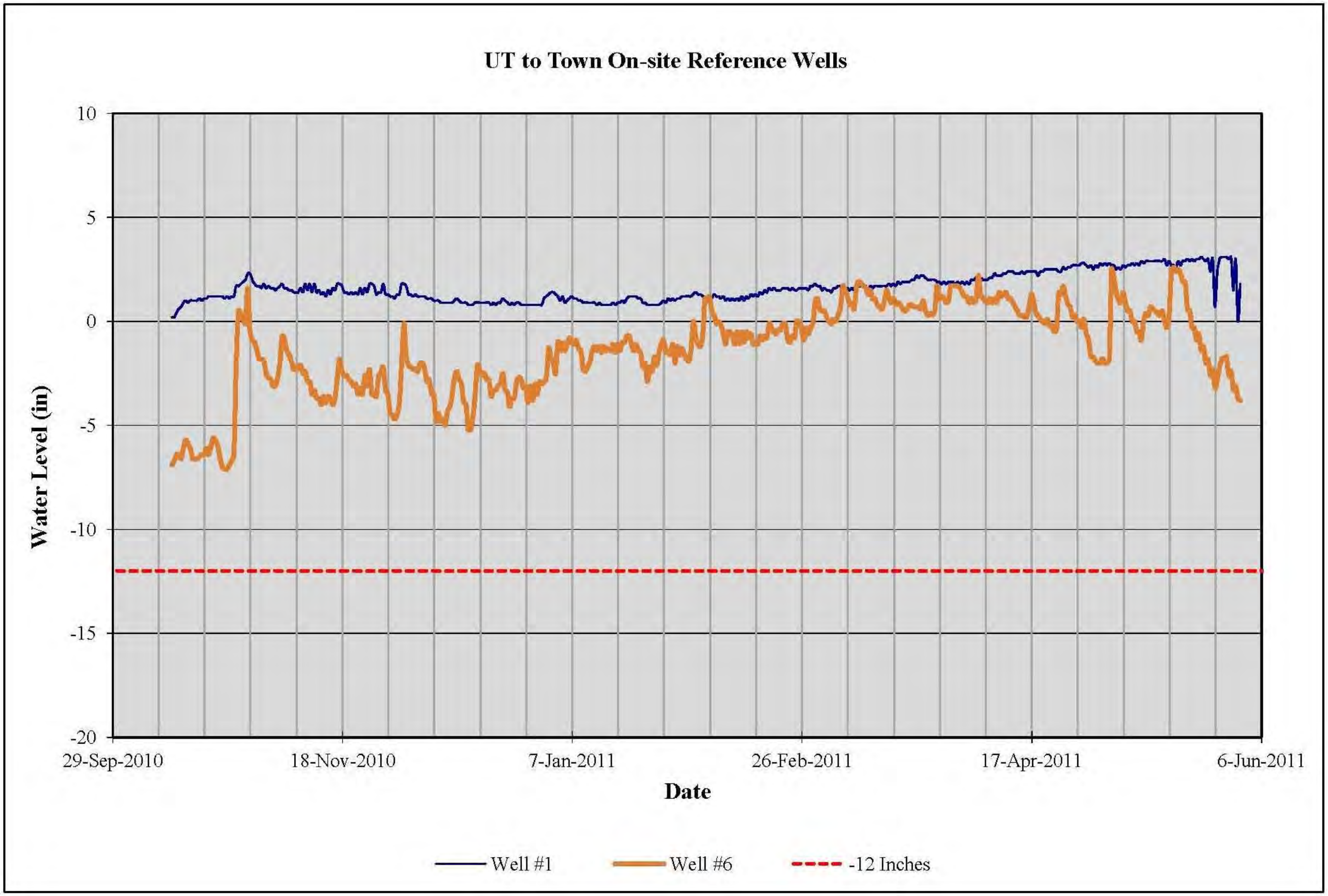
7.3 Soil Characterization

The primary soil type mapped in the reference sites is Oakboro silt loam. The unit consists of moderately well drained loamy alluvium found on floodplains. Soils within the proposed reference wetland areas exhibited hydric indicators, specifically "Depleted Matrix" (indicator F3) (USACE, 2010). Soil texture within the profiles ranged from silty loam to loam. A profile description for the soil at the reference wetland site is provided in Appendix B.

7.4 Vegetative Community Types and Disturbance History

Reference Wetlands 2 and 7 are located within active pastures and have also been impacted by cattle grazing. See Section 5.4 for additional information about disturbance history. Vegetative species common to the reference wetlands include a mix of understory and canopy species, which include red maple (*Acer rubrum*), black willow (Salix nigra), and Chinese privet (*Ligustrum sinense*). Herbaceous vegetation with the reference wetland areas is primarily comprised of smart weed (*Polygonum* sp.), spike rush (*Eleocharis* sp.), rush (*Juncus* sp.), sedge (*Carex* sp.), and Arrowhead duck potato (*Sagittaria* sp.). Though the reference sites are comprised of 100 percent facultative or wetter species and therefore meet the hydrophytic vegetation requirement, their dominant vegetative species are also reflective of a previously disturbed headwater wetland community; therefore, the reference wetlands will not be used as an ecological reference site. Instead vegetative species selection for re-vegetation of the wetlands will generally follow those suggested by Schafale (2012) for forested headwater and piedmont alluvial species.

Figure 7.1 Water Table Depths Recorded in the Reference Areas.



8 PROJECT SITE MITIGATION PLAN

This section relates the goals and objectives of the Project to the goals identified in NCEEP's RBRP document for the Lower Yadkin – Pee Dee River Basin (2009). It also covers the design criteria selected for the stream and wetland restoration and enhancement, the wetland creation, and the implementation of two (2) stormwater wetland BMPs on the UT to Town Creek Project site.

The implementation of the design along UT to Town Creek and its tributaries are justified for the following reasons:

1. UT to Town Creek has been channelized and is incised in areas where bedrock is not present along the Project reach. Pattern, profile, and dimension adjustments to the channel will reduce bank erosion, and improve hydrologic connectivity to the floodplain and its wetland systems;
2. The lack of woody vegetation within the riparian zone and along the channel banks has exacerbated bank erosion within the Project area. Replanting these areas will increase the stability of the stream channel and floodplain;
3. There are widespread cattle impacts that have resulted in erosion, sedimentation, silt-laden stream channels, and water quality issues due to fecal contamination. The permanent conservation easement will be fenced immediately after construction to provide permanent livestock exclusion;
4. Anthropogenic modifications to the contributing watershed and surrounding floodplain have buried and drained potential and existing wetlands. Minimal floodplain grading and manipulation will uncover shallow buried hydric soils while improving hydrologic connectivity in order to support wet tolerant vegetation plantings and allow the wetlands to achieve full function; and
5. As the downstream receiving stream reach of Little Long Creek is impaired, UT to Town Creek and its tributaries are likely impaired from surrounding agriculture and cattle land use practices. Implementation of constructed wetlands will improve water quality.

The design proposed for the Project will include Rosgen Priority Level I/II Stream Restoration (5,597 LF) and Levels I and II Enhancement (791 LF) approaches. A Priority I approach will be implemented on Reaches 1, 2, upper part of Reaches 3, 6, and 7 by constructing a new channel at the elevation of the existing top of bank. The new design channels for Reaches 1, 2, and 3 will have a more natural meander geometry and will be reconnected to their active floodplain. Level I or Level II Enhancement efforts will be implemented on the remaining reaches where adjustments to channel pattern will be minimal and riparian enhancement will involve controlling invasive species vegetation and replanting native species vegetation within the protected conservation easement. All areas will be permanently fenced such that livestock cannot access the stream within the conservation easement. Several additional acres, beyond the amount required for the typical 50-ft buffer along the UT to Town Creek mainstem, will also be included in the easement, as will the constructed stormwater wetland BMPs on Reach 4 and 7. A majority of this land is degraded pasture which will be planted with native riparian seed and bare root trees to further enhance the Project site's ecosystem.

The restoration and enhancement design for the Project site will allow stream flows greater than bankfull to spread onto the reconnected floodplain, dissipating flow energies and reducing in-stream shear stress. Where abandoned, the old stream channels will be backfilled using fill material generated by the grading of new channel and floodplain benches. Any excess fill material generated during construction will be disposed of on-site in designated disposal areas or shall be transported offsite to a permitted disposal location. In-stream structures will be used to control streambed grade, reduce stresses on streambanks, and promote bedform and in-stream habitat diversity. In-stream structures shall consist of constructed riffles, boulder sills, rock or log vanes, rock cross vanes, rock or log j-hooks (various types). Reach-wide grade control will be provided by the aforementioned in-stream structures and by bedrock, where present. Where possible, both wood and rock will be incorporated into the structures to promote a diversity of habitat features. Streambanks will be stabilized with a combination of bioengineering measures, such as vegetated geolifts and brush mattresses, erosion control matting, bare-root plantings, and live staking.

8.1 Overarching Goals and Application of Mitigation Plans

After examining the existing conditions data and exploring the potential functional uplift of the site's ecosystem, an approach was developed that would address restoration, enhancement, and creation of the site's stream reaches, existing wetlands, historical wetlands and potential wetland areas. The approach also addresses invasive species vegetation issues and throughout the site. Appropriate stream types were selected for all the reaches based on the valley type and slope characteristics of the site, as discussed in Section 3. It was determined that enhancement approaches would be most appropriate on Reaches 5 and 4 (see Figure 4). Baker developed a restoration approach for the mainstem of UT to Town Creek (Reaches 1, 2, and 3) that also would restore, enhance, and create adjacent riparian wetlands. A restoration approach was also applied to two significantly degraded tributaries (Reach 6 and 7). The proposed design will restore historic flow patterns to wetlands along UT to Town Creek and allow the streams within the Project area to access the floodplain more frequently.

8.2 Restoration Project Goals and Objectives

UT to Town Creek was identified as a viable restoration site because the Project reaches and existing wetland systems that have been impacted by agricultural and other past land use practices. Cattle currently have access to most of the stream and wetland areas, primarily in areas downstream of Reach 1. The northern portion of the Project area retains a partially forested buffer, but is heavily overgrown with invasive species vegetation such as Chinese privet and multi-flora rose.

Based on both the RBRP document for the Lower Yadkin – Pee Dee River Basin (NCEEP, 2009) and the Yadkin-Pee Dee River Basinwide Water Quality Plan (NCDENR, 2008), many streams in the Rocky River Watershed (HUC 03040105) are impaired or impacted by habitat degradation. Stressors identified in the plan include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. As stated in the Basinwide Plan, the watershed naturally consists of erodible soils; therefore, increasing the system's vulnerability to the aforementioned stressors. Activities within the Project area have further promoted erosion and habitat degradation through the clearing of the riparian zone for pasture grazing and the straightening of stream channels and filling in the floodplain to maximize pasture acreage. Additionally, cattle have had access to the all reaches within the Project area for multiple years, and their activities have exacerbated the existing erosion and instability issues.

Town Creek is classified by the NCDWR as Class 'C' waters (NCDWR Index No. 13-17-31-1-1) (NCDENR, 2011). Based on North Carolina's tributary rule, its tributaries would also be considered Class "C" waters (NCDENR, 2007). Neither UT to Town Creek nor Town Creek is specifically monitored for water quality impairments as a part of the Yadkin-Pee Dee Basinwide Plan (NCDENR, 2008). However, Town Creek and its tributaries discharge to Little Long Creek (NCDWR Index No. 13-17-31-1), which is listed on the 2010 303(d) List as an impaired water for ecological/biological integrity (NCDENR, 2010).

UT to Town Creek is a tributary to Town Creek which drains into Little Long Creek located in northeastern Stanly County. North Carolina Ecosystem Enhancement Program (NCEEP) has identified the 14-digit HUC 03040105060-040, Little Long Creek, as a Targeted Local Watershed within the most recent RBRP document for the Lower Yadkin – Pee Dee River Basin (NCEEP, 2009). Little Long Creek is listed as a Category 5 on the NCDWR's 303(d) List of impaired waters for ecological/biological integrity for use by aquatic life (NCDENR, 2010). The NCDWR 2008 Yadkin – Pee Dee Basin Plan for the Rocky River Watershed (HUC 03040105) cites habitat degradation in the Little Long Creek watershed due to impervious surfaces (NCDNER, 2008).

The goals for this restoration Project are as follows:

- Improve aquatic and terrestrial habitat through increasing dissolved oxygen concentrations, reduction in nutrient and sediment loading, improving substrate and in-stream cover, and reduction of in-stream water temperature;
- Improve both aquatic and riparian aesthetics;
- Create geomorphically stable conditions along UT to Town Creek and its tributaries through the Project area;
- Prevent cattle from accessing the Project area thereby protecting wetland and riparian vegetation and reducing excessive bank erosion; and
- Restore historical wetlands, create new wetlands, and enhance/preserve existing wetlands to improve terrestrial habitat and reduce sediment and nutrient loading to UT to Town Creek and the Little Long Creek Watershed.

To accomplish these goals, this Project will pursue the following objectives:

- Restore, enhance, protect and create riparian wetlands and buffers to reduce nutrient and pollutant loading by particle settling and vegetation filtering and nutrient uptake;
- Construct stormwater wetland BMPs on the upstream extent of Reach 4 and 7 to improve water quality by capturing and retaining stormwater run-off from the adjacent cattle pastures to allow for the biological removal of nutrient pollutant loads and for sediment to settle out of the water column;
- Restore existing incised, eroding, and channelized streams by creating stable channels with access to their geomorphic floodplains;
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and reducing bank erosion;
- Control invasive species vegetation within the Project area; and
- Establish native stream bank, riparian floodplain, and wetland vegetation protected by a permanent conservation easement to increase stormwater runoff filtering capacity, improve bank stability, shade the stream to decrease water temperature, and provide improved wildlife habitat quality.

8.2.1 Design Channel Classification

Multiple analyses and existing conditions data were incorporated in the development of site-specific natural channel design (NCD) approaches. Among these are hydraulic and sediment transport analyses, existing site conditions data collection, regime equations, and evaluation of results from past Projects.

Design criteria are dependent on the general restoration approach determined to be a best fit for the UT to Town Creek reaches (Table 8.1). The approach for restoration was based on an assessment of each reach and its assigned needs. After selection of the general restoration approach, specific design criteria were developed so that the plan view layout, cross-section dimensions, and profile could be described for each reach. These criteria are presented in the preliminary construction documents included in this submittal.

Assigning an appropriate stream type for the corresponding valley to accommodate the existing and future hydrologic and sediment contributions was considered conceptually prior to developing design approaches. Design criteria for the proposed streams were selected based on the range of the reference data ratios and the desired performance of the proposed channel.

Following initial application of the design criteria, refinements were made to accommodate the existing valley morphology, to work around Project constraints, to minimize unnecessary disturbance of the existing wetland areas, to maximize wetland creation, restoration, and enhancement, and to allow for natural channel adjustment following construction. The construction documents will be tailored to produce a cost- and resource-efficient design that is constructible, using a level of detail that corresponds to the tools of construction. The design also reflects a philosophy that the stream will adapt to the inherent uniformity of the restoration Project and be allowed to adjust over long periods of time under the processes of flooding, re-colonization of vegetation, and local topographic influences.

Table 8.1 Project Design Stream Types
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Stream	Reach	Proposed Stream Type	Rationale[1]
UT to Town Creek	1	B4c	Rosgen Priority Level I Restoration will be used to construct a channel with more sinuosity, increased bed diversity, and a connection to a floodplain. The upstream section will be constructed as a Rosgen Bc stream type with some minor changes in channel pattern due to topography and adjacent wetlands. The reconstruction of the stream will improve floodplain connectivity to existing and proposed wetlands and eliminate the presence of vertical, eroding banks. Slight meandering and riffle-pool sequences with a series of small grade drops will be used to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Non-Native, invasive species vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks.
	2	B4c	Rosgen Priority Level I Restoration will be used to construct a channel with more sinuosity, increased bed diversity, and a connection to a floodplain. The reconstruction of the stream will improve floodplain connectivity to existing and proposed wetlands and eliminate the presence of vertical, eroding banks. Slight meandering and riffle-pool sequences with a series of small grade drops will be used to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Non- native, invasive vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks.
	3	C4	This reach will be restored using Rosgen Priority I and Level II approaches. The reconstruction of the stream will improve floodplain connectivity to existing and proposed wetlands and eliminate the presence of vertical, eroding banks. Increased meandering with riffle-pool sequences and a series of small grade drops will be used to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Non-native, invasive vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks.

Table 8.1 Project Design Stream Types UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648			
Stream	**Reach**	**Proposed Stream Type**	**Rationale[1]**
	4	B4	An Enhancement Level I approach will be used to restore the proper channel dimension and profile within this reach. In-stream structures will be placed in key locations to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Non- Native, invasive species vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks. In addition, a constructed wetland will be built at the upstream extent of this reach to improve water quality by reducing nutrient loads from the contributing watershed.
	5[2]	B4	An Enhancement Level II approach will be used to restore the proper channel dimension and profile within this reach. In-stream structures will be placed in key locations to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Banks will be grades to a more stable slope in areas of existing erosion. Non- Native, invasive species vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks.
	6[2]	B4	Rosgen Priority Level I Restoration will be used to recreate a channel with increased sinuosity (lower 233 LF), increased bed diversity, and a connection to a floodplain. The reconstruction of the stream will improve floodplain connectivity and eliminate the presence of vertical, eroding banks. In-stream structures will be placed in key locations to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. The lower portion of this reach will be moved offline from its current location to take advantage of a larger floodplain and dissipate energy through meanders and grade control structures. Non- Native, invasive vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks.
	7[2]	B4a	Rosgen Priority Level I Restoration will be used to restore the proper channel dimension, pattern, and profile within this reach. In-stream structures will be placed in key locations to aid in dissipating stream flow energy, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Channel dimensions will be adjusted to create bankfull channel capable of carrying the channel forming discharge. Non- Native, invasive species vegetation will be controlled and planting of buffers and installing bioengineering practices with native vegetation will also improve habitat and stabilize the banks. In addition, a constructed wetland will be built at the upstream extent of this reach to improve water quality by reducing nutrient loads from the contributing watershed.
Notes: 1. The conservation easement will be permanently fenced along all reaches and both constructed stormwater wetland BMPs, except in areas where cattle will not have access in and around the stream reaches. 2. Reaches 4, 5, and 7, each, include enhancement plantings upstream of the proposed design, which will be included as part of the conservation easement and permanently fenced, but is not being sought for mitigation credit.			

8.2.2 Stream Restoration (Reaches 1, 2, 3, 6, and 7)

Restoration efforts will include establishing appropriate stream dimension, pattern, and profile of UT to Town Creek (Reaches 1, 2, 3, 6 and 7) (Figure 6). A Rosgen Priority Level I Restoration approach will be applied to Reach 1. A new off-line C stream type will be constructed to restore floodplain connectivity, provide stream bed and bank stability, improve transport of sediment and water quality, improve existing wetland hydrology, provide hydrology to restored wetlands and provide habitat and bedform diversity. In-stream structures will be used to control grade, improve aquatic habitat, and to protect stream banks.

Reach 2 begins at the confluence of Reaches 1 and 7. A Rosgen Priority Level I Restoration approach will be utilized for this reach. A new, off-line Bc/C stream type will be constructed to restore floodplain connectivity, provide stream bed and bank stability, improve transport of sediment and water quality, improve existing wetland hydrology, provide hydrology to restored and created wetlands and provide habitat and bedform diversity.

Reach 3 begins at the confluence of Reaches 2 and 6. Rosgen Priority Levels I and II Restoration approaches will be applied to this reach. A new, off-line Bc/C stream type will be constructed to restore floodplain connectivity, provide stream bed and bank stability, improve transport of sediment and water quality, improve existing wetland hydrology, provide hydrology to restored wetlands and provide habitat and bedform diversity.

Reach 6 begins at the confluence of Reaches 4 and 5. A Rosgen Priority Level I Restoration approach will be applied to this reach. Most of this channel will be kept in its current location except near the confluence with UT to Town Creek. Grade control structures will be used to maintain channel slope and sediment transport functions while increasing habitat through bedform diversity. Reach 7 begins at the outlet of a proposed constructed wetland and continues to its confluence with Reach 1. A Rosgen Priority Level I Restoration approach will be applied to this reach. A majority of this channel will be kept in its current location, while the channel dimension and profile will be restored. Grade control structures will be used to maintain channel slope and sediment transport functions while increasing habitat through bedform diversity.

In all restoration reaches, invasive species vegetation will be controlled and native plant communities restored through riparian plantings. Fencing will be installed along the conservation easement to restrict cattle access to the stream. Abandoned stream channels will be backfilled using fill material generated by the grading of a new channel and floodplain benches will be integrated with local topography. Any excess fill material generated during construction in all reaches will be wasted and stabilized on-site in locations noted in the plans or disposed of in a permitted disposal area.

8.2.3 Stream Enhancement I (Reach 4)

Reach 4 begins at the outlet of a proposed constructed wetland and continues to its confluence with Reach 5 (the beginning of Reach 6). A B stream type will be constructed to restore the appropriate dimension and profile. In-stream structures will be placed in key locations to aid in dissipating stream flow energy, control grade, enhance pool-to-pool spacing, and improve the quality of pool habitat present.

Invasive species vegetation will be controlled and native plant communities enhanced through riparian plantings. Fence will be installed along the conservation easement to permanently restrict cattle access to the stream. Where applicable, floodplain benches or other channel grading will be integrated with local topography. Any excess fill material generated during construction in all reaches will be wasted and stabilized on site in locations noted in the plans or disposed of in a permitted disposal area.

8.2.4 Stream Enhancement II (Reach 5)

Enhancement Level II practices will be applied to Reach 5, starting at its upstream extent and continuing 324 LF to its confluence with Reach 4 (Figure 6). In-stream structures will be placed in key locations to aid in dissipating stream flow energy, control grade, enhance pool-to-pool spacing, and improve the quality of pool habitat present. Banks will be graded to a more stable slope in areas of existing erosion. Fencing will be installed along the conservation easement to permanently restrict cattle access to the restored stream. Invasive species vegetation will be controlled along with re-establishment of the riparian buffer consisting of woody and herbaceous vegetation native to the ecoregion.

8.2.5 General Project Design Features

Two culverted crossings will be installed as part of the project on Reaches 2 and 6, respectively. All crossings will be excluded from the conservation easement. Gates will be installed on either side of the crossing and across the farm road on the western side of the easement to permanently restrict cattle access to the stream. Two wells currently exist on the property and seven livestock watering station will be installed and connected to the existing wells. These stations will be strategically located throughout the site, away from crossings, in order to provide cattle access to drinking water and limit their desire to congregate at crossing locations. See the Fencing/Cattle Exclusion Overview Map in the Plan Set for feature locations.

8.3 Stream Project and Design Justification

The primary objective of the restoration design is to construct a stable stream that has access to its floodplain at bankfull flows while enhancing riparian and aquatic habitat. The philosophy applied by Baker to the UT to Town Creek site consisted of creating stable Ba, Bc, B, and C stream types. The proposed design parameters for each of the reaches are detailed in Tables 7.2a - 7.2g.

The design rationale and design parameters for all of the design reaches are presented below.

8.3.1 Channel Dimension

Throughout the entire proposed design, the channel dimensions for all reaches will be adjusted to reduce velocities and near-bank shear stress. The selected design parameters will prevent further incision and provide access to the floodplain. It is expected those reaches designed as C-type channels will narrow to E-type morphology over time. A low bank height ratio (BHR) of 1.0 was chosen to develop a channel with access to its floodplain for relief during events having flows in excess of bankfull. Typical cross-sections are shown on the plan sheets provided with this submittal.

8.3.2 Pattern

The existing pattern of the Project streams are representative of channelization, relocation, and livestock impacts. In general, the proposed restoration of on the mainstem of UT to Town Creek (Reaches 1-3) is designed to dissipate energy through meandering and in-stream structures. A meandering morphology is most appropriate for streams that have slopes less than 1.5 percent, as is the case of these reaches. The new alignment will center the channel in the low part of the valley and allow for overbank flow on both sides of the stream. The sinuosity of the mainstem of UT to Town Creek will increase with the development of the meandering channel and the flattening of channel slopes.

Reaches 4-7 have minimal pattern changes proposed except in areas where existing channel pattern dictates adjustments. In these reaches stream energy will be dissipated mainly through in-stream structures to replicate typical step-pool morphology. The lower portion of Reach 6 will be realigned due to the change in slope and to take advantage of a wider, flatter floodplain.

8.3.3 Profile/Bedform

The existing profile of the mainstem of UT to Town Creek has little bedform diversity and is comprised of long pools with relatively short riffles, common on channelized streams. The proposed meandering channel will have a more natural riffle–pool sequence. The design channels will meander across the valley and be reconnected to their original floodplain (Rosgen Priority 1 approach). Areas of floodplain grading are proposed in sections where wetland restoration and creation will be implemented or where the channel must transition down to the existing bed elevation towards the lower end of Reach 3 (Shallow Rosgen Priority Level II approach).

Design riffle slopes for Reaches 1-3 vary from 0.005 ft/ft to 0.023 ft/ft. Pools were designed with little to no slope. Riffle and pool slopes have been designed to provide for a diversity of bedform and maintain quality habitat as sediment is transported through the reach.

Profiles will be adjusted in these reaches to provide grade control, access to the floodplain, or where pool-to-pool spacing requires altering.

Table 8.2 Natural Channel Design Criteria used for Project Reaches
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	MIN	MAX	MIN	MAX
Stream Type (Rosgen)	C4		B4, B4c, B4a	
Bankfull Mean Velocity, Vbkf (ft/s)	3.5	5.0	4.0	6.0
Width to Depth Ratio, W/D (ft/ft)	10.0	14.0	12.0	18.0
Riffle Max Depth Ratio, Dmax/Dbkf	1.1	1.3	1.2	1.4
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.0	1.1	1.0	1.1
Meander Length Ratio, Lm/Wbkf	7.0	12.0	N/A	N/A
Rc Ratio, Rc/Wbkf	2.0	3.0	N/A	N/A
Meander Width Ratio, Wblt/Wbkf	3.5	8.0	N/A	N/A
Sinuosity, K	1.2	1.6	1.1	1.2
Riffle Slope Ratio, Srif/Schan	1.5	2.0	1.1	1.8
Pool Slope Ratio, Spool/Schan	0	0.2	0	.4
Pool Max Depth Ratio, Dmaxpool/Dbkf	2.0	3.5	2.0	3.5
Pool Width Ratio, Wpool/Wbkf	1.3	1.7	1.1	1.5
Pool-Pool Spacing, Lps/Wbkf	4.0	7.0	1.5	5.0

Table 8.3a Project Comparison of Geomorphic Parameters: Reach 1
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	Reach 1 - Existing[9]		Reach 1 - Proposed		Composite Reference Data		Rationale
	Min	Max	Min	Max	Min	Max	
Stream Length (ft)	1,181		1,192		-	-	-
Drainage Area, DA (sq mi)	0.83		0.83		-	-	-
Stream Type (Rosgen)	E4 (incised)		B4c		-	-	Note 1
Bankfull Discharge, Qbkf (cfs)	50		50		-	-	Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	13.8		13.8		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	3.6		3.6		4.0	6.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	9.0	11.9	13.5		-	-	-
Bankfull Riffle Mean Depth, Dbkf (ft)	1.2	1.5	1.0		-	-	D=A/W
Width to Depth Ratio, W/D (ft/ft)	5.8	10.3	13.2		12.0	18.0	Note 3
Width Floodprone Area, Wfpa (ft)	77		45	63	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	6.5	8.6	3.3	4.7	-	-	Note 4

Table 8.3a Project Comparison of Geomorphic Parameters: Reach 1 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 1 - Existing[9]**		**Reach 1 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Riffle Max Depth @ bkf, Dmax (ft)	1.8	2.1	1.4		-	-	-
Riffle Max Depth Ratio, Dmax/Dbkf	1.4	1.56	1.3		1.2	1.4	Note 5
Max Depth @ tob, Dmaxtob (ft)	2.1	2.6	1.4		-	-	-
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.2	1.6	1.0		1	1.1	Note 6
Meander Length, Lm (ft)	63	144	-	-	-	-	Note 7
Meander Length Ratio, Lm/Wbkf	5.3	16.0	-	-	-	-	Note 7
Radius of Curvature, Rc (ft)	17	77	-	-	-	-	Note 7
Rc Ratio, Rc/Wbkf	1.4	8.6	-	-	-	-	Note 7
Belt Width, Wblt (ft)	31	101	-	-	-	-	Note 7
Meander Width Ratio, Wblt/Wbkf	2.6	11.2	-	-	-	-	Note 7
Sinuosity, K	1.06		1.18		1.1	1.2	-
Valley Slope, Sval (ft/ft)	0.0106		0.0100		0.020	0.030	-
Channel Slope, Schan (ft/ft)	0.0100		0.0094		-	-	-
Riffle Slope, Srif (ft/ft)	0.0110	0.0560	0.0100	0.0170	-	-	-
Riffle Slope Ratio, Srif/Schan	1.1	5.6	1.1	1.8	1.1	1.8	Note 5
Slope Pool, Spool (ft/ft)	0.0000	0.0013	0.0000	0.0038	-	-	-
Pool Slope Ratio, Spool/Schan	0.0	0.1	0.0	0.4	0.00	0.4	Note 5
Pool Max Depth, Dmaxpool (ft)	2.8		2.1	3.6	-	-	-
Pool Max Depth Ratio, Dmaxpool/Dbkf	1.8	2.4	2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	10.7	14.9	20.3		-	-	-
Pool Width Ratio, Wpool/Wbkf	0.9	1.2	1.1	1.5	1.1	1.5	Note 8
Pool-Pool Spacing, Lps (ft)	65.6	206.5	20.3	67.5	-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	5.5	23.0	1.5	5.0	1.5	5.0	Note 5
d16 (mm)	11.3		11.3		-	-	-
d35 (mm)	33.0		33.0		-	-	-
d50 (mm)	50.0		50.0		-	-	-
d84 (mm)	128.0		128.0		-	-	-
d95 (mm)	>2048		>2048		-	-	-

Notes:
1. A Bc stream type is appropriate for gently sloped channels (generally less than 0.015 ft/ft), that are moderately confined due to incision.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar Bc type channels in the Piedmont.
6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Parameters were not derived since the channel is relatively straight (low sinuosity).
8. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
9. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

Table 8.3b Project Comparison of Geomorphic Parameters: Reach 2 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 2 - Existing[9]**		**Reach 2 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Stream Length (ft)	1,672		1,833		-	-	-
Drainage Area, DA (sq mi)	0.88		0.88		-	-	-
Stream Type (Rosgen)	E4 (incised)		B4c		-	-	Note 1
Bankfull Discharge, Qbkf (cfs)	55		55		-	-	Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	14.5		14.7		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	3.8		3.7		4.0	6.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	12.6		14.0		-	-	-
Bankfull Riffle Mean Depth, Dbkf (ft)	1.2		1.1				D=A/W
Width to Depth Ratio, W/D (ft/ft)	11.0		13.3		12.0	18.0	Note 3
Width Floodprone Area, Wfpa (ft)	81		83	104	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	6.4		5.9	7.4	-	-	Note 4
Riffle Max Depth @ bkf, Dmax (ft)	1.6		1.4		-	-	-
Riffle Max Depth Ratio, Dmax/Dbkf	1.4		1.3		1.2	1.4	Note 5
Max Depth @ tob, Dmaxtob (ft)	2.0		1.4		-	-	-
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.3		1.0		1.0	1.1	Note 6
Meander Length, Lm (ft)	100.0	340.0	-	-	-	-	Note 7
Meander Length Ratio, Lm/Wbkf	7.9	27.0	-	-	-	-	Note 7
Radius of Curvature, Rc (ft)	21.0	80.0	-	-	-	-	Note 7
Rc Ratio, Rc/Wbkf	1.7	6.3	-	-	-	-	Note 7
Belt Width, Wblt (ft)	60	185	-	-	-	-	Note 7
Meander Width Ratio, Wblt/Wbkf	4.8	14.7	-	-	-	-	Note 7
Sinuosity, K	1.07		1.07		1.1	1.2	-
Valley Slope, Sval (ft/ft)	0.0103		0.0136		0.020	0.030	-
Channel Slope, Schan (ft/ft)	0.0096		0.0127		-	-	-
Riffle Slope, Srif (ft/ft)	0.0100	0.0330	-	-	-	-	-
Riffle Slope Ratio, Srif/Schan	1.0	3.4	1.1	1.8	1.1	1.8	Note 5

Table 8.3b Project Comparison of Geomorphic Parameters: Reach 2 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 2 - Existing[9]**		**Reach 2 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Slope Pool, Spool (ft/ft)	0.0000		0.0000	0.0051	-	-	-
Pool Slope Ratio, Spool/Schan	0.0	0.4	0.0	0.4	0.00	0.40	Note 5
Pool Max Depth, Dmaxpool (ft)	2.1		2.1	3.7	-	-	-
Pool Max Depth Ratio, Dmaxpool/Dbkf	1.8		2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	22.2		15.4	21.0	-	-	-
Pool Width Ratio, Wpool/Wbkf	1.8		1.1	1.5	1.1	1.5	Note 8
Pool-Pool Spacing, Lps (ft)	49	319	21	70	-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	3.9	25.3	1.5	5.0	1.5	5.0	Note 5
d16 (mm)	11.3		11.3		-	-	-
d35 (mm)	33.0		33.0		-	-	-
d50 (mm)	50.0		50.0		-	-	-
d84 (mm)	128.0		128.0		-	-	-
d95 (mm)	>2048		>2048		-	-	-

Notes:
1. A Bc stream type is appropriate for gently sloped channels (generally less than 0.015 ft/ft), that are moderately confined due to incision.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar Bc type channels in the Piedmont.
6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Parameters were not derived since the channel is relatively straight (low sinuosity).
8. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
9. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

Table 8.3c Project Comparison of Geomorphic Parameters: Reach 3 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 3 - Existing[8]**		**Reach 3 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Stream Length (ft)	721		803				
Drainage Area, DA (sq mi)	1.20		1.20				
Stream Type (Rosgen)	E4		C4				Note 1

Table 8.3c Project Comparison of Geomorphic Parameters: Reach 3 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 3 - Existing** [8]		**Reach 3 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Bankfull Discharge, Qbkf (cfs)	65		65				Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	18	18.2	18.2		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	3.4	3.6	3.6		3.5	5.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	9.8	15.5	15.5		-	-	-
Bankfull Riffle Mean Depth, Dbkf (ft)	1.2	1.5	1.2				D=A/W
Width to Depth Ratio, W/D (ft/ft)	5.4	13.2	13.2		10.0	14.0	Note 3
Width Floodprone Area, Wfpa (ft)	230		104	218	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	5.2	18.3	6.7	14.1			Note 4
Riffle Max Depth @ bkf, Dmax (ft)	1.6	2.9	1.55		-	-	-
Riffle Max Depth Ratio, Dmax/Dbkf	1.3	1.7	1.3		1.1	1.4	Note 5
Max Depth @ tob, Dmaxtob (ft)	1.6	2.9	1.6		-	-	-
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.0		1.0		1.0	1.1	Note 6
Meander Length, Lm (ft)	63	199	109	186			Note 5
Meander Length Ratio, Lm/Wbkf	5.0	20.3	7.0	12.0	7.0	12.0	Note 5
Radius of Curvature, Rc (ft)	34	61	31	47			Note 5
Rc Ratio, Rc/Wbkf	1.7	4.9	2.0	3.0	2.0	3.0	Note 5
Belt Width, Wblt (ft)	40	65	54	124			Note 5
Meander Width Ratio, Wblt/Wbkf	3.1	6.2	3.5	8.0	3.5	8.0	Note 5
Sinuosity, K	1.07		1.3		1.2	1.6	-
Valley Slope, Sval (ft/ft)	0.0043		0.0043		0.005	0.015	-
Channel Slope, Schan (ft/ft)	0.0040		0.0032		-	-	-
Riffle Slope, Srif (ft/ft)	0.0140	0.0300	0.0050	0.0060	-	-	-
Riffle Slope Ratio, Srif/Schan	3.5	7.5	1.5	2.0	1.5	2.0	Note 5
Slope Pool, Spool (ft/ft)	0.0000	0.0018	0.0000	0.0006	-	-	-
Pool Slope Ratio, Spool/Schan	0.0	0.5	0.0	0.2	0	0.2	Note 5
Pool Max Depth, Dmaxpool (ft)	2.6		2.4	4.11	-	-	-

Table 8.3c Project Comparison of Geomorphic Parameters: Reach 3 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 3 - Existing [8]**		**Reach 3 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Pool Max Depth Ratio, Dmaxpool/Dbkf	1.4	1.7	2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	14.1		20.2	26.4	-	-	-
Pool Width Ratio, Wpool/Wbkf	1.1	1.4	1.3	1.7	1.3	1.7	Note 7
Pool-Pool Spacing, Lps (ft)	38	132	62	109	-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	3.0	13.5	4.0	7.0	4.0	7.0	Note 5
d16 (mm)	1.0		1.0		-	-	-
d35 (mm)	11.0		11.0		-	-	-
d50 (mm)	15.0		15.0		-	-	-
d84 (mm)	64.0		64.0		-	-	-
d95 (mm)	150.0		150.0		-	-	-

Notes:
1. A Bc stream type is appropriate for gently sloped channels (generally less than 0.015 ft/ft), with a wide alluvial valleys.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar C type channels in the Piedmont.
6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
8. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

Table 8.3d Project Comparison of Geomorphic Parameters: Reach 4 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 4 - Existing [9]**		**Reach 4 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Stream Length (ft)	404		444		-	-	-
Drainage Area, DA (sq mi)	0.08		0.08		-	-	-
Stream Type (Rosgen)	B4		B4				Note 1
Bankfull Discharge, Qbkf (cfs)	5.8		5.8				Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	1.8		2.3		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	3.3		2.6		4.0	6.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	6.8		5.5		-	-	-

Table 8.3d Project Comparison of Geomorphic Parameters: Reach 4 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648						
Parameter	**Reach 4 - Existing**[9]		**Reach 4 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Bankfull Riffle Mean Depth, Dbkf (ft)	0.3		0.4		-	-	D=A/W
Width to Depth Ratio, W/D (ft/ft)	26.1		13.4		12.0	18.0	Note 3
Width Floodprone Area, Wfpa (ft)	11		21	41	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.6		3.8	7.5	-	-	Note 4
Riffle Max Depth @ bkf, Dmax (ft)	0.6		0.5		-	-	-
Riffle Max Depth Ratio, Dmax/Dbkf	2.2		1.2		1.2	1.4	Note 5
Max Depth @ tob, Dmaxtob (ft)	1.4		0.5		-	-	-
Bank Height Ratio, Dtob/Dmax (ft/ft)	2.4		1.0		1.0	1.1	Note 6
Meander Length, Lm (ft)	40	112	-	-	-	-	Note 7
Meander Length Ratio, Lm/Wbkf	5.9	16.5	-	-	-	-	Note 7
Radius of Curvature, Rc (ft)	8.0	29.0	-	-	-	-	Note 7
Rc Ratio, Rc/Wbkf	1.2	4.3	-	-	-	-	Note 7
Belt Width, Wblt (ft)	40	52	-	-	-	-	Note 7
Meander Width Ratio, Wblt/Wbkf	5.9	7.7	-	-	-	-	Note 7
Sinuosity, K	1.11		1.10		1.1	1.2	
Valley Slope, Sval (ft/ft)	0.0243		0.0234		-	-	-
Channel Slope, Schan (ft/ft)	0.0212		0.0212		-	-	-
Riffle Slope, Srif (ft/ft)	-		0.0230	0.0380	-	-	-
Riffle Slope Ratio, Srif/Schan	-		1.10	1.80	1.1	1.8	Note 5
Slope Pool, Spool (ft/ft)	-		0.0000	0.0085	-	-	-
Pool Slope Ratio, Spool/Schan	-		0.0	0.4	0.0	0.4	Note 5
Pool Max Depth, Dmaxpool (ft)	0.5		0.7	1.2	-	-	-
Pool Max Depth Ratio, Dmaxpool/Dbkf	2.0		2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	5.7		6.1	8.3	-	-	-
Pool Width Ratio, Wpool/Wbkf	0.8		1.1	1.5	1.1	1.5	Note 8
Pool-Pool Spacing, Lps (ft)	21	313	8	28	-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	3.1	46.2	1.5	5.0	1.5	5.0	Note 5
d16 (mm)	-		-		-	-	-

Table 8.3d Project Comparison of Geomorphic Parameters: Reach 4 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 4 - Existing**[9]		**Reach 4 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
d35 (mm)	-		-		-	-	-
d50 (mm)	-		-		-	-	-
d84 (mm)	-		-		-	-	-
d95 (mm)	-		-		-	-	-

Notes:
1. A B stream type is appropriate for moderately sloped channels (generally greater than 0.02 ft/ft), that are moderately confined due to incision.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar B type channels in the Piedmont.
6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Parameters were not derived since the channel is relatively straight (low sinuosity).
8. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
9. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

Table 8.3e Project Comparison of Geomorphic Parameters: Reach 5 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 5 - Existing**[9]		**Reach 5 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Stream Length (ft)	324		347		-	-	-
Drainage Area, DA (sq mi)	0.06		0.06		-	-	-
Stream Type (Rosgen)	B4		B4		-	-	Note 1
Bankfull Discharge, Qbkf (cfs)	5.8		5.8		-	-	Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	2.0		2.0		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	3.0		2.9		4.0	6.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	3.9		5.5		-	-	-
Bankfull Riffle Mean Depth, Dbkf (ft)	0.5		0.4		-	-	D=A/W
Width to Depth Ratio, W/D (ft/ft)	7.8		15.0		12.0	18.0	Note 3
Width Floodprone Area, Wfpa (ft)	5.5		10.0	37.0	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.4		1.8	6.8	-	-	Note 4
Riffle Max Depth @ bkf, Dmax (ft)	0.7		0.5		-	-	-

Table 8.3e Project Comparison of Geomorphic Parameters: Reach 5 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 5 - Existing** [9]		**Reach 5 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Riffle Max Depth Ratio, Dmax/Dbkf	1.4		1.2		1.2	1.4	Note 5
Max Depth @ tob, Dmaxtob (ft)	1.8		0.5		-	-	-
Bank Height Ratio, Dtob/Dmax (ft/ft)	2.5		1.0		1.0	1.1	Note 6
Meander Length, Lm (ft)	28	67	-	-	-	-	Note 7
Meander Length Ratio, Lm/Wbkf	7.2	17.2	-	-	-	-	Note 7
Radius of Curvature, Rc (ft)	6.0	29.0	-	-	-	-	Note 7
Rc Ratio, Rc/Wbkf	1.5	7.4	-	-	-	-	Note 7
Belt Width, Wblt (ft)	44	71	-	-	-	-	Note 7
Meander Width Ratio, Wblt/Wbkf	11.3	18.2	-	-	-	-	Note 7
Sinuosity, K	1.2		1.2		1.1	1.2	
Valley Slope, Sval (ft/ft)	0.0423		0.0423		0.020	0.030	
Channel Slope, Schan (ft/ft)	0.0358		0.0358		-	-	-
Riffle Slope, Srif (ft/ft)	-		0.0390	0.0650	-	-	-
Riffle Slope Ratio, Srif/Schan	-		1.1	1.8	1.1	1.8	Note 5
Slope Pool, Spool (ft/ft)	-		0.0000	0.0143	-	-	-
Pool Slope Ratio, Spool/Schan	-		0.0	0.4	0	0.4	Note 5
Pool Max Depth, Dmaxpool (ft)	1.0		0.7	1.3	-	-	-
Pool Max Depth Ratio, Dmaxpool/Dbkf	2.0		2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	7.2		6.1	8.3	-	-	-
Pool Width Ratio, Wpool/Wbkf	1.9		1.1	1.5	1.1	1.5	Note 8
Pool-Pool Spacing, Lps (ft)	29	181	8	28	-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	7.4	46.4	1.5	5.0	1.5	5.0	Note 5
d16 (mm)	-		-		-	-	-
d35 (mm)	-		-		-	-	-
d50 (mm)	-		-		-	-	-
d84 (mm)	-		-		-	-	-
d95 (mm)	-		-		-	-	-

Table 8.3e Project Comparison of Geomorphic Parameters: Reach 5
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	Reach 5 - Existing [9]		Reach 5 - Proposed		Composite Reference Data		Rationale
	Min	Max	Min	Max	Min	Max	

Notes:
1. A Ba stream type is appropriate for moderately sloped channels (generally greater than 0.04 ft/ft), that are moderately confined due to incision.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar Ba type channels in the Piedmont.
6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Parameters were not derived since the channel is relatively straight (low sinuosity).
8. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
9. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

Table 8.3f Project Comparison of Geomorphic Parameters: Reach 6
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	Reach 6 - Existing [9]		Reach 6 - Proposed		Composite Reference Data		Rationale
	Min	Max	Min	Max	Min	Max	
Stream Length (ft)	1,349		1,370		-	-	-
Drainage Area, DA (sq mi)	0.18		0.18		-	-	-
Stream Type (Rosgen)	B4		B4				Note 1
Bankfull Discharge, Qbkf (cfs)	14		14				Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	4.7		6.3		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	300		2.2		4.0	6.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	6.1		10.0		-	-	-
Bankfull Riffle Mean Depth, Dbkf (ft)	0.8		0.6				D=A/W
Width to Depth Ratio, W/D (ft/ft)	7.8		15.9		12.0	18.0	Note 3
Width Floodprone Area, Wfpa (ft)	10		19	87	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.6		1.9	8.7			Note 4
Riffle Max Depth @ bkf, Dmax (ft)	1.3		0.9		-	-	-
Riffle Max Depth Ratio, Dmax/Dbkf	1.7		1.4		1.2	1.4	Note 5
Max Depth @ tob, Dmaxtob (ft)	2.60		0.90		-	-	-

Table 8.3f Project Comparison of Geomorphic Parameters: Reach 6
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	Reach 6 - Existing [9]		Reach 6 - Proposed		Composite Reference Data		Rationale
	Min	Max	Min	Max	Min	Max	
Bank Height Ratio, Dtob/Dmax (ft/ft)	2.0		1.0		1.0	1.1	Note 6
Meander Length, Lm (ft)	49	141	-	-			Note 7
Meander Length Ratio, Lm/Wbkf	8.1	23.2	-	-	-	-	Note 7
Radius of Curvature, Rc (ft)	8.0	69.0	-	-			Note 7
Rc Ratio, Rc/Wbkf	1.3	11.4	-	-	-	-	Note 7
Belt Width, Wblt (ft)	40	65	-	-			Note 7
Meander Width Ratio, Wblt/Wbkf	6.6	10.7	-	-	-	-	Note 7
Sinuosity, K	1.06		1.08		1.1	1.2	
Valley Slope, Sval (ft/ft)	0.0244		0.0244		0.020	0.030	
Channel Slope, Schan (ft/ft)	0.0230		0.0226		-	-	-
Riffle Slope, Srif (ft/ft)	-		0.0250	0.0410	-	-	-
Riffle Slope Ratio, Srif/Schan	-		1.1	1.8	1.1	1.8	Note 5
Slope Pool, Spool (ft/ft)	-		0.0000	0.0090	-	-	-
Pool Slope Ratio, Spool/Schan	-		0.0	0.4	0	0.4	Note 5
Pool Max Depth, Dmaxpool (ft)	1.4		1.3	2.2	-	-	-
Pool Max Depth Ratio, Dmaxpool/Dbkf	1.81		2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	6.2		11.0	15.0	-		
Pool Width Ratio, Wpool/Wbkf	1.0		1.1	1.5	1.1	1.5	Note 8
Pool-Pool Spacing, Lps (ft)	15	24	50		-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	1.5	4.0	5.0		1.5	5.0	Note 5
d16 (mm)	11.3		11.3		-	-	-
d35 (mm)	22.0		22.6		-	-	-
d50 (mm)	32.0		32.0		-	-	-
d84 (mm)	90.0		90.0		-	-	-
d95 (mm)	150.0		150.0		-	-	-

Table 8.3f Project Comparison of Geomorphic Parameters: Reach 6 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 6 - Existing** [9]		**Reach 6 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	

Notes:
1. A B stream type is appropriate for moderately sloped channels (generally greater than 0.02 ft/ft), that are moderately confined due to incision.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar B type channels in the Piedmont.
6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Parameters were not derived since the channel is relatively straight (low sinuosity).
8. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
9. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

Table 8.3g Project Comparison of Geomorphic Parameters: Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 7 - Existing** [9]		**Reach 7 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Stream Length (ft)	386		399		-	-	-
Drainage Area, DA (sq mi)	0.046		0.046		-	-	-
Stream Type (Rosgen)	B4a		B4a		-	-	Note 1
Bankfull Discharge, Qbkf (cfs)	4.7		4.7		-	-	Note 2
Bankfull Riffle XSEC Area, Abkf (sq ft)	1.6		1.6		-	-	-
Bankfull Mean Velocity, Vbkf (ft/s)	3.0		3.0		4.0	6.0	V=QA
Bankfull Riffle Width, Wbkf (ft)	5.0		5.0		-	-	-
Bankfull Riffle Mean Depth, Dbkf (ft)	0.3		0.3		-	-	D=A/W
Width to Depth Ratio, W/D (ft/ft)	15.7		15.6		12.0	18.0	Note 3
Width Floodprone Area, Wfpa (ft)	8		10	38	-	-	-
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.5		2.0	7.6	-	-	Note 4
Riffle Max Depth @ bkf, Dmax (ft)	0.5		0.4		-	-	-
Riffle Max Depth Ratio, Dmax/Dbkf	1.4		1.3		1.2	1.4	Note 5
Max Depth @ tob,	1.2		0.4		-	-	-

Table 8.3g Project Comparison of Geomorphic Parameters: Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	**Reach 7 - Existing[9]**		**Reach 7 - Proposed**		**Composite Reference Data**		**Rationale**
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	
Dmaxtob (ft)							
Bank Height Ratio, Dtob/Dmax (ft/ft)	2.6		1.0		1.0	1.1	Note 6
Meander Length, Lm (ft)	26	101	-	-	-	-	Note 7
Meander Length Ratio, Lm/Wbkf	5.2	20.1	-	-	-	-	Note 7
Radius of Curvature, Rc (ft)	7.0	41.0	-	-	-	-	Note 7
Rc Ratio, Rc/Wbkf	1.4	8.2	-	-	-	-	Note 7
Belt Width, Wblt (ft)	30	48	-	-	-	-	Note 7
Meander Width Ratio, Wblt/Wbkf	6.0	9.6	-	-	-	-	Note 7
Sinuosity, K	1.09		1.09		1.1	1.2	
Valley Slope, Sval (ft/ft)	0.0443		0.0443		-	-	-
Channel Slope, Schan (ft/ft)	0.0407		0.0407		-	-	-
Riffle Slope, Srif (ft/ft)	-	-	0.0450	0.0730	-	-	-
Riffle Slope Ratio, Srif/Schan	-	-	1.10	1.80	1.1	1.8	Note 5
Slope Pool, Spool (ft/ft)	-	-	0.0000	0.0163	-	-	-
Pool Slope Ratio, Spool/Schan	-	-	0.0	0.4	0.0	0.4	Note 5
Pool Max Depth, Dmaxpool (ft)	1.1		0.6	1.1	-	-	-
Pool Max Depth Ratio, Dmaxpool/Dbkf	3.5		2.0	3.5	2.0	3.5	Note 5
Pool Width, Wpool (ft)	5.1		5.5	7.5	-	-	-
Pool Width Ratio, Wpool/Wbkf	1.0		1.1	1.5	1.1	1.5	Note 8
Pool-Pool Spacing, Lps (ft)	19	259	8	25	-	-	-
Pool-Pool Spacing Ratio, Lps/Wbkf	3.8	51.6	1.5	5.0	1.5	5.0	Note 5
d16 (mm)	8.5		-		-	-	-
d35 (mm)	12.4		-		-	-	-
d50 (mm)	17.5		-		-	-	-
d84 (mm)	50.6		-		-	-	-
d95 (mm)	81.6		-		-	-	-

Notes:
1. A Ba stream type is appropriate for moderately sloped channels (generally greater than 0.04 ft/ft), that are moderately confined due to incision.
2. Bankfull discharge was estimated using Manning's equation.
3. A final W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, in-house composite ratios, as well as sediment transport analyses.
4. Required for stream classification.
5. Values were chosen based on reference reach database analysis and past project evaluation of similar Ba type

Table 8.3g Project Comparison of Geomorphic Parameters: Reach 7 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648							
Parameter	Reach 7 - Existing[9]		Reach 7 - Proposed		Composite Reference Data		Rationale
	Min	Max	Min	Max	Min	Max	

channels in the Piedmont.

6. A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality resulting in lower risk of channel instability.
7. Parameters were not derived since the channel is relatively straight (low sinuosity).
8. Values were chosen based on reference reach database analysis and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow, which is a positive evolutionary step towards greater stability.
9. All existing stream parameters based on existing condition reach breaks. Proposed parameters based on proposed reach breaks.

8.3.4 Sediment Transport Analysis

The purpose of sediment transport analysis is to ensure that the stream restoration design creates a stable channel that does not aggrade or degrade over time. The overriding assumption is that the site should be transporting the total sediment load delivered from upstream sources, thereby being a “transport” reach and generally classified as a stable Rosgen “B”, “C” or “E” type channel. The ability of the stream to transport its total sediment load can be quantified through two measures: sediment transport competency (force) and sediment transport capacity (power). Lane (1955) describes a generalized relationship of stream stability and dynamic equilibrium wherein the product of sediment load and sediment size is proportional to the product of stream slope and discharge. In sand-bed or fine-grained streams, sediment transport capacity is a critical analysis, whereas in gravel/cobble bed streams, sediment transport competency is a critical analysis.

Shear stress and stream power relationships were generated for Reaches 1-4. Sediment transport analysis was not conducted on Reaches 5-7 due to the stream beds relatively stable nature. Reaches 1 and 2 have median particle sizes of very coarse gravel. Reach 3 has a median particle sizes of medium-coarse gravel, while Reach 6 has a median particle sizes of coarse gravel. In isolated locations, coarse material and bedrock in riffles appear to control grade. Based on visual observations, the streams also receive significant quantities of fine materials from both bank erosion and contributions from the upstream catchment. While restoration of the channel will reduce localized bank erosion, the channel will still need to transport the fine materials from upstream sources. In sand-bed streams, sediment transport capacity is a critical analysis, whereas in gravel bed streams, sediment transport competency is a critical analysis. Since the design reaches must transport both sand and gravel sized particles, both capacity and competency were analyzed.

Sediment transport capacity, measured as unit stream power (watts/meter^2), was compared for the existing stream channels and the design conditions. Table 8.4a and 8.4b show bankfull boundary shear stress and stream power values for existing and design conditions.

Sediment transport competency is estimated in terms of the relationship between critical depth and design mean depth at a given slope and occurs when the channel dimensions produce enough shear stress to move the D_{100} sub pavement particle. As shown in Tables 8.4a and 8.4b, the design bankfull mean depths were designed slightly less than the critical depth. Over time, stream banks in these sections should slowly aggrade and evolve from a C to an E stream type. As the top width of the channel narrows and develops into an E stream type, the mean depth will increase which will also increase sediment transport competence. A C/E stream type is the final desired channel dimension form for these meandering reaches; however, it is not constructed due to the highly unstable nature of stream banks with low width to depth ratios, but allowed to evolve over time as vegetation becomes established.

As shown in Table 8.4b, the design bankfull mean depth for Reach 3 is very close to the critical depth, which indicates a stable channel for sediment transport. Although the competency calculations indicate a stable sediment transport reach, past project experiences indicate that a slight sandy deposition on the stream banks and point bar features can be anticipated over time. Much like Reaches 1 and 2, Reach 3 is expected to gradually evolve into a C/E stream type.

As shown in Table 8.4b, the design bankfull mean depth for Reach 6 is slightly higher than the critical depth which may indicate the tendency to degrade. Though natural bedrock within the step-pool reaches will help prevent vertical channel degradation, additional grade control structures will be added to dissipate excess energy with vertical drops. As a competency comparison, boundary shear stress was plotted on the Shield's Curve to estimate the largest moveable particle during bankfull storm events. All reaches show a largest moveable particle within an acceptable range of the d_{100}, with the exception of Reach 6. This reach's competency calculations show that it can move sediment particles much larger than the D_{100}. This is expected in steeper channel gradients (B / Ba stream types) such as Reach 6 and excess stream energy will be dissipated with vertical drops provided by grade control structures.

Table 8.4a Boundary Shear Stresses and Stream Power for Existing and Proposed Conditions of Reach 1 & Reach 2
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	Reach 1 Existing Conditions	Reach 1 Proposed Conditions	Reach 2 Existing Conditions	Reach 2 Proposed Conditions
Bankfull Discharge, Q (cfs)	50	50	55	55
Bankfull Area (square feet)	11.2	13.0	14.8	15.0
Mean Bankfull Velocity (cfs)	4.4	3.8	3.8	3.7
Bankfull Width, W (feet)	8.2	13.0	15.6	14.0
Bankfull Mean Depth, D (feet)	1.4	1.0	1.0	1.1
Width to Depth Ratio, w/d (ft/ft)	6.0	13.0	15.6	13.0
Wetted Perimeter (feet)	11.0	15.0	10.9	16.0
Hydraulic Radius, R (feet)	1.0	0.9	1.0	1.0
Channel Slope (feet/ foot)	0.0090	0.0076	0.0087	0.0069
Boundary Shear Stress, τ (lbs/ft^2)	0.56	0.41	0.56	0.40
Subpavement D_{100} (mm)	32.7	100	13.2	100
Largest Moveable Particle (mm) (Modified Shield's Curve)	119	102	135	95
Critical Depth (feet)	1.12	1.20	1.17	1.33
Critical Slope (feet/ foot)	0.0087	0.0100	0.0098	0.0100
Stream Power (W/m^2)	48.4	26.6	27.9	35.7

Table 8.3b Boundary Shear Stresses and Stream Power for Existing and Proposed Conditions of Reach 3 & Reach 6
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Parameter	Reach 3 Existing Conditions	Reach 3 Proposed Conditions	Reach 6 Existing Conditions	Reach 6 Proposed Conditions
Bankfull Discharge, Q (cfs)	65.0	65.0	8.9	8.9
Bankfull Area (square feet)	18.0	17.5	2.6	3.0

Table 8.3b Boundary Shear Stresses and Stream Power for Existing and Proposed Conditions of Reach 3 & Reach 6 UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648				
Parameter	**Reach 3 Existing Conditions**	**Reach 3 Proposed Conditions**	**Reach 6 Existing Conditions**	**Reach 6 Proposed Conditions**
Mean Bankfull Velocity (cfs)	3.7	3.5	3.4	3.0
Bankfull Width, W (feet)	9.8	15.1	7.5	6.2
Bankfull Mean Depth, D (feet)	1.83	1.10	0.40	0.40
Width to Depth Ratio, w/d (ft/ft)	5.4	12.9	18.8	15.5
Wetted Perimeter (feet)	13.5	17.5	13.5	7.0
Hydraulic Radius, R (feet)	1.3	1.0	1.3	0.4
Channel Slope (feet/ foot)	0.0056	0.0032	0.0220	0.0250
Boundary Shear Stress, τ (lbs/ft^2)	0.47	0.23	1.83	0.67
Subpavement D_{100} (mm)	90	100	250	90
Largest Moveable Particle (mm) (Modified Shield's Curve)	100	80	330	180
Critical Depth (feet)	0.90	1.12	0.30	0.33
Critical Slope (feet/ foot)	0.0080	0.0032	0.0260	0.0250
Stream Power (W/m^2)	33.7	12.5	23.7	32.6

8.4 Wetland Restoration, Creation, and Enhancement

Existing Condition

Existing on-site wetland areas categorized as riparian non- riverine wetlands and their primary source of hydrology is from groundwater seeps. These wetlands are extremely impaired from cattle waste, hoof shear, over grazing, poor hydrology, and floodplain deposition from degraded upland pastures that have covered historic riparian wetland areas. In addition, groundwater hydrology has been impaired from channel incision along UT to Town Creek and drainage ditches within the floodplain. Restoration activities, on the degraded stream channel and within the adjacent floodplain, will enhance existing wetlands and restore historic wetlands once prolific throughout the Project site.

Soils Analysis and Mitigation Recommendations

As part of this Project, Baker contracted with TEC to complete a hydric soils analysis of the site. TEC, in conjunction with Catena, conducted a field investigation of the site on November 5 and 8, 2010. Soil borings and soil pits excavation samples were used analyze the site. Results of this investigation were compiled in a report (*Hydric Soil Investigation Report)***.** Soil units were broken out into four distinct categories: 1A, 1B, 2, and non-hydric. Soil Unit 1A and 1B were classified as hydric based upon meeting one or more hydric soil indicators. Soil Unit 2 was classified as not meeting any hydric soil indicators, but as having morphological indicators that would classify it as having poor or somewhat poor drainage. Non-hydric soil determinations were based on the soils not meeting any hydric indicators. Details from this report are provided in Appendix B and summarized in this section. Hydric soil determinations were based upon *Field Indicator Hydric Soils in the United States - A Guide for Identifying and Delineating Hydric Soils* (Version 7.0, 2010).

Results from the investigation designated three distinct soil areas, Soil Area 1A, 1B, and 2. Each soil area is comprised mostly of soil unit upon which it represents (i.e. Soil Area 1 A is comprised mostly of Soil Unit 1A, etc.). Though both Soil Area 1A and 1B have hydric soils, they lack hydrophytic vegetation and assumed hydrology, and therefore do not currently meet the definition of a jurisdictional wetland. Additionally, the investigation documented several acres of floodplain that have shallow buried hydric layers (an indication of historic wetlands). These areas coincide with areas designated as Soil Area 2, and substantiate that Soil Unit 2's indicators of poorly drained soils could have historically supported jurisdictional wetlands. Therefore, it is anticipated, based on soil borings and site conditions, that the restoration of hydrologic conditions to these Soil Areas is feasible through minor grading, shallow fill removal, and/or raising the water table. These adjustments would allow these areas to support wetland vegetation, further develop hydric soils, and fully function as wetland systems.

Floodplain grading in Soil Areas 1A, 1B, and 2, and vertical adjustment of the channel profile along Reaches 1, 2, and 3 will be implemented to restore floodplain hydrology. In general, proposed wetland restoration areas will require little to no excavation in the floodplain as compared to creation areas, because hydric soil layers lie within 0 to 12-inches of the soil surface. Proposed creation areas may require slightly more excavation because hydric soils in these areas are located in buried horizons. The *Hydric Soil Investigation Report* denotes indicators within the soil profile that suggest that these alluvium have been incrementally deposited within the floodplain as the result of human activity, especially in areas mapped as Soil Unit 2. Soil removal depths were recommended by the soil scientists conducting the on-site soil investigation to create wetland conditions.

Because the depth of grading varies throughout the soil areas, as outlined in the *Hydric Soil Investigation Report* in Appendix B, Baker installed groundwater wells throughout wetland restoration and creation areas to monitor the Project site's existing groundwater hydrology (As noted in Section 6.2 and Figure 6.1). The data collected from each well over a period of approximately 15 months, established a baseline groundwater elevation for each well (Table 8.4). Average water depths determined from the groundwater monitoring mostly support the soil areas of hydric soils and the boring depths to hydric soils from the *Hydric Soil Investigation Report* (Appendix B), except for AW4 and AW8.

Soil areas surrounding AW4 and AW8 were defined as Soil Area 1B and Soil 1A, respectively, and soil borings exhibit depths to hydric soils within 0-in to 12-inches below the ground surface. In order to discern these differences in findings, Baker examined the surveyed existing conditions topography. Results from this investigation showed that the location of wells AW4 and AW8 were installed in areas where the topographic relief was 1-ft to 2-ft higher in elevation than the surrounding grade; therefore, corroborating that the location of the wells were the reason that these areas did not exhibit the anticipated hydrologic results based on the soil investigation. Therefore, Baker referred to the results from the *Hydric Soil Investigation Report* to establish the proposed wetland mitigation type for these areas.

Table 8.5 Groundwater Well Average Water Depths
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Groundwater Well	Average Water Depth (in) ["-" indicates depth below ground]*	Hydroperiod Criterion Achieved*	Proposed Design Type
AW1 (Reference Well)	-2.12	88.5%	Enhancement
AW2	-14.95	44.8%	Restoration
AW3	-12.03[1]	22.3%[1]	Restoration
AW4	-27.36[2]	0.7%[2]	Restoration
AW5	-28.03	4.1%	Creation
AW6 (Reference Well)	-3.28	97.8%	Enhancement
AW7	-10.36[2]	42.1%[2]	Restoration
AW8	-23.35	22.5%	Restoration
AW10	-29.71	2.0%	Creation

Notes: * Based Stanly County's 222 day growing season from 3/27 – 11/5/2011 (NRCS, 2002) and a groundwater level within 12-in of the soil surface.
[1]AW3 stopped recording data on 7/15/2011; however, data reported was based on the entire 222 day growing season.
[2]AW4 and AW7 stopped recording data on 9/13/2011; however, data reported was based on the entire 222 day growing season.

Design Approach

Proposed wetland restoration and creation areas are based upon the type of soil unit identified in the *Hydric Soil Investigation Report*, hydrologic results, and the soil borings. The proposed mitigation will be implemented through floodplain grading and the vertical adjustment of the channel's profile. A majority of the channel's mainstem (Reaches 1-3), are proposed for Priority 1 restoration and will vertically adjust the channel bed upward; therefore, raising the surrounding groundwater elevation.

Floodplain grading with be conducted to improve surface hydrologic inputs to wetlands, as well as to increase detention time for higher pollutant removal. The topography of the restored wetlands will be patterned after reference sites that promote diversity of hydrologic conditions and habitats common to natural wetland areas. The prescribed grading is a key component to the restoration of forest soil properties and to the diversity and patterns of plant communities (Lutz, 1940; Stephens, 1956; Bratton, 1976; Ehrnfeld, 1995).

Planting of native wetland species vegetation and permanent cattle exclusion will also be implemented throughout the wetland restoration, creation, and enhancement areas. See Table 8.7 for a list of specific species that will be planted and the plans for the areas where fencing will be installed to exclude cattle from the conservation easement and protect the wetland areas in perpetuity.

8.5 Constructed Stormwater Wetland BMPs

Constructed stormwater wetland BMPs located at the upstream extent of Reaches 4 and 7 were designed to treat stormwater runoff from their contributing watersheds. These watersheds are likely contributing high nutrient and fecal coliform loads to UT to Town Creek. Stormwater runoff from the 1-inch rainfall event will be detained for approximately 48 hours in each constructed wetland to help remove these pollutants. Design features including a V-Notch weir, wetland and littoral shelf vegetation plantings and an emergency spillway will aid in providing pollutant removal. Both constructed wetlands will be included in the project conservation easement and its fencing perimeter. All of these features are depicted on the plans. BMP design calculations are included in Appendix J.

8.6 Site Construction

8.6.1 Site Grading, Structure Installation, and Other Project Related Construction

A construction sequence is provided below and can be found within the accompanying plans for Project. Site construction will be conducted by River Works, Inc. and may be referred to as "Contractor" in the construction sequence and associated construction documents. Baker will provide construction observation during the construction phase of this project. Contractor shall refer to the approved erosion and sedimentation control plan for specific construction sequence items and shall be responsible for following the approved plans and permit conditions.

GENERAL CONSTRUCTION SEQUENCE

1. Preparation for site access. Contractor must call 1-800-632-4949 to locate all underground utilities before mobilizing to the site. Contractor must schedule and attend a pre-construction conference with the NCDENR – Department of Land Quality Sediment and Erosion Control Inspector, the Engineer, and appropriate utility companies.

2. Equipment and materials shall be mobilized to the site. The Contractor shall install the erosion and sedimentation control measures as shown on the plans prior to any grading activities. Measures and devices shall be installed and maintained by the Contractor in accordance with the approved plan to protect jurisdictional waters from significant runoff prior to permanent site stabilization. Measures and devices to be used are shown on the plans (e.g. silt fence, check dams, temporary construction entrances, temporary stream crossings, haul road, etc.).

3. A temporary gravel construction entrance shall be installed at access points that connect to a public road. See plan set for construction entrance locations and installation details.
4. Set up all staging areas and install haul roads as shown on plans. All existing roads or farm paths used for construction activities such as haul roads and site access shall be repaired, if necessary, to the pre-construction condition or better.
5. Contractor is to not disturb more than can be stabilized within the same day. Contractor is not to disturb any areas outside the limits of disturbance and shall minimize disturbance to areas in and around the existing wetlands. Contractor shall minimize disturbance to existing buffer vegetation and construction corridor to the extent practical.
6. Clearing and Grubbing activities shall be limited to the minimal amount necessary for haul roads, channel relocations, and stockpile areas and can be accomplished with an excavator and track truck; therefore, additional equipment, such as a pan or off-road dump trucks, are not required. Waste material is to be disposed within the project limits as depicted on the plan set. Where feasible, the channel construction should always begin at the upstream extents and work downstream. When access to a construction area requires crossing a delineated jurisdictional feature, impacts shall be minimized by placing a temporary stream/wetland crossing across the feature prior to accessing the area with heavy equipment per the approved plans and specifications.
7. Work within the specific project areas shall be divided into phases as outlined in "Stormwater Wetland BMP Construction" and "Channel Construction" below. Work will follow these outlined phases and as a general rule will start on the upstream. The Contractor will not be allowed to advance to the next phase until the current phase is completed and stabilized. Constructed wetland installations and floodplain wetland grading shall be conducted prior to stream construction. Contractor shall use temporary stream crossings to access the constructed wetland installation and floodplain wetland grading areas.
8. Temporary rock check dams shall be installed at the end of the reach that is under construction within the current phase and at the end of the construction limits. See plan set for check dam installation areas. The Contractor shall be responsible for inspecting the temporary rock check dams on a daily basis and cleaning or repairing them as needed. The Contractor shall be required to remove sediment from the check dams once the depth of sediment reaches 12 inches.
9. Contractor is required to remove existing topsoil layer and stockpile in designated areas separate from other stockpiled soil for reapplication to the excavated floodplain and constructed wetlands.
10. Contractor shall construct the new stream channel off-line where feasible as described below. In-line construction will be necessary in areas where the proposed channel crosses the existing channel. See "Off-line Channel Construction" and "Pump-around Channel Construction". The Contractor must establish temporary vegetation in accordance with the plans and technical specifications before turning water into the new stream channel segments.
11. After construction on a reach is complete, stabilize banks with erosion control matting and temporary/permanent vegetation before proceeding to the next reach. No more area is to be disturbed than what can be stabilized within the work day. All disturbed areas are to be stabilized at the end of each work day. Disturbed areas shall be seeded and mulched per the plans and technical specifications. Temporary seeding shall be placed on all disturbed areas within 24 hours and all slopes steeper than 3:1 shall be stabilized with ground cover as soon as practicable within 7 calendar days. All other disturbed areas and slopes flatter than 3:1 shall be stabilized within 14 calendar days from the last land-disturbing activity. Permanent seeding shall be placed on all disturbed areas within 15 working days or 90 calendar days (whichever comes first) following construction completion.
12. The Engineer must approve all grading activities and groundcover stabilization prior to riparian vegetation planting.

13. Demobilize from site as described in "Construction Demobilization".

STORMWATER WETLAND BMP CONSTRUCTION

14. See sheet 1A for vegetation selection and revegetation plan for planting locations.
15. No lime shall be incorporated with the seeding and planting areas unless otherwise directed by the engineer.
16. Site stabilization shall occur at the end of every work day and prior to any rain event. Stabilization measures shall consist of temporary seeding, mulching, and erosion control matting on all disturbed areas within the constructed wetlands.
17. The Engineer must approve all grading activities and groundcover stabilization prior to riparian vegetation planting and acceptance of flow through the constructed wetland.
18. Contractor is responsible for pumping excess water from each constructed wetland site, as needed, in order to grade contours to the design elevations specified in the plan set.
19. Contractor shall remove topsoil layer and stockpile in designated stockpile areas separate from other soil material for reapplication to constructed wetlands. The remaining soil (non-topsoil layer) shall be stockpiled in designated areas as shown on the plans.
20. Contractor shall construct the wetlands such that when the stockpiled topsoil layer is reapplied the finished grades shall match design grades as noted in the plans.
21. Permanent and temporary seed and mulch all disturbed areas below the permanent pool. Permanent and temporary seed, mat, and mulch all other disturbed areas before proceeding to the next area.

CHANNEL CONSTRUCTION (PUMP-AROUND OPERATION)

22. Pump-around areas of construction where proposed channel intersects existing channel frequently and where concentrated flow enters the main stem. Contractor shall stage work to minimize the length and duration of pump-around operations.
23. Install impervious dikes at upstream and downstream ends of pump around locations. The pump-around operation shall be performed between these locations as described in plan details.
24. Construct channel and floodplain between upstream and downstream dike locations.
25. Remove topsoil layer and stockpile in designated stockpile areas separate from other stockpiled soil for reapplication to the floodplain.
26. Contractor shall excavate the floodplain such that when the stockpiled topsoil layer is reapplied the finished grades match the lines and grades as noted in the plans.
27. Stockpile remaining soil (non-topsoil layer) in designated stockpile areas or backfill existing channel. Contractor shall verify that a continuous channel exists at all times in order to carry overflow during heavy rainfall events. Silt fence shall be installed on the stream side(s) of the base of the stockpiles and maintained when sediment has accumulated above one third of the height of the silt fence and/or before the silt fence has failed.
28. In-stream channel work shall be constructed within the isolated channel section.
29. Reapply stockpiled topsoil on excavated floodplain and apply permanent and temporary seed, mat, and mulch banks and floodplain areas.
30. Once disturbed areas and exposed slopes are stabilized and accepted by the Engineer; plug existing channel, remove impervious dikes, and turn water into the new channel. Stockpile any remaining coarse bed material separately from the excavated soil for later use.

31. Backfill abandoned channel sections with stockpiled soil (non-topsoil layer). Non-native and invasive vegetation (i.e. *Chinese privet*, *Microstegium* sp., and *Myriophyllum aquaticum*) shall be removed from the existing channel prior to backfilling. Excess soil shall be hauled to the designated permanent stockpile location and stabilized as shown on the plans before demobilization.

32. Permanent and temporary seed, mat, and mulch backfill sections before proceeding to the next work area.

<u>CONSTRUCTION DEMOBILIZATION</u>

33. The flow diversions and temporary stream crossings shall be removed when no longer needed and the banks in these areas are stabilized with seeding and matting.

34. Plant woody vegetation and live stakes according to planting details and specifications. Contractor shall complete the reforestation (bare-root planting) phase of the project and apply permanent seeding at the appropriate time of the year. Bank and floodplain vegetation, including brush materials and live stakes, are preferably installed during the dormant season (November to March).

35. Staging and stockpile areas, and silt fences shall be removed and the ground shall be repaired to its original condition once planting is complete or once they are no longer needed.

36. The Contractor shall ensure that the site is free of trash and leftover materials prior to demobilization of equipment from the site.

37. Demobilize grading equipment from the site.

38. Temporary seeding shall be applied on all disturbed areas susceptible to erosion (i.e. disturbed ditch banks, steep slopes, and spoil areas) within 24 hours and all slopes steeper than 3:1 shall be stabilized with ground cover as soon as practicable within 7 calendar days. All other disturbed areas and slopes flatter than 3:1 shall be stabilized within 14 calendar days from the last land-disturbing activity. Permanent ground cover shall be established for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction. Seed, mulch, and stabilize all disturbed areas including, but limited to staging areas, stockpiles, permanent stockpiles, haul roads, and construction entrances.

8.6.2 In-Stream Structures and Other Construction Elements

A variety of in-stream structures are proposed for the Project site. Structures such as constructed riffles, rock cross vanes, log and rock vanes, log and rock j-hook vanes, log and rock step pools, and boulder steps will be used to stabilize the newly-restored stream reaches. This Project will primarily utilize those structures which provide grade control and enhance pool habitat as C and B stream types that make up the Project site. Only a small quantity of native wood material will be generated through the construction of this Project; therefore, a majority of logs used in this Project will be imported to the site. Table 8.6 summarizes the use of in-stream structures at the site.

Table 8.6 Proposed In-Stream Structure Types and Locations
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Structure Type	Location
Constructed Riffles	Through straight, steeper sections to provide grade control.
Log and Rock Step Pools	Through straight, steeper sections to provide grade control and promote bed form diversity.
Log/Rock Vanes	In meander bends to turn water to protect outside banks and promote scour to maintain pools.
Log/Rock J-hook Vanes	In meander bends to provide grade control, turn water to protect outside banks and promote scour to maintain pools.
Rock Cross Vanes	Downstream of floodplain constrictions to direct high velocity flow emerging from the constriction to the center of the channel to prevent bank erosion and provide grade control.

Boulder Steps	In steep channels to control grade and maintain step-pool system.
Vegetated Geolifts	Outside of meander bends to provide bank protection
Brush Mattresses	Outside of meander bends to provide bank protection.

Constructed Riffles

A constructed riffle consists of the placement of coarse bed material in the stream at specific riffle locations along the profile. A buried log within the constructed riffle may be used to provide mini-pools to improve bedform diversity throughout the riffle. The purpose of this structure is to provide grade control and establish riffle habitat. Constructed riffles will be placed throughout the Project reaches. Constructed riffles will be intermixed with other structures to provide diversity of structure and in-stream habitat.

Log and Rock Step Pools

Log and rock step pools consist of the placement of logs, boulders and coarse stone in the stream at specific locations along the profile. The logs are keyed into the streambanks and provide grade control and habitat. Log and rock step pools will be intermixed with other structures to provide diversity of structure and in-stream habitat.

Log/Rock Vanes and J-Hook Vanes

A log/rock vane is used to protect the stream bank. The length of a single vane structure can span one-half to two-thirds the bankfull channel width. Vanes are located along a meander bends and function to initiate or complete the redirecting of flow energies resulting in reduced near bank shear stresses . Vanes are located just downstream of the point where the stream flow intercepts the bank at acute angles. J-hook vanes may also be used outside of meanders for grade control, a primary concern in this Project. Logs and/or boulders may be used to construct vanes.

Rock Cross Vanes

Cross vanes are used to provide grade control, keep the thalweg in the center of the channel, and protect the stream bank. A cross vane consists of two rock vanes joined by a center structure installed perpendicular to the direction of flow. This centering structure sets the invert elevation of the stream bed.

Boulder Steps

Boulder steps consist of header stones and footer stones placed in the bed of the stream channel, perpendicular to stream flow. The rocks extend into the stream banks on both sides of the structure to prevent erosion and bypassing of the structure. The rocks are installed flush with the channel bottom upstream of the rock. The footer rock is placed to the depth of scour expected, to prevent the structure from being undermined. Boulder steps provide bedform diversity, maintain channel profile, and provide pool and cover habitat. Boulder steps are installed along reaches that are too small to appropriately fit a other grade control structures such as a cross vane or j-hook vane.

Vegetated Geolifts

A vegetated geolift consists of a layer of biodegradable matting back filled with soil (creating a lift) that is stacked upon a stone toe or brush/rootwad base. A row of native, riparian, woody vegetation is laid on top of this first soil lift and a second lift is constructed on top of the woody material. This alternating of lift and woody material continues to the desired elevation. Geolifts provide a high degree of bank protection.

Brush Mattresses

Brush mattresses are placed on bank slopes on the outside of meander bends for stream bank protection. Layers of live, woody cuttings are wired together and staked into the bank. Brush mattresses help to establish vegetation on the bank to secure the soil. Once the vegetation is established, the cover also provides habitat for wildlife.

8.6.3 Natural Plant Community Restoration

Native riparian species vegetation will be established in the restored stream buffer. Areas of invasive species vegetation such as Chinese privet, multiflora rose, and Japanese honeysuckle will be removed and controlled to avoid competition with the newly-established native plants within the conservation easement.

Soil Preparation

Topsoil will be stripped from floodplain in all grading areas and stockpiled in designated stockpile locations separate from other stockpile material. Floodplain grading will follow the topsoil stripping. Re-application of topsoil to the lines and grades on the plans will commence following site grading. Topsoil stripping and reapplication to the floodplain is critical to the success of proposed planting throughout the Project site.

Stream Buffer Vegetation

Bare-root trees, live stakes, shrubs, and permanent seeding will be planted within designated areas of the conservation easement. A minimum 50-foot buffer measured from the top of banks (sometimes substantially more) will be established along the restored or enhanced stream reaches. Bare-root vegetation (trees and shrubs) will be planted at a target density of 680 or greater stems per acre, or approximately 8-foot by 8-foot grid. The proposed species to be planted are listed in Table 8.7. Planting of bare-root trees, live stakes and shrubs will be conducted during the first dormant season following construction. If construction activities are completed in summer/fall of a given year, all vegetation will be installed prior to the start of the growing season of the following calendar year.

Species selection for re-vegetation of the site will generally follow those suggested by Schafale (2012) for Forested Headwater Wetlands and Piedmont Alluvial Forests. Tree species selected for stream restoration areas will generally be weakly tolerant to tolerant of flooding. Weakly tolerant species are able to survive and grow in areas where the soil is saturated or flooded for relatively short periods of time. Moderately tolerant species are able to survive in soils that are saturated or flooded for several months during the growing season. Flood tolerant species are able to survive on sites in which the soil is saturated or flooded for extended periods during the growing season (WRP, 1997).

Once trees are transported to the site, they will be planted within two days or will be held in cold-storage. Soils across the site will be sufficiently disked and loosened prior to planting. Trees will be planted by manual labor using a dibble bar, mattock, planting bar, or other approved method. Planting holes for the trees will be sufficiently deep to allow the roots to spread out and down without "J-rooting." Soil will be loosely compacted around trees once they have been planted to prevent roots from drying out.

Live stakes will be installed three feet apart in meander bends and four to six feet apart in the riffle sections using triangular spacing along the stream banks between the toe of the stream bank and bankfull elevation. Site variations may require slightly different spacing.

Permanent seed mixtures will be applied to all disturbed areas of the Project site. Table 8.7 lists the species, mixtures, and application rates that will be used. Mixtures will also include temporary seeding (rye grain during cold season or browntop millet during warm season). The permanent seed mixture specified for floodplain areas will be applied to all disturbed areas outside the banks of the restored stream channel and is intended to provide rapid growth of herbaceous ground cover and biological habitat value. The species provided are deep-rooted and have been shown to proliferate along restored stream channels, providing long-term stability.

Temporary seeding will be applied to all disturbed areas of the site that are susceptible to erosion. These areas include constructed stream banks, access roads, side slopes, and spoil piles. If temporary seeding is applied from November through April, rye grain will be used and applied at a rate of 130 pounds per acre. If applied from May through October, temporary seeding will consist of browntop millet, applied at a rate of 45 pounds per acre.

Table 8.7 Proposed Bare-Root, Live Stake, Herbaceous Plug, and Permanent Riparian Seeding Species
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Common Name	Scientific Name	% Planted by Species	Wetness Tolerance
Riparian Zone Plantings			
Trees & Shrubs - Planted 8' X 8' Spacing – 680 Trees & Shrubs/ Acre			
River birch	*Betula nigra*	5	FACW
Sugarberry	*Celtis laevigata*	8	FACW
Persimmon	*Diospyros virginiana*	3	FAC
Green ash	*Fraxinus pennsylvanica*	12	FACW
Tulip poplar	*Liriodendron tulipifera*	7	FACU
Sycamore	*Platanus occidentalis*	15	FACW
Swamp chestnut oak	*Quercus michauxii*	5	FACW
Willow oak	*Quercus phellos*	5	FAC
Tag alder	*Alnus serrulata*	10	OBL
Paw paw	*Asimina triloba*	5	FAC
Ironwood	*Carpinus caroliniana*	5	FAC
Silky dogwood	*Cornus amomum*	10	FACW
Elderberry	*Sambucus nigra*	10	FAC
Live Stakes – Planted 3' X 3' Spacing on the outside of meanders and 4'X4' spacing along riffle sections			
Silky Dogwood	*Cornus amomum*	35%	FACW
Black Willow	*Salix nigra*	10%	OBL
Silky Willow	*Salix sericea*	35%	OBL
Elderberry	*Sambucus nigra*	20%	FAC
Brush Material			
Silky Dogwood	*Cornus amomum*	35%	FACW
Black Willow	*Salix nigra*	10%	OBL
Silky Willow	*Salix sericea*	35%	OBL
Elderberry	*Sambucus canadensis*	20%	FAC
Geolifts			
Silky Dogwood	*Cornus amomum*	35%	FACW
Black Willow	*Salix nigra*	10%	OBL
Silky Willow	*Salix sericea*	35%	OBL
Elderberry	*Sambucus nigra*	20%	FAC
Wetland Zone Plantings			
Trees & Shrubs - Planted 8' X 8' Spacing – 680 Trees & Shrubs/ Acre			
Sycamore	*Platanus occidentalis*	15	FACW
Green ash	*Fraxinus pennsylvanica*	15	FACW
River birch	*Betula nigra*	15	FACW
Overcup oak	*Quercus lyrata*	10	OBL
Willow oak	*Quercus phellos*	10	FAC
Tag alder	*Alnus serrulata*	10	OBL
Silky dogwood	*Cornus amomum*	10	FACW
Elderberry	*Sambucus canadensis*	5	FAC
Silky willow	*Salix sericea*	10	OBL
Upland Zone Plantings			
Trees & Shrubs – Planted 8' X 8' Spacing – 680 Trees & Shrubs/ Acre			
Tulip poplar	*Liriodendron tulipifera*	15	FACU

Table 8.7 Proposed Bare-Root, Live Stake, Herbaceous Plug, and Permanent Riparian Seeding Species UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648			
Common Name	**Scientific Name**	**% Planted by Species**	**Wetness Tolerance**
Persimmon	*Diospyros virginiana*	10	FAC
Red Maple	*Acer rubrum*	8	FAC
Black Gum	*Nyssa sylvatica*	10	FAC
Southern red Oak	*Quercus falcata*	12	FACU
White Oak	*Quercus alba*	10	FACU
Ironwood	*Carpinus caroliniana*	10	FAC
Paw paw	*Asimina triloba*	5	FAC
Redbud	*Cercis canadensis*	5	FACU
Flowering dogwood	*Cornus florida*	10	FACU
Hazelnut	*Corylus americana*	5	FACU
Note: Species selection may change due to refinement or availability at the time of planting.			
Constructed Wetlands			
Herbaceous Plugs - Planted 2' X 2' Spacing			
Soft Rush	*Juncus effusus*	30	FACW
Lurid Sedge	*Carex lurida*	25	OBL
Wool Grass	*Scirpus cyperinus*	20	FACW
Sweetflag	*Acorus calamus*	15	OBL
Cardinal Flower	*Lobelia cardinalis*	5	FACW
Swamp Hibiscus	*Hibiscus moscheutos*	5	FACW
Permanent Riparian Seeding			
Redtop	*Agrostis alba*	10	FACW
Virginia Wildrye	*Elymus virginicus*	15	FACW
Switchgrass	*Panicum virgatum*	15	FAC
Gamma Grass	*Tripsacum dactyloides*	5	FACW
Pennsylvania Smartweed	*Polygonum pennsylvanicum*	5	FACW
Little Blue Stem	*Schizachyrium scoparium*	5	FACU
Soft Rush	*Juncus effusus*	5	FACW
Tickseed	*Bidens aristosa*	10	FACW
Lance-Leaved Coreopsis	*Coreopsis lanceolata*	10	FACU
Deer Tongue	*Dichanthelium clandestinum*	10	FAC
Big Bluestem	*Andropogon gerardii*	5	FAC
Indian Grass	*Sorghastrum nutans*	5	FACU
Note: Species selection may change due to refinement or availability at the time of planting.			

On-site Invasive Species Vegetation Management

Invasive species vegetation such as Multiflora rose (*Rosa multiflora*), Chinese Privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*) are interspersed in the riparian buffer along the upper 750 LF of Reach 1, while Chinese Privet (*Ligustrum sinense*) is common throughout the remainder of the Project site. Grading operations will remove these invasive species within the restored field areas. These areas will be monitored so that the invasive species do not threaten the newly-planted riparian vegetation.

Fields within the easement boundaries are predominantly planted in fescue. Fescue will be treated by physical and chemical means in order to reduce competition for native grasses.

The most appropriate means of treating invasive grasses growing in the creek and on the margins of the channel will be assessed and implemented prior to vegetation control. In many cases, building a new offline channel will reduce or eliminate this issue and the long-term development of a forested stream will provide shade to limit invasive species habitat.

9 PERFORMANCE CRITERIA

Channel stability, vegetation survival, and viability of wetland functions will all be monitored on the Project site. Post-restoration monitoring will be conducted for a minimum of five years or until the success criteria are met following the completion of construction to document Project success. Different monitoring approaches are proposed throughout the Project area and are based on the design approach to be used. Reaches 1, 2, 3, 4, 6, and 7 involve the Restoration and/or Enhancement I of the historic flow patterns as a single-thread channel, success criteria will follow those recommended by the Stream Mitigation Guidelines (USACE, et.al, 2003). Reach 5 will implement the Enhancement II. Success criteria for these reaches will focus primarily on visual assessments and vegetation success. The approaches to be used relative to the design type are described below.

9.1 Streams

Channel stability will be monitored for success on the Project site. Post-restoration monitoring will be conducted for a minimum of five years or until the success criteria are met following the completion of construction to document Project success. The methods used and related success criteria are described below for each reach and parameter.

9.1.1 Success Criteria – Restoration and Enhancement I for Reaches 1, 2, 3, 4, 6, and 7

Stream monitoring for the Restoration and Enhancement I of Reaches 1, 2, 3, 4, 6, and 7 will be conducted for a minimum of five years to evaluate the effectiveness of the restoration practices. Monitored stream parameters include stream dimension (cross-sections), profile (longitudinal profile), and photographic documentation. The methods used and related success criteria are described below for each parameter.

Bankfull Events

Two bankfull events must be documented within the 5-year monitoring period. The bankfull events must occur in separate years; otherwise, the monitoring will continue until two floodplain events have been documented in separate years.

Cross-sections

There should be little change in as-built cross-sections. If changes do take place they should be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen Stream Classification System, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

Longitudinal Profile

The longitudinal profiles should show that the bedform features are remaining stable (i.e., they are not aggrading or degrading). The pools should remain deep with flat water surface slopes, and the riffles should remain steeper and shallower than the pools. Bedforms observed should be consistent with those observed for channels of the design stream type.

Bed Material Analysis

Pebble counts shall be conducted immediately after construction and, thereafter, at the time the cross-section and longitudinal surveys are performed during the five-year monitoring period. These samples will reveal any changes in sediment gradation that occur over time as the stream adjusts to upstream sediment loads. Distributions trends for the D_{50} and D_{84} should resemble design parameters, generally with coarser material in riffles and finer material in pools. Significant changes in sediment gradation trending away from design specifications shall be evaluated with respect to the effect on stream stability and changes in the watershed.

9.1.2 Success Criteria – Enhancement II for Reach 5

Visual monitoring of Reach 5 will be conducted for a minimum of five years or until the success criteria are met to evaluate the effectiveness of the enhancement practices. Since this reach involves Level II Enhancement techniques to stabilize the existing channel. Monitoring efforts will focus on visual documentation of channel stability.

9.1.3 Photo Reference Sites

Photographs will be used throughout the site to visually document the Project's success.

9.2 Constructed Stormwater Wetland BMPs

Implementation of stormwater wetland BMPs located at the upstream extent of Reaches 4 and 7 will be visually monitored for vegetative survivability and permanent pool storage capacity using photo documentation during the 5-Year monitoring period. Maintenance measures will be implemented during the 5-Year monitoring period to replace dead vegetative material and to remove excess sedimentation from permanent pools, as needed.

9.3 Wetlands

Groundwater monitoring stations will be installed across the Project area to document hydrologic conditions of the restored site and will be monitored for seven years post-construction or until wetland success criteria are met. Groundwater and surface water levels (overbank events) will be compared to pre-restoration conditions and onsite reference stations; however, success criteria for wetland hydrology will be met when each wetland site is saturated within 12 inches of the soil surface for 9 percent of the growing season (NCIRT, 2013).

Visual inspection of proposed wetland areas will be conducted to document any visual indicators that would be typical of jurisdictional wetlands. This could include, but is not limited to, vegetation types present, surface flow patterns, stained leaves, and ponded water. Wetland plants will be documented along with other visual indicators noted above. Proposed wetland restoration, creation, and enhancement areas that exhibit all three wetland indicators (the presence of hydric soils, wetland hydrology, and wetland vegetation) after construction and through the monitoring period will validate the design approach as successful.

As stated in the May 13, 2013 letter from NCEEP to the IRT, "In the fourth year of monitoring, EEP will decide if the specific site may qualify to close out after five successful monitoring years. For those, EEP will submit to the IRT for early closure. For any … site that EEP does not think meet early closeout criteria, EEP will contact out to complete the final two years" of monitoring (NCEEP, 2013). A copy of the letter has been included in Appendix K for reference.

9.4 Vegetation

Successful vegetative restoration on a stream and wetland mitigation site is dependent upon hydrologic restoration, active planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the criteria are achieved, vegetation-monitoring quadrants will be installed and monitored for 5 years across the restoration site in accordance with the CVS- NCEEP Protocol for Recording Vegetation, Level 1-2 Plot Sampling, Version 4.2 (2008).

At the end of the first growing season, species composition, diameter, height, density, and survival will be evaluated, and for each subsequent year or until the final success criteria are achieved (Lee, et al., 2008).

Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked such that they can be found in succeeding monitoring years.

The interim measure of vegetative success for the site will be the survival of at least 320, 3-year old, planted woody stems (trees and shrubs) per acre at the end of year three of the monitoring period. The final vegetative success criteria will be the survival of 260, 5-year old, planted woody stems (trees and shrubs) per acre at the end of year five of the monitoring period.

While measuring species density is the current accepted methodology for evaluating vegetation success on restoration projects, species density alone may be inadequate for assessing plant community health due to natural variability within the riparian and non-riparian planting zones. For this reason, the vegetation monitoring plan will incorporate the evaluation of additional plant community indices to assess overall vegetative success such as noting vegetative problem areas as outlined in the Vegetative Assessment Section of the NCEEP's Requirements for Monitoring Reports (2010b).

9.5 Schedule/Reporting

A baseline monitoring document for both stream and wetland mitigation activities will be developed after the completion of site planting and the installation of wells on the restored site. The report will include all information required by NCEEP mitigation plan guidelines in accordance with NCEEP Mitigation Plan Document, Version 1.0 (2010a).

A monitoring program will be implemented to document system development and progress toward achieving the success criteria referenced in the previous sections. The monitoring program will be undertaken for five years, or until the final success criteria are achieved, whichever is longer. Monitoring reports will be prepared in the fall of each monitoring year and submitted to NCEEP in accordance with NCEEP's Requirements for Monitoring Reports (2010b). The monitoring reports will include:

- A detailed narrative summarizing the Project background that will include, Project objectives restoration approach, Project history and background;
- Stream assessment that includes morphometric and hydrologic success criteria, monitoring results and/or problems areas, stream photographs, and data tables;
- Vegetation assessment that includes vegetative success criteria, monitoring results and/or problem areas, vegetative photographs, and data tables;
- Overall conclusions and recommendations;
- Wildlife observations;
- References; and
- As-built topographic maps showing locations of monitoring gauges, vegetation sampling plots, permanent photo points, and location of transects.

10 MONITORING PLAN

Channel stability, vegetation survival, and viability of wetland function will all be monitored on the Project site. As outlined in the RFP #16-002836, all monitoring activities will follow the NCEEP Monitoring Report Template, Version 1.2.1 – 12/1/09. As stated in the May 13, 2013 letter from NCEEP to the IRT, stream related monitoring will be conducted for five years post construction and wetland related monitoring will be conducted for seven years post-construction or until wetland success criteria are met. "In the fourth year of monitoring, EEP will decide if the specific site may qualify to close out after five successful monitoring years. For those, EEP will submit to the IRT for early closure. For any … site that EEP does not think meet early closeout criteria, EEP will contact out to complete the final two years" of monitoring (NCEEP, 2013). A copy of the letter has been included in Appendix K for reference.

Annual monitoring reports will be submitted to EEP by December 31 of the year during which the monitoring was conducted. The monitoring report shall provide a project data chronology for EEP to document the project status and trends. Project success criteria must be met by the final monitoring year (based on the May 13, 2013 letter from NCEEP to the IRT) prior to roject closeout, or monitoring will continue until unmet criteria are successfully met.

Different monitoring approaches are proposed throughout the Project area and are based on the design approach to be used. Reaches 1, 2, 3, 4, 6, and 7 involve the Restoration and/or Enhancement I of the historic flow patterns as a single-thread channel, success criteria will follow those as outlined previously in Section 9 Performance Criteria. Reach 5 will implement Enhancement II. Success criteria for these reaches will focus primarily on visual assessments and vegetation success. The approaches to be used relative to the design type are described below.

10.1 Streams

Channel stability and vegetation survival will be monitored on the Project site. Post-restoration monitoring will be conducted for a minimum of five years or until the success criteria are met following the completion of construction to document Project success. The methods used and related success criteria are described below for each reach and parameter.

In order to determine if the rainfall is normal for the given year, rainfall amounts will be tallied using data obtained from the Stanly County WETS Station (NRCS, 2002) and from the automated weather station at the North Stanly Middle School (NEWL) in New London, approximately 1.5 miles southeast of the Project site on Old Salisbury Rd. Data from the NEWL station can be obtained from the CRONOS Database located on the State Climate Office of North Carolina's website (2011). Therefore, a rain gauge will not be installed on-site.

10.1.1 Stream Monitoring-Restoration and Enhancement I for Reaches 1, 2, 3, 4, 6 and 7

Stream monitoring for the Restoration and Enhancement I of Reaches 1, 2, 3, 4, 6, and 7 will be conducted for a minimum of five years to evaluate the effectiveness of the restoration practices. Monitored stream parameters include stream dimension (cross-sections), profile (longitudinal profile), and photographic documentation. The methods used and related success criteria are described below for each parameter.

Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of on-site crest gauges and site photographs. Each crest gauge will be installed within 10 feet of the restored channel on the restored portion Reach 3, as well as, at the head and tail of Reach 6 and Reach 7. The crest gauges will record the highest watermark between site visits and the gauges will be checked during each site visit to determine if a bankfull event has occurred. Site photographs may be used to document the occurrence of debris lines and sediment deposition on the floodplain during site visits.

Flow Documentation

Monitoring of flow will be conducted to demonstrate that the restored stream systems classified as intermittent exhibit base flow for some portion of the year during a year with normal rainfall conditions. In order to determine if rainfall amounts are normal for the given year, a rainfall gage will be installed on the site to compare precipitation amounts using tallied data obtained from the nearest Stanly County WETS Station. Data from the weather station can be obtained from the CRONOS Database located on the State Climate Office of North Carolina's website. If a normal year of precipitation does not occur during the first seven years of monitoring, flow conditions will continue to be monitored on the site until it documents that the intermittent streams have been flowing during the appropriate times of the year.

The proposed monitoring of the restored intermittent reaches will include a combination of photographic documentation and the installation of groundwater monitoring wells within the thalweg (bottom) of the channel towards the downstream portion of the reach. A regular and continuous series of remote photos over time will be used to subjectively evaluate channel flow conditions throughout the year. More specifically, the longitudinal photos should indicate the presence of flow within the channel in order to effectively discern water levels within the pools and riffles. The photographs will be taken from a height of approximately five to six feet to ensure that the same locations (and view directions) at the site are documented in each monitoring period and will be shown on a plan view map. The visual monitoring effort, including the photo locations with descriptions, will be included with NCEEP's annual monitoring reports. The monitoring gages (pressure transducers) will be installed towards the downstream portion of restored intermittent reaches. The devices will be inspected on a quarterly/semi-annual basis to document surface hydrology and provide a basis for evaluating general flow response to rainfall events and surface runoff during various water tables levels throughout the monitoring period.

Cross-sections

Based the methodology described in the NCEEP's (2009b) Baseline Monitoring Document, v. 1.0 (Baseline Monitoring Guidance), cross-section monitoring will be conducted on reaches where at least 500 LF of stream work was implemented and resulted in a significant change to geomorphic components of the reach. A total of 19 cross-sections will be installed throughout the Project area. Following the above referenced guide, Table 10.1 outlines the number and the general location of each cross-section per reach. See Figure 7 for post-construction cross-section monitoring locations.

Table 10.1 Number of Cross-sections to be Monitored per Reach
UT to Town Creek Restoration Site – Option A - NCEEP Contract #003277 Project #94648

Reach Name	Reach Length (LF)	# of Riffle Cross-sections	# of Pool Cross-sections
Reach 1	1,192	3	2
Reach 2	1,833	3	2
Reach 3	803	3	1
Reach 4	404	Visual Assessment Only*	Visual Assessment Only*
Reach 6	1,370	3	2
Reach 7	399	Visual Assessment Only*	Visual Assessment Only*

*Very small reaches (500 LF or less) can be monitored through a visual assessment.
(NCEEP, 2009b)

Each cross-section will be marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently used to facilitate easy comparison of year-to-year data. The annual cross-section survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections will be classified using the Rosgen Stream Classification System.

Longitudinal Profile

A longitudinal profile will be completed immediately after construction and annually thereafter for the duration of the five-year monitoring period. The as-built survey will be used as the baseline for subsequent surveys. The profile will be conducted for a total of 3,000 LF of the restored channels. Measurements will include thalweg, water surface, inner berm, bankfull, and top of low bank. Each of these measurements will be taken at the head of each feature (e.g., riffle, run, pool, and glide) and the maximum pool depth. The survey will be tied to a permanent benchmark.

Bed Material Analysis

Reach wide pebble counts shall be conducted annually for Reaches 1, 2, 3, and 6. Pebble counts shall be conducted immediately after construction and annually thereafter at the time the cross-section and longitudinal surveys are performed during the five-year monitoring period. These samples will reveal any changes in sediment gradation that occur over time as the stream adjusts to upstream sediment loads. Significant changes in sediment gradation shall be evaluated with respect to stream stability and watershed changes.

Photo Reference Sites

Photographs will be used to document success visually. Reference sites will be photographed for a minimum of five years following construction. Reference photos will be taken once a year. Photographs will be taken from a height of approximately five to six feet. To ensure that the same locations are monitored photograph locations will be field staked and located during the as-built survey. When modifications to photo position must be made due to obstructions or other reasons, the position will be noted along with any landmarks and the same position will be geographically located using a sub-meter GPS unit for use in subsequent monitoring years.

Lateral Reference Photos

Reference photo transects will be taken at each permanent cross-section. Photographs will be taken of both banks at each cross-section. The survey tape will be centered in the photographs of the bank. The water line will be located in the lower edge of the frame, and as much of the bank as possible will be included in each photo. Photographers will make an effort to consistently document the same view in each photo point over time. Lateral photos should not indicate excessive erosion or continuing degradation of the banks.

Structure Photos

Photographs will be taken of structures along the restored streams. Photographers will make every effort to consistently document the same area in each photo point over time. All structure photos will be taken looking upstream towards the structure. Points will be close enough together to provide an overall view of the reach. The angle of the shot will depend on what angle provides the best view and will be noted and continued in future shots. Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively.

10.1.2 Stream Monitoring – Enhancement II for Reach 5

Visual monitoring of Reach 5 will be conducted for a minimum of five years or until the success criteria are met to evaluate the effectiveness of the restoration practices. Since this reach involves Level II Enhancement techniques to stabilize the existing channel single channel, monitoring efforts will focus on visual documentation of stability. The methods used and any related success criteria are described below for each parameter.

Photo Reference Sites

Photographs will be used to document success visually. Reference sites will be photographed for a minimum of five years following construction. Reference photos will be taken once a year. Photographs will be taken from a height of approximately five to six feet. The stream will be photographed longitudinally. Photographs will be taken looking upstream and to ensure that the same locations are monitored photograph locations will be field staked and located during the as-built survey. Points will be close enough together to provide an overall view of the reach. The angle of the shot will depend on what angle provides the best view and will be noted and continued in subsequent monitoring years. When modifications to photo position must be made due to obstructions or other reasons, the position will be noted along with any landmarks and the same position will be geographically located using a sub-meter GPS unit for use in subsequent monitoring years.

10.2 Stormwater Management Devices

Implementation of stormwater wetland BMPs located at the upstream extent of Reaches 4 and 7 will be visually monitored for vegetative survivability and permanent pool storage capacity using photo documentation during the 5-Year monitoring period. Maintenance measures will be implemented during the 5-Year monitoring period to replace dead vegetative material and to remove excess sedimentation from permanent pools, as needed.

10.3 Wetlands

Wetland restoration, creation, and enhancement will be monitored after construction through the use of groundwater wells and periodic visual inspections. Wetland sites will be monitored for seven years post-construction or until wetland success criteria are met. As stated in the May 13, 2013 letter from NCEEP to the IRT, "In the fourth year of monitoring, EEP will decide if the specific site may qualify to close out after five successful monitoring years. For those, EEP will submit to the IRT for early closure. For any … site that EEP does not think meet early closeout criteria, EEP will contact out to complete the final two years" of monitoring (NCEEP, 2013). A copy of the letter has been included in Appendix K for reference.

Groundwater wells will be reinstalled, after construction is complete, in locations similar to those from pre-construction monitoring. See Figure 7 for depictions of the proposed post-construction well locations. Installation and monitoring of the groundwater stations will follow the USACE standard methods outlined in the *ERDC TN-WRAP-05-2* (USACE, 2005). Water levels will be collected and analyzed in the same manner as in the pre-construction monitoring period. Comparison of pre- and post-construction groundwater levels will be conducted to determine the overall hydrologic uplift resulting from the proposed design approach.

Visual inspection of proposed wetland areas will be conducted to document any visual indicators that would be typical of jurisdictional wetlands. This could include, but is not limited to, vegetation types present, surface flow patterns, stained leaves, and ponded water.

In order to determine if the rainfall is normal for the given year, rainfall amounts will be tallied using data obtained from the Stanly County WETS Station (NRCS, 2002) and from the automated weather station at the North Stanly Middle School (NEWL) in New London, approximately 1.5 miles southeast of the Project site on Old Salisbury Rd. Data from the NEWL station can be obtained from the CRONOS Database located on the State Climate Office of North Carolina's website (2011). Therefore, a rain gauge will not be installed on-site.

10.4 Vegetation

Successful restoration of the vegetation on a mitigation site is dependent upon hydrologic restoration, active planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the criteria are achieved, vegetation-monitoring quadrants will be installed and monitored across the planted area within the site in accordance with the Carolina Vegetation Survey (CVS)-NCEEP Protocol for Recording Vegetation, Version 4.2 (2008). Based on the CVS-EEP Entry Tool Database version 2.2.7 (Lee, 2007), at least nineteen permanent monitoring quadrants will be established within the floodplain areas throughout the conservation easement to monitored planted stems per Protocol Level 1. The size of each quadrant is 100 square meters for woody species. Vegetation monitoring will occur in the fall, prior to the loss of leaves. Individual quadrant data will follow the guidelines established per CVS- NCEEP Protocol Level 1 (2006) and will include species composition, density, and survivability. Individual seedlings will be marked to ensure that they can be found in subsequent monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings. Vegetation monitoring will be conducted for five years post-construction or until vegetative success criteria are met. See Figure 7 for post-construction vegetation plot monitoring locations.

At the end of the first growing season, species composition, diameter, height, density, and survival will be evaluated, and for each subsequent year or until the final success criteria are achieved (Lee, et al., 2008). Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked such that they can be found in succeeding monitoring years.

While measuring species density is the current accepted methodology for evaluating vegetation success on restoration projects, species density alone may be inadequate for assessing plant community health due to natural variability within the riparian and non-riparian planting zones. For this reason, the vegetation monitoring plan will incorporate the evaluation of additional plant community indices to assess overall vegetative success such as noting vegetative problem areas as outlined in the Vegetative Assessment Section of the NCEEP's Requirements for Monitoring Reports (2005). During site monitoring, areas within the conservation easement will be evaluated to determine if invasive species are impacting the growth of native vegetation. If this is found to be the case, appropriate action will be taken.

Herbaceous vegetation, primarily native grasses, shall be seeded/planted throughout the site. During and immediately following construction activities, all ground cover at the Project site shall be in compliance with the North Carolina Erosion and Sedimentation Control Ordinance (NCDENR, NCSCD, and NCAES, 2006). Bare-root tree and shrub species will be planted within all areas of the site conservation easement. Bare-root vegetation is typically planted at a target density of 680 or greater stems per acre, or approximately 8- by 8-foot grid. Planting of bare-root species will be conducted during the dormant season, which lasts from late November to early March for most of North Carolina.

11 SITE PROTECTION AND ADAPTIVE MANAGEMENT STRATEGY

The Project site, including the constructed stormwater wetland BMPs, will be protected by a permanent conservation easement that will be held by the state. The site will be monitored for a minimum of five years following construction. Post-construction monitoring activities will be conducted to evaluate site performance, to identify maintenance and/or repair concerns, and to maintain the integrity of the Project boundaries. If during the post-construction monitoring period it is determined Project compliance is jeopardized, Baker shall take the necessary action to resolve the Project concerns and bring the Project back into compliance. If maintenance or site repairs become necessary, Baker will evaluate the level of response required, secure a contractor to make the repairs and monitor the work performed by the construction contractor.

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Projects with sandy, non-cohesive soils are more prone to short-term bank erosion than cohesive soils with high gravel and cobble content.
- Alluvial valley channels with wide floodplains are less vulnerable than confined channels.
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive species can affect the extent to which a native buffer can be established.
- The presence of beaver colonies can affect the establishment of riparian species, disrupt natural channel flow, and make channel performance evaluations difficult.

Maintenance issues and recommended remediation measures will be detailed and documented in the monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed.

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40 CFR 230.3, (t)

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Figures 1 - 8

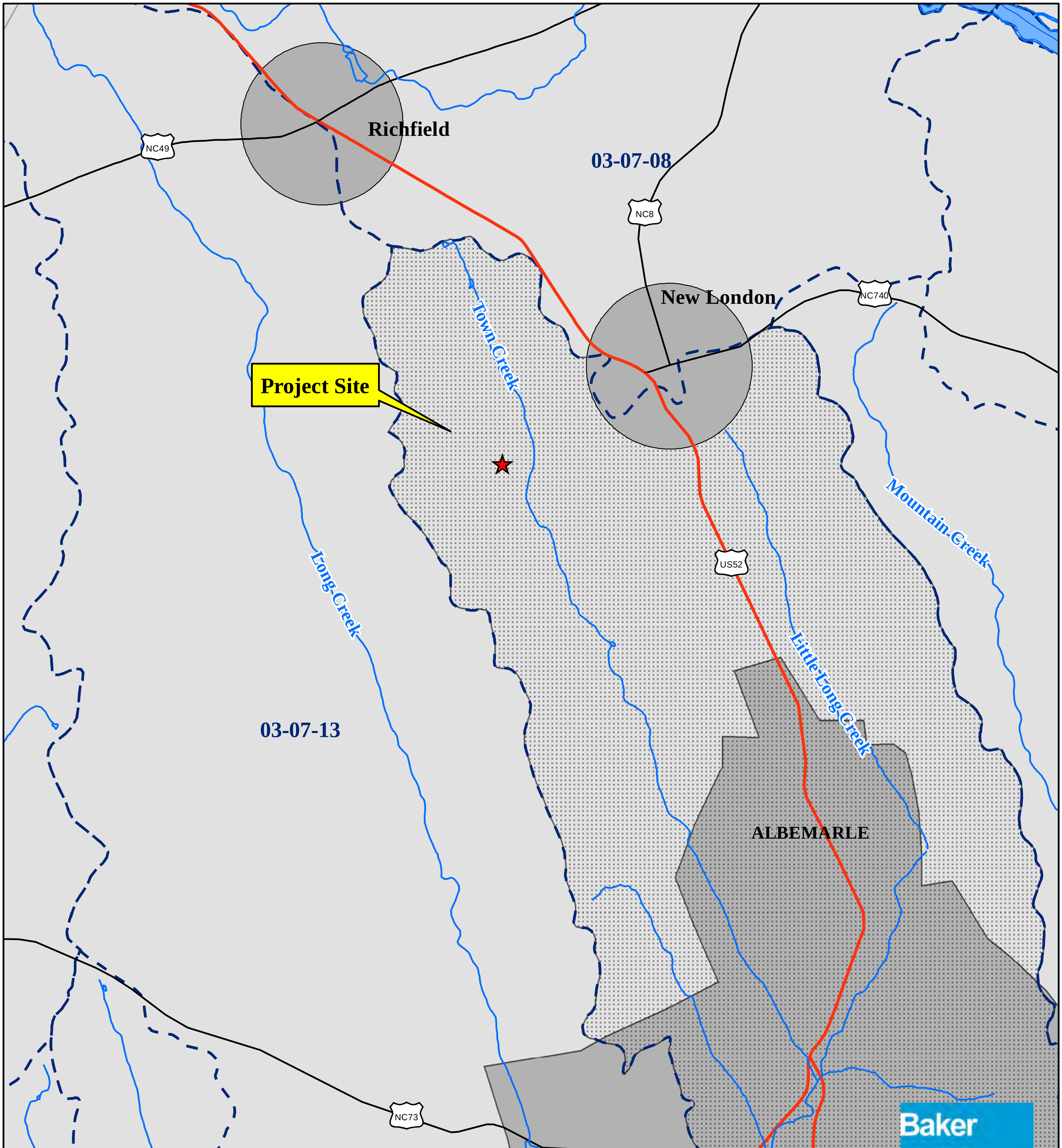


Figure 1. Vicinity Map

UT to Town Creek Restoration Site - Option A

Stanly County, NC

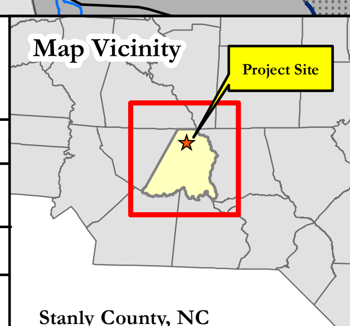
Ecosystem Enhancement PROGRAM

Reference: NCDOT 02 & NC One Map

NC EEP:
Contract No. 003277 & Project No. 94648

December 2014

1" = 1 Mile   0 0.25 0.5 1 Miles



LEGEND

- US Highways
- Roads
- DWQ Subbasins
- Major Waterways
- Municipalities
- HUC 03040105060-040

N

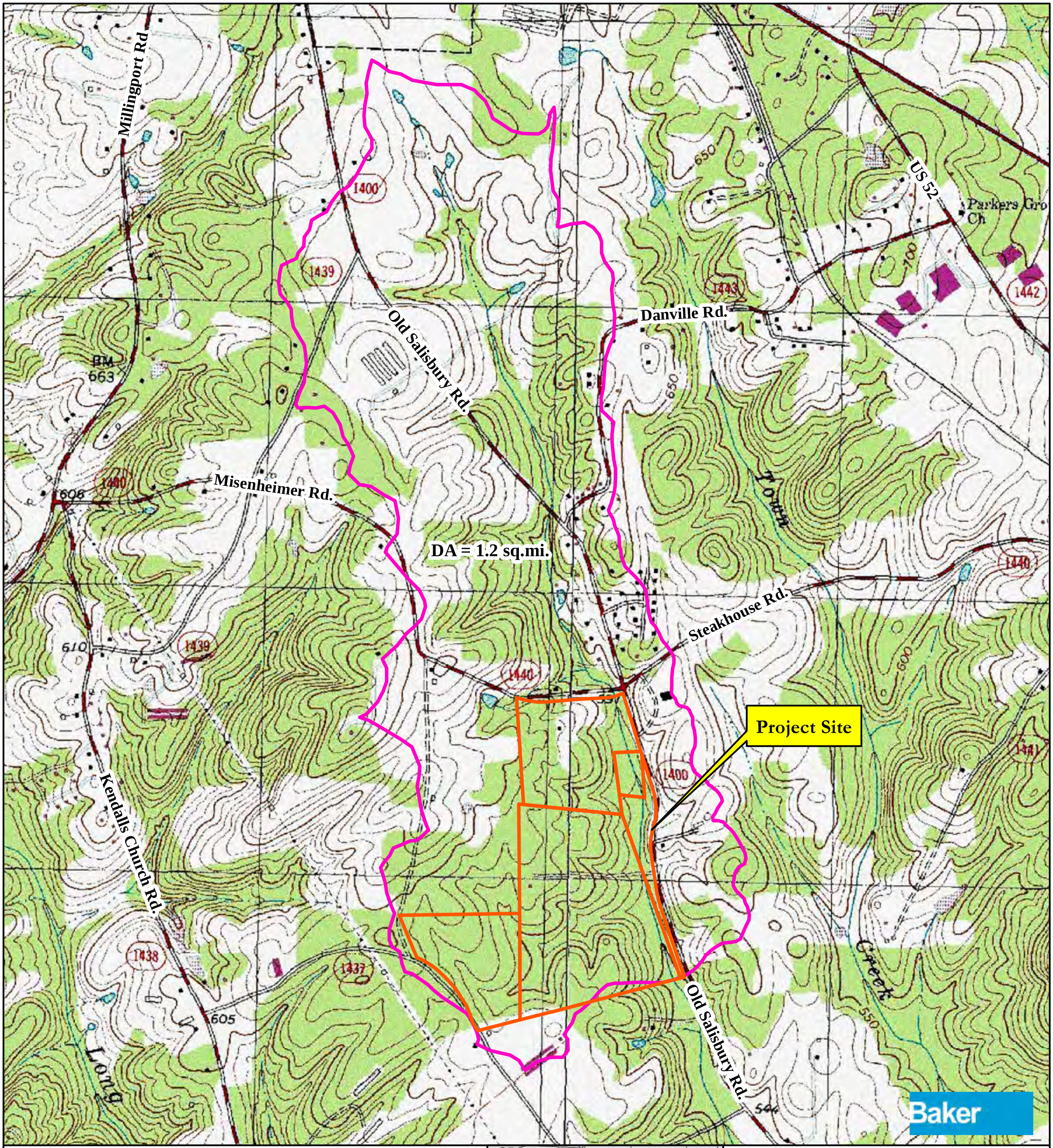


Figure 2. Watershed Map

UT to Town Creek Restoration Site - Option A

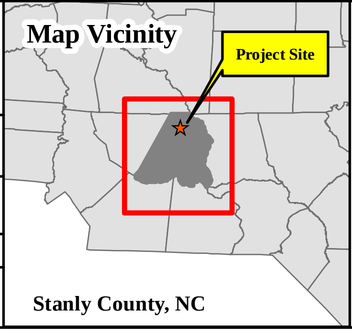
Stanly County, NC

Reference: NCDOT 02 & NC One Map
USGS Quads: Richfield & New London

NC EEP:
Contract No. 003277 & Project No. 94648

December 2014

1" = 1,500'   0 375 750 1,500 Feet



LEGEND

- Project Parcels
- Project Watershed Boundary

N

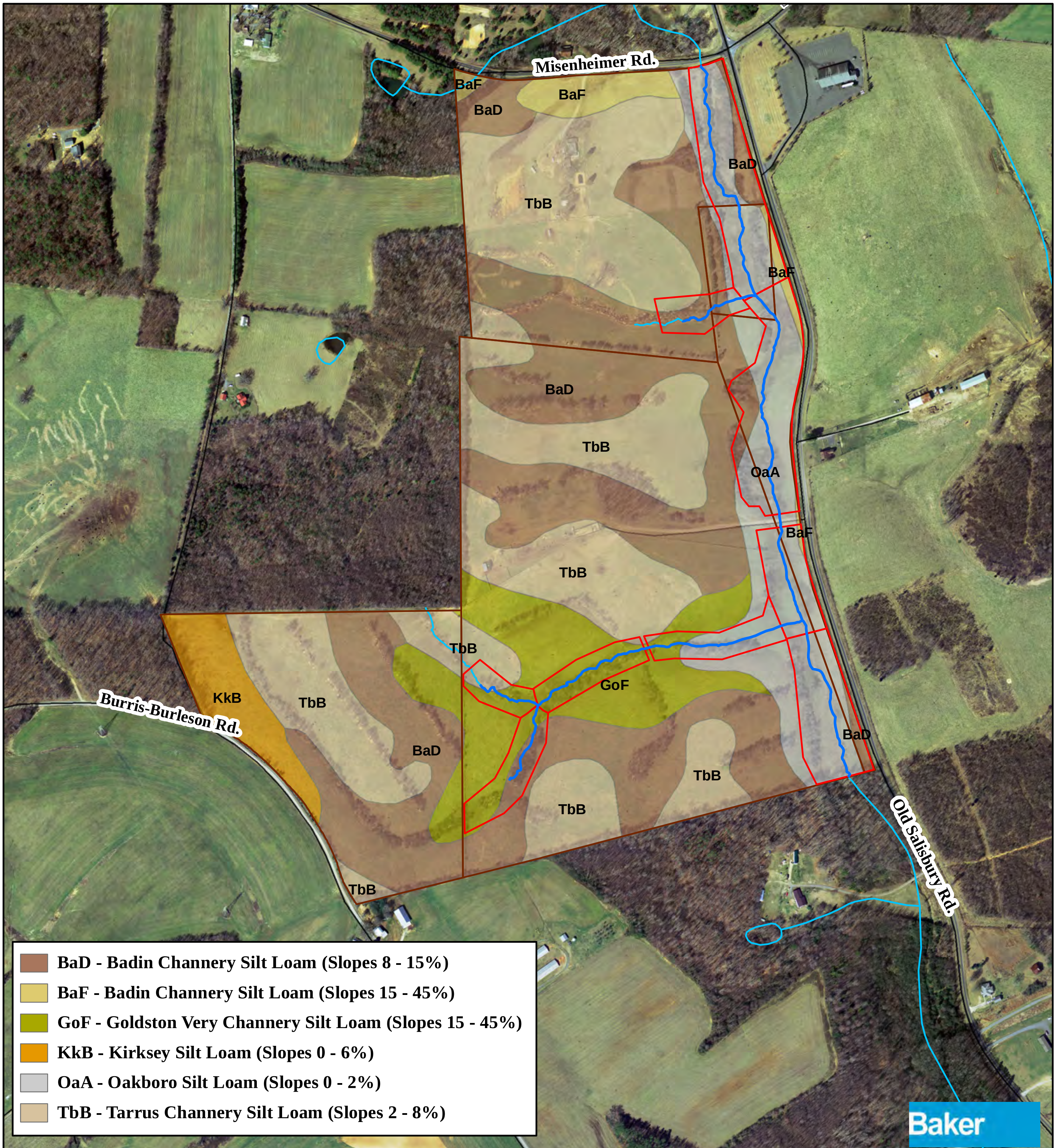


Figure 3. Soils Map

UT to Town Creek Restoration Site - Option A

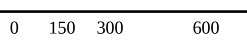
Stanly County, NC

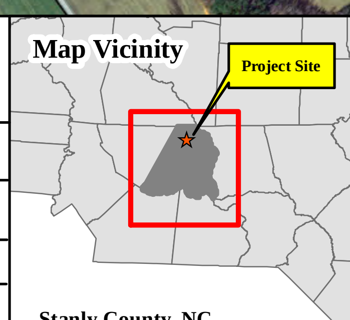
Reference: NCDOT 02 & NC One Map
NRCS Soils Data Mart, 2009 Stanly County

NC EEP:
Contract No. 003277 & Project No. 94648

December 2014

1" = 600'





LEGEND

- Project Streams
- Conservation Easement
- Project Parcels
- Streams
- Roads

N

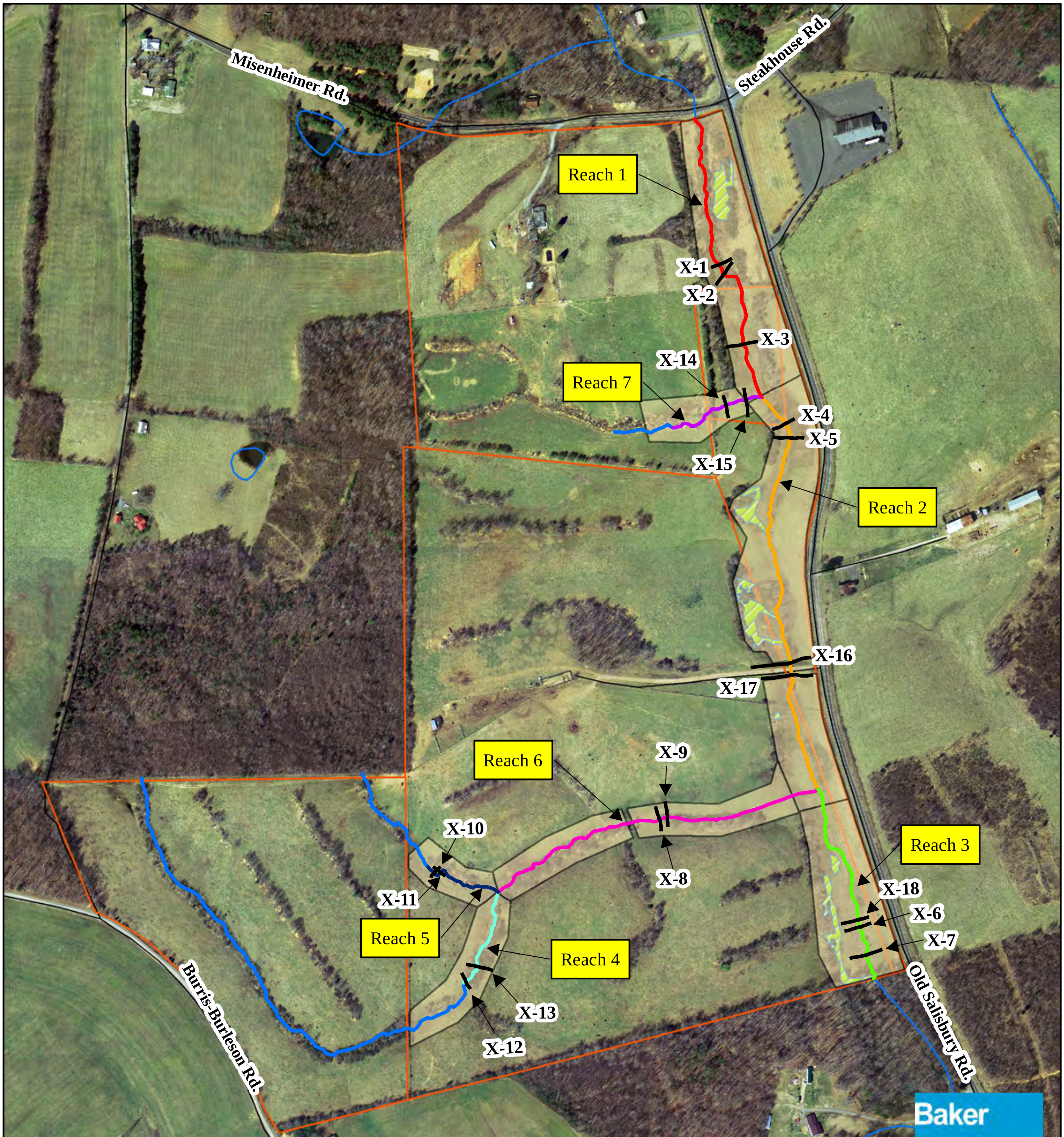


Figure 4. Existing Conditions Map

UT to Town Creek Restoration Site - Option A

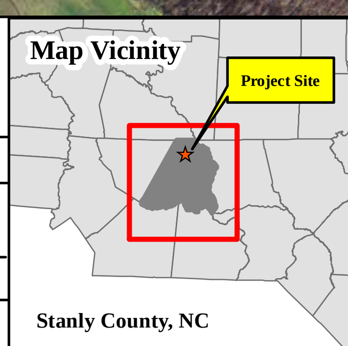
Stanly County, NC

Reference: Stanly Co. GIS - 2005 Aerial

NC EEP:
Contract No. 003277 & Project No. 94648

December 2014

1" = 500' 0 125 250 500 Feet



LEGEND

	Reach 1		Cross-sections
	Reach 2		Conservation Easement
	Reach 3		Existing Wetlands
	Reach 4		Project Parcels
	Reach 5		Streams
	Reach 6		Roads
	Reach 7		

N

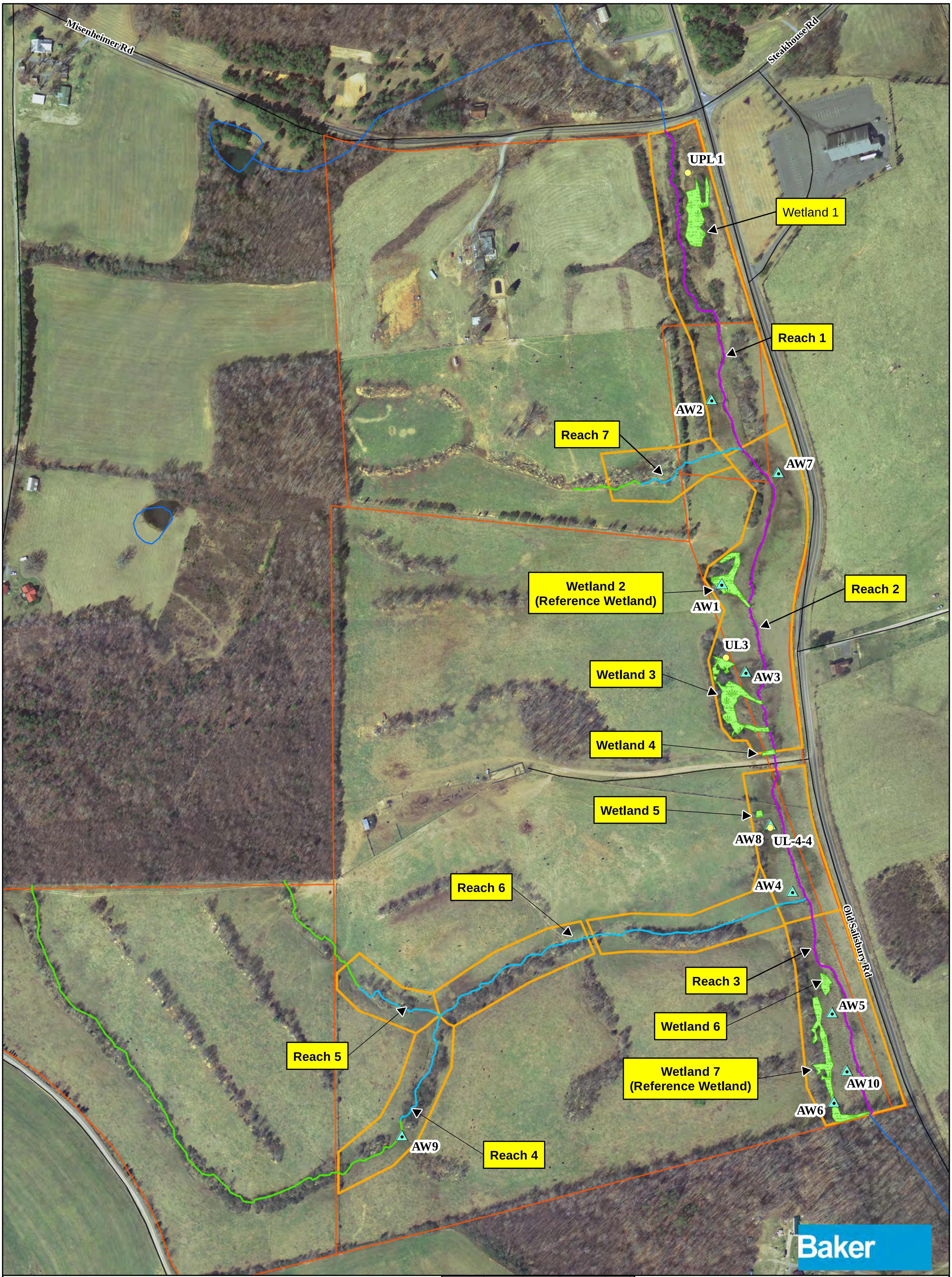


Figure 5. Jurisdictional Waters Map

UT to Town Creek Restoration Site - Option A

Stanly County, NC

Reference: Aerial Date: 2005
Parcel Data: Stanly County GIS 2011

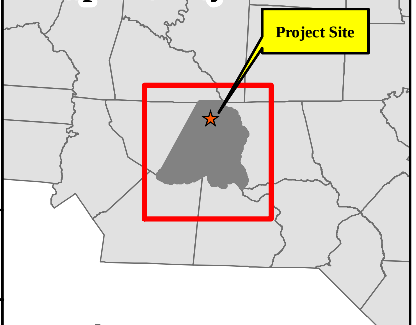
Survey: Wetland Delineations - Oct. 8, 11, & 13, 2011
Stream Delineations - Jan. 3, 2011

NC EEP
Contract No. 003277 & Project No. 94648

December 2014

0 150 300 Feet
1" = 300 Feet

Map Vicinity



Stanly County, NC

LEGEND

Jurisdictional Status
- Ephemeral
- Intermittent
- Perennial
- Wetlands
- Groundwater Gauges
- Upland Points
- Conservation Easement
- Project Parcels
- Streams

N

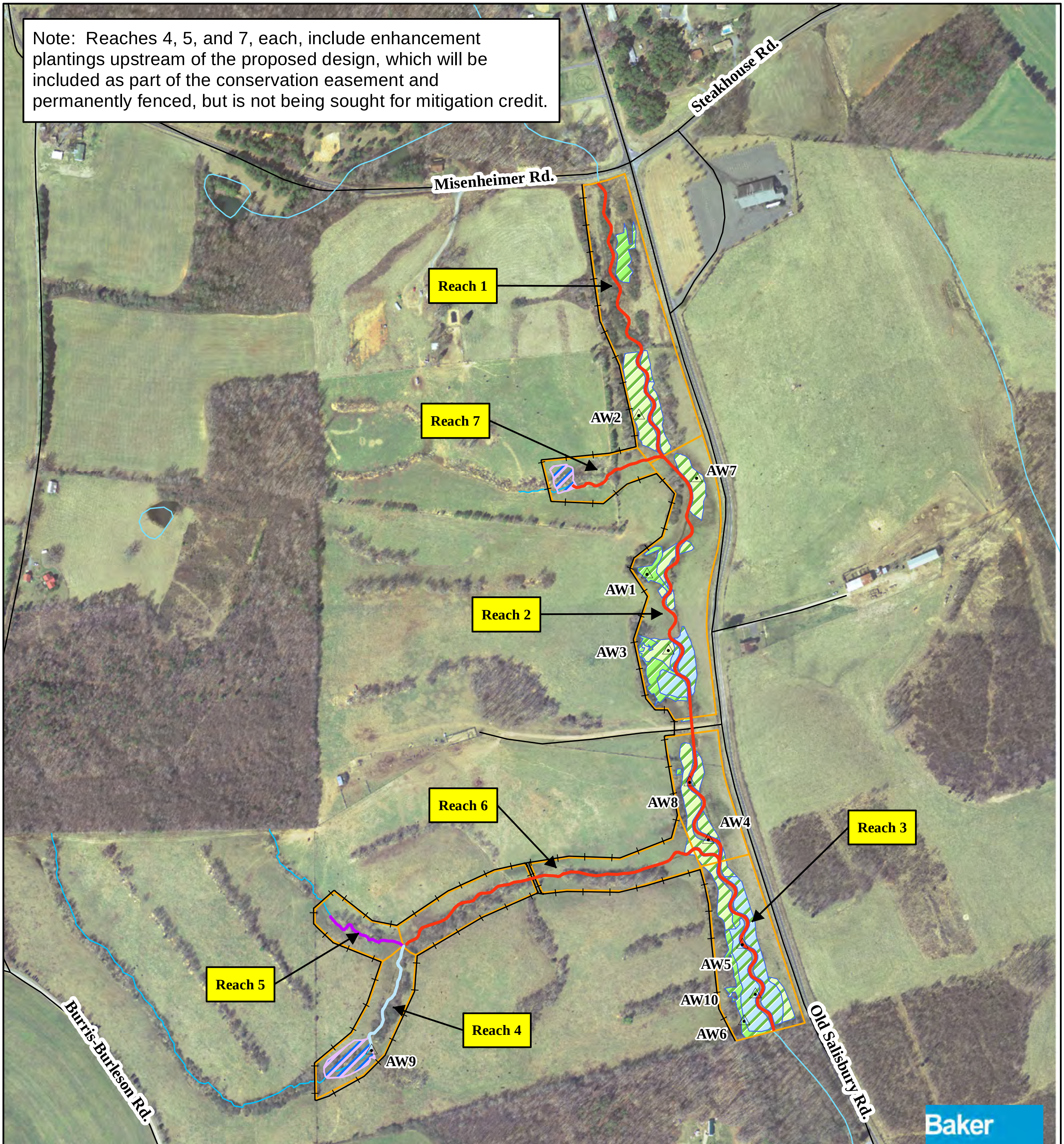


Figure 6. Proposed Conditions Map

UT to Town Creek Restoration Site - Option A

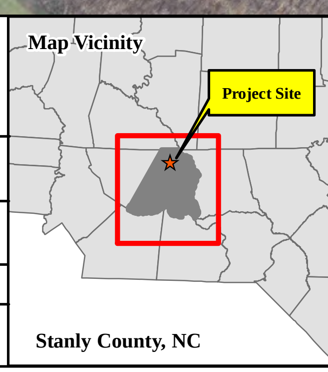
Stanly County, NC

Reference:
Stanly Co. GIS - 2005 Aerial

NC EEP: Contract No. 003277 & Project No. 94648

December 2014

0 125 250 500 Feet 1" = 500'



LEGEND

- Restoration (PI)
- Enhancement I (P3)
- Enhancement II (P4)
- Wetland Creation
- Wetland Restoration
- Fencing
- Conservation Easement
- Existing Wetlands
- Groundwater Wells
- Wetland BMPs
- Streams
- Roads

N

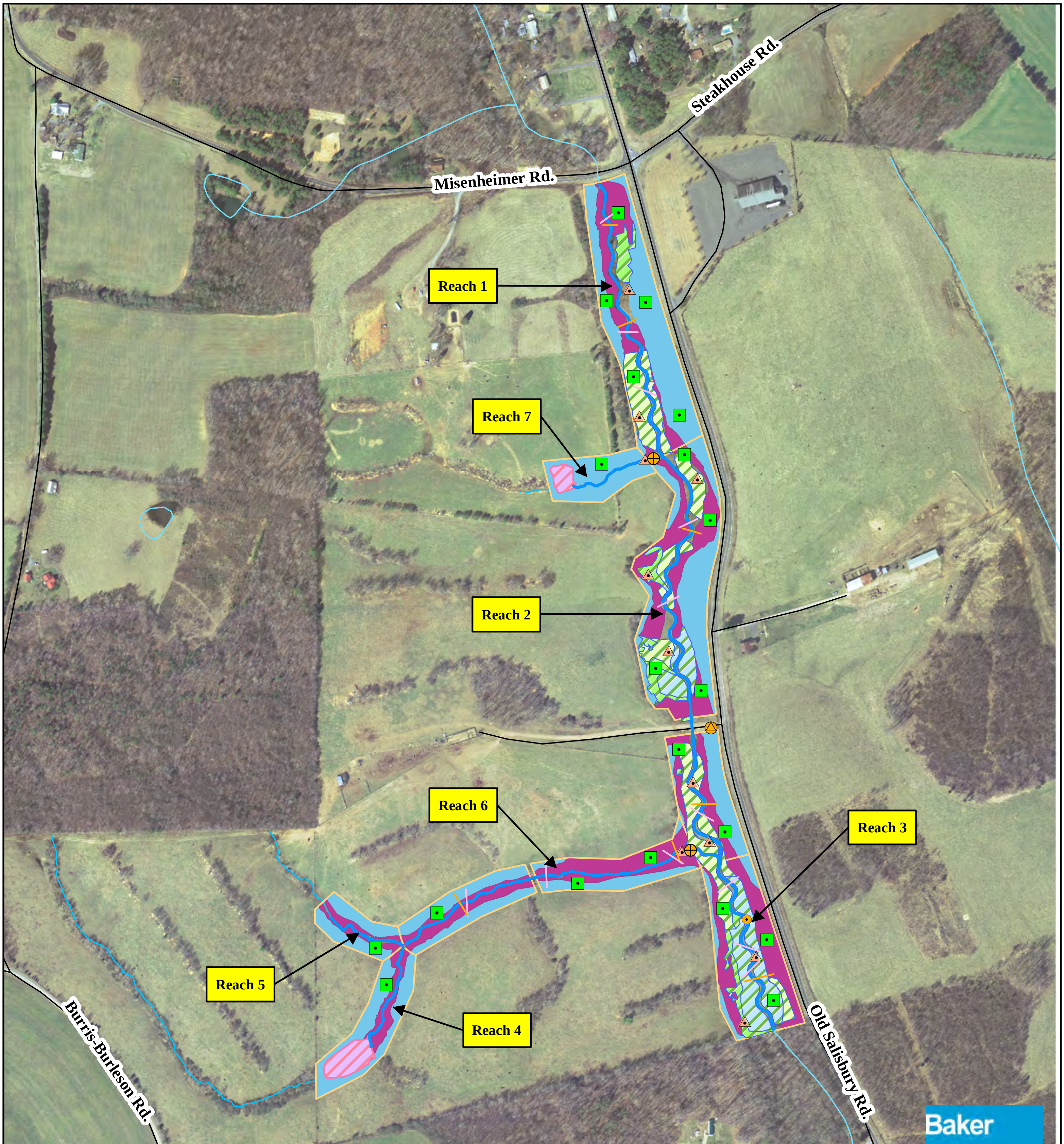


Figure 7. Proposed Monitoring Device Locations

UT to Town Creek Restoration Site - Option A

Stanly County, NC

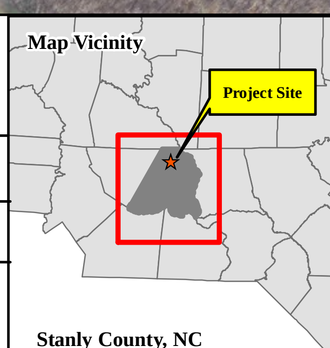
Reference:
Stanly Co. GIS - 2005 Aerial

NC EEP: Contract No. 003277
& Project No. 94648

December 2014

0 125 250 500 Feet

1" = 500'



LEGEND

- Flow Tranducer
- Rain Gage
- Cross-section Pool
- Cross-section Riffle
- Vegetation Plots
- Groundwater Wells
- Crest Gage
- Proposed Alignment
- Riparian Plantings
- Upland Plantings
- Easement
- Wetland BMPs
- Wetland Creation
- Wetland Restoration
- Wetland Enhancement

N

Segment	Buffer Location	Avg. Buffer Width (LF)	Increase Stream Credit
1	Left Floodplain	128	10.0%
1	Right Floodplain	70	3.5%
2 & 3	Left Floodplain	114	10.0%
2 & 3	Right Floodplain	98	6.0%
4	Left Floodplain	107	10.0%
4	Right Floodplain	112	10.0%

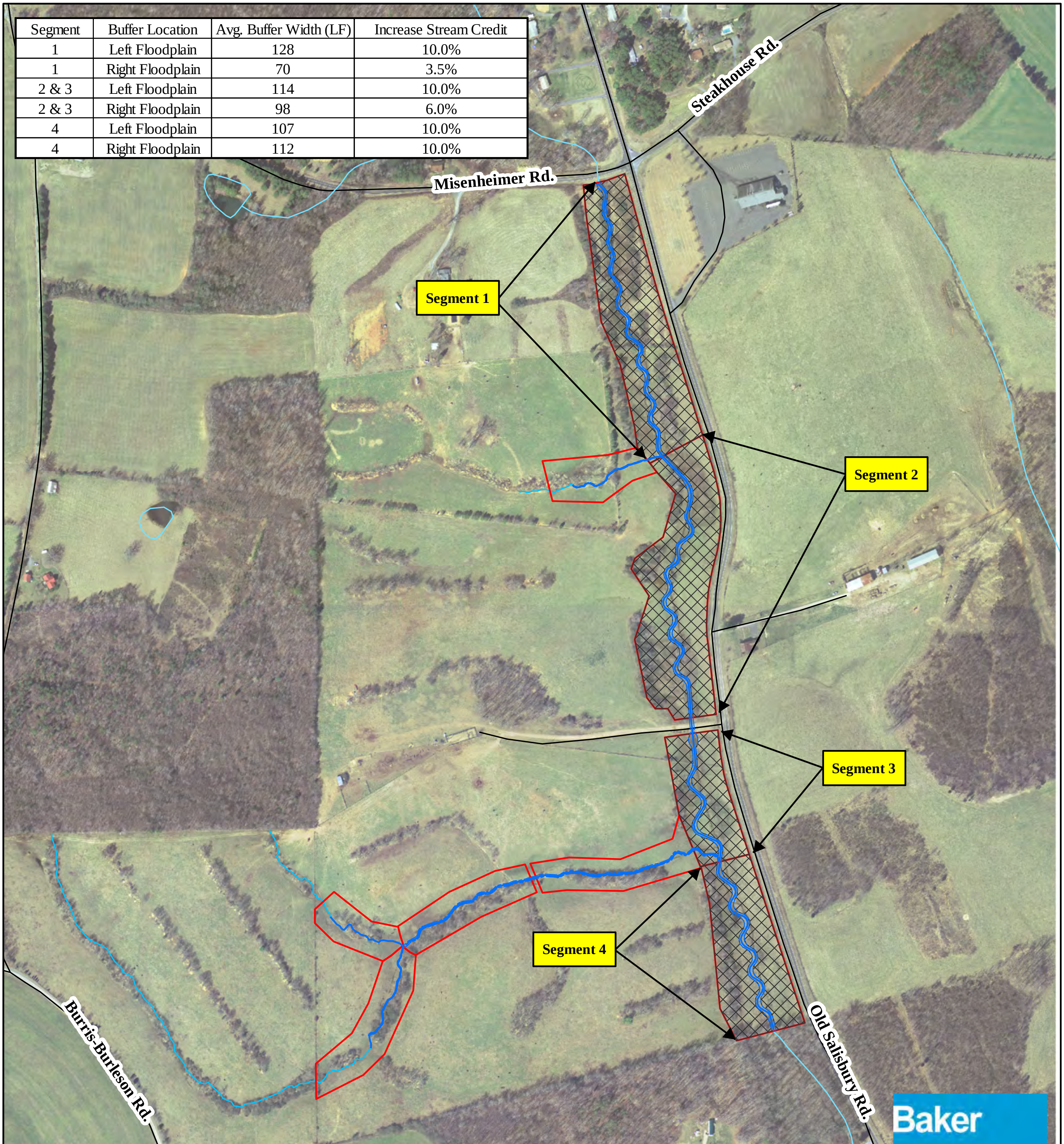


Figure 8. Proposed Stream Mitigation Credit Adjustments

UT to Town Creek Restoration Site - Option A

Stanly County, NC

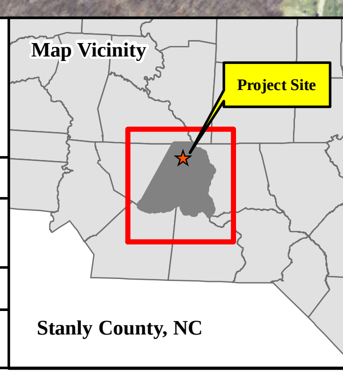
Reference: Stanly Co. GIS - 2005 Aerial

NC EEP:
Contract No. 003277 & Project No. 94648

December 2014

1" = 500'

0 125 250 500 Feet



LEGEND

- Proposed Center Line
- Proposed Top of Bank
- Buffer Width Areas
- Conservation Easement
- Streams
- Roads

N

Appendix A

Existing Conditions Photographs

Project Site Photographs - UT to Town Creek

Looking downstream near beginning of Reach 1

Looking downstream at raw outer meander bank of existing Reach 1

Looking downstream along left floodplain in upper half of Reach 1, area maintained by bushhogging

Looking upstream at fence line crossing in lower half of Reach 1

Looking at raw right bank along lower half of Reach 1

Looking downstream at the end of Reach 1

Project Site Photographs - UT to Town Creek

Looking downstream near top of Reach 2, channel is overwide

Looking towards Reach 2 mid-reach from Wetland #2 in the right floodplain

Looking towards Reach 2 from left floodplain. Debris on upstream side of culvert crossing has created backwater

Looking towards Reach 2 from Wetland #3 in right floodplain above farm crossing

Looking downstream from farm crossing at debris hung up on fence line crossing.

Looking downstream at fresh cattle carcass near end of Reach 2

Project Site Photographs - UT to Town Creek

Looking downstream at beginning of Reach 3

Looking at Wetland #6 in the right floodplain from Reach 3

Automated Well #6 in Wetland #7 along the toe of slope of the right floodplain

Reach 3 showing overly widened channel at downstream property line

Looking upstream at Reach 6 from the confluence with Reach 3, Reach 6 channel not as well defined in flat valley bottom

Looking downstream along Reach 6 mid-reach, channel is well defined is narrow, steeper section

Project Site Photographs - UT to Town Creek

Looking downstream near top of Reach 5 during relatively wet period when intermittent drainage flows

Looking upstream at bedrock knickpoint near the midpoint of Reach 5

Looking upstream from the bottom of Reach 5 during relatively dry period

Looking up valley immediately above Reach 4 at Automated Well #9 installed in vicinity of future BMP

Cattle grazing along left hill slope of Reach 4

Looking upstream along Reach 4 during relatively wet period when intermittent drainage flows

Project Site Photographs - UT to Town Creek

Looking upstream at the headcut where Reach 7 begins

Looking upstream just below headcut at the top of Reach 7

Looking downstream along Reach 7 mid-reach where cattle have trampled bed and bank

Looking upstream at fence line across Reach 7 that has accumulated debris and is holding minor amount of grade

Looking downstream towards Reach 7's confluence with Reach 2

Looking upstream at downstream section of Reach 7 from the top of Reach 2

Project Site Photographs - UT to Town Creek

Looking down the left floodplain at Wetland #1, October 2010

Wetland #1 during February 2011

Wetland #2

Wetland #2

Wetland #3

Wetland #3

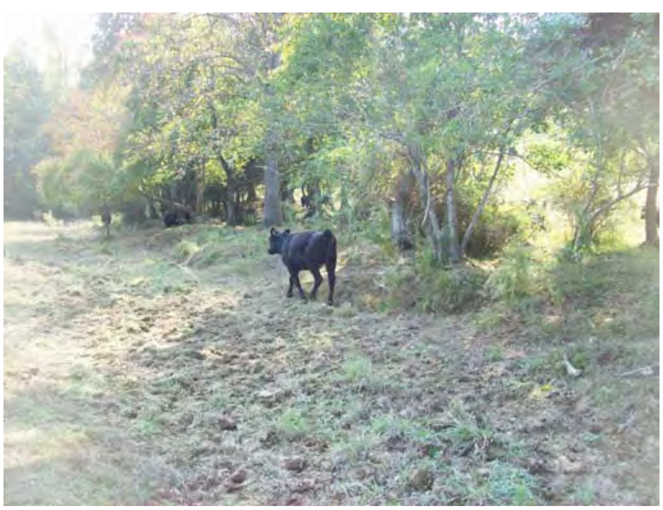
Project Site Photographs - UT to Town Creek

Small Wetland #4 immediately upstream of farm crossing in right floodplain

Wetland #5

Looking towards Wetland #6 from Reach 3 during February 2010

Looking across Wetland #6 towards Reach 3 during October 2011



Cattle grazing in Wetland #7

Looking from Reach 3 towards a portion of Wetland #7 along downstream property line

Project Site Photographs - UT to Town Creek

Automated Well #1

Automated Well #2

Automated Well #3

Automated Well #4

Automated Well #5

Automated Well #6

Project Site Photographs - UT to Town Creek

Automated Well #7

Automated Well #8

Automated Well #9

Automated Well #10

Appendix B

USACE Routine Wetland Determination Data

NCWAM Forms

NCDWQ Stream Classification Forms

Approved Jurisdictional Determination

Hydric Soil Investigation Report and Data

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Upland 1 City/County: Stanly County Sampling Date: 2010-10-08

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Upland 1

Investigator(s): Ian Eckardt & Kristi Suggs Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☐	No ☒

Is the Sampled Area within a Wetland? **Yes** ☐ **No** ☒

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been manipulated historically for pasture use and had recently been bush-hogged prior to the site visit.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ **No** ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrologic indicators were present.

VEGETATION – Use scientific names of plants. Sampling Point: Upland 1

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size: ______)			
1. Ligustrum sinense (Chinese Privet)		☐	FAC
2. Rubrus spp. (Blackberry)		☒	FACU
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: ______)			
1. Carex spp. (Sedge)		☒	FAC
2. Juncus spp. (Rush)		☒	FACW
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	= Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. Lonicera japonica (Japanese honeysuckle)		☒	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: (If observed, list morphological adaptations below).

Area historically used as pasture and shows signs of tilling and heavy equipment. The area had been recently bush-hogged by the property owner.

SOIL

Sampling Point: Upland 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 yr 5/4						Silty Loam	
3-8	10 yr 5/4		7.5 yr 5/6		C	M	Loam	
8-12	2.5 y 6/4		7.5 yr 5/6		C	M	Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☒ **No** ☐

Remarks:

Iron reductions were present in the upper 3 inches of the sample core. Chroma was a 4 throughout the sample core.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Upland 2 City/County: Stanly County Sampling Date: 2010-10-08

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Upland 2

Investigator(s): Ian Eckardt & Kristi Suggs Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): - Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☐	No ☒

Is the Sampled Area within a Wetland? **Yes** ☐ **No** ☒

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ **No** ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrologic indicators were present.

VEGETATION – Use scientific names of plants.

Sampling Point: Upland 2

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Sapling Stratum (Plot size: ____)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Shrub Stratum (Plot size: ____)			
1. Ligustrum sinense (Chinese Privet)		☒	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		
Herb Stratum (Plot size: ____)			
1. Polygonum spp. (Smart weed)		☒	FAC
2. Eupatorium capillifolium (Dog Fennel)		☐	FACU
3. Phytolacca americana (Pokeberry)		☐	FACU
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	= Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently used by cattle and is highly disturbed.

SOIL

Sampling Point: Upland 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	7.5 yr 4/4						Loam	
5-12	7.5 yr 5/6						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☒ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Iron masses are present in soil core; however, chroma throughout the core samples were greater than 4.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Upland 3 City/County: Stanly County Sampling Date: 2010-10-11

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Upland 3

Investigator(s): Kristi Suggs Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☐	No ☒	

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ **No** ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators present

VEGETATION – Use scientific names of plants.

Sampling Point: Upland 3

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Asimina triloba (Common Paw Paw)		☐	FAC
2. Platanus Occidentalis (Sycamore)		☐	FACW
3. Liriodendron tulipifera (Tulip Poplar)		☐	FACU
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Sapling Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Shrub Stratum (Plot size: ______)			
1. Ligustrum sinense (Chinese Privet)		☒	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Herb Stratum (Plot size: ______)			
1. Polygonum spp. (Smart weed)		☒	FAC
2. Eupatorium capillifolium (Dog Fennel)		☒	FACU
3. Cynodon dactylon (Bermuda Grass)		☐	FACU
4. Unknown pasture weed		☐	Unknow
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	______ = Total Cover		

Woody Vine Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	67%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

Area is highly disturbed by heavy cattle grazing. Only sparse grasses and scrub vegetation we present.

SOIL

Sampling Point: Upland 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	2.5 y 5/4		7.5 yr 4/6		C	M	Silty Loam	
5-10	2.5 y 6/1		7.5 yr 4/6		RM	M	Silty Loam	
10-12	10 yr 5/2		7.5 yr 4/6		RM	PL	Silty Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☒ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

Reduced soils present in a stratified layer and matrix. Soil consisted of a depleted matrix of 5 or more with a chroma of 2 or less from within 10 inches of the site.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 1 City/County: Stanly County Sampling Date: 2010-10-08

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 1

Investigator(s): Ian Eckardt & Kristi Suggs Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Slightly concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐
Hydric Soil Present? Yes ☒ No ☐
Wetland Hydrology Present? Yes ☒ No ☐

Is the Sampled Area within a Wetland? Yes ☒ **No** ☐

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been manipulated historically for pasture use and had recently been bush-hogged prior to the site visit.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☒ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☒ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☒ Sparsely Vegetated Concave Surface (B8)
- ☒ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☒ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): 0-2
Water Table Present? Yes ☒ No ☐ Depth (inches): 8-12
Saturation Present? Yes ☒ No ☐ Depth (inches): 0-12
(includes capillary fringe)

Wetland Hydrology Present? Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Standing water was present in some of the auger holes at 8 inches below the soil surface. Soils were saturated above the water table and in areas where evidence of the water table was not present. Surface water was present in a small portion of the wetland. The wetland is large and hydrology factors differentiated throughout the wetland site.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 1

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum (Red Maple)		☒	FAC
2. Diospyros Virginiana (Common Persimmon)		☐	FAC
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense (Chinese Privet)		☐	FAC
2. Rubrus spp. (Blackberry)		☒	FACU
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum sagittatum (Tear Thumb)		☒	OBL
2. Boehmeria cylindrica (False nettle)		☒	FACW
3. Juncus spp. (Rush)		☒	FACW
4. Carex spp. (Sedge)		☒	FAC
5. Arthraxon hispidus (Joint head Arthraxon)		☐	FACU
6. Lobelia cardinalis (Cardinal Flower)		☐	FACW
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	______ = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 83% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: (If observed, list morphological adaptations below).

Area historically used as pasture and shows signs of tilling and heavy equipment. The area had been recently bush-hogged by the property owner.

SOIL

Sampling Point: Wetland 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5 y 6/3		10 yr 5/6		C	PL	Silty Sand	
6-12	2.5 y 6/1		10 yr 5/8		RM	M	Silty Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☒ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Soil consisted of a depleted matrix of 5 or more with a chroma of 2 or less. Redox concentrations were evident along root linings and throughout the sample in the form of a depleted matrix. Iron and Manganese masses were common.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 2 City/County: Stanly County Sampling Date: 2010-10-08

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 2

Investigator(s): Ian Eckardt & Kristi Suggs Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain / Toe of Slope Local relief (concave, convex, none): Concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	Is the Sampled Area within a Wetland? Yes ☒ No ☐
Hydric Soil Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☒ Surface Water (A1)	☒ Water-Stained Leaves (B9)
☐ High Water Table (A2)	☐ Aquatic Fauna (B13)
☐ Saturation (A3)	☐ Marl Deposits (B15) **(LRR U)**
☐ Water Marks (B1)	☐ Hydrogen Sulfide Odor (C1)
☐ Sediment Deposits (B2)	☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Drift Deposits (B3)	☐ Presence of Reduced Iron (C4)
☐ Algal Mat or Crust (B4)	☐ Recent Iron Reduction in Tilled Soils (C6)
☒ Iron Deposits (B5)	☐ Thin Muck Surface (C7)
☐ Inundation Visible on Aerial Imagery (B7)	☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☒ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☒ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☒ No ☐	Depth (inches): 0-2
Water Table Present?	Yes ☐ No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☒ No ☐	Depth (inches): 0-4

Wetland Hydrology Present? Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Standing water was present on the wetland surface in multiple areas. Soil saturation was also present in areas. Wetland area was located at in the floodplain at the toe of slope. The area was additionally defined by topography and drainage patterns. The wetland is large and hydrology factors differentiated throughout the wetland site.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum (Red Maple)		☒	FAC
2. Salix Nigra (Black Willow)		☒	OBL
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense (Chinese Privet)		☐	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum spp. (Smart weed)		☒	FAC
2. Sagittaria spp. (Arrowhead duck potato)		☒	OBL
3. Phytolacca americana (Pokeberry)		☐	FACU
4. Sparganium americanum (Burr reed)		☐	OBL
5. Ludwigia Alternifolia (Bushy seedbox)		☐	OBL
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently used by cattle and is highly disturbed around the edges of the wetland and in the shaded areas.

SOIL

Sampling Point: Wetland 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10yr 4/2		7.5 yr 5/8		RM	M	Silty Loam	
4-12	2.5 y 5/2						Silty Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Soil consisted of a depleted matrix of 4 or more with a chroma of 2 throughout the site.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 3 City/County: Stanly County Sampling Date: 2010-10-11

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 3

Investigator(s): Kristi Suggs Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain / Toe of Slope Local relief (concave, convex, none): Concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☒	No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☒ Surface Water (A1)	☐ Water-Stained Leaves (B9)
☐ High Water Table (A2)	☐ Aquatic Fauna (B13)
☒ Saturation (A3)	☐ Marl Deposits (B15) **(LRR U)**
☐ Water Marks (B1)	☐ Hydrogen Sulfide Odor (C1)
☐ Sediment Deposits (B2)	☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Drift Deposits (B3)	☐ Presence of Reduced Iron (C4)
☒ Algal Mat or Crust (B4)	☐ Recent Iron Reduction in Tilled Soils (C6)
☒ Iron Deposits (B5)	☐ Thin Muck Surface (C7)
☐ Inundation Visible on Aerial Imagery (B7)	☒ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☒ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☒	No ☐	Depth (inches): 0-2
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): Varies

Wetland Hydrology Present? Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Standing water was present on the wetland surface in multiple areas. Soil saturation was also present in areas. Iron oxidizing bacteria was present in areas where there was standing surface water. Wetland area was located at in the floodplain at the toe of slope. The area was additionally defined by topography and drainage patterns. The wetland is large and hydrology factors differentiated throughout the wetland site.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 3

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum (Red Maple)		☒	FAC
2. Platanus Occidentalis (Sycamore)		☐	FACW
3. Liriodendron tulipifera (Tulip Poplar)		☐	FACU
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Sapling Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense (Chinese Privet)		☒	FAC
2. Ulmus americana (American Elm)		☒	FACW
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum spp. (Smart weed)		☒	FAC
2. Sagittaria spp. (Arrowhead duck potato)		☒	OBL
3. Phytolacca americana (Pokeberry)		☐	FACU
4. Sparganium americanum (Burr reed)		☐	OBL
5. Myriophyllum aquaticum (Parrot feather)		☐	OBL
6. Eleocharis spp. (Spikerush)		☒	FACW
7. Boehmeria cylindrica (False nettle)		☐	FACW
8. Carex spp. (Sedge)		☐	FAC
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently used by cattle and is highly disturbed around the edges of the wetland and in the shaded areas.

SOIL

Sampling Point: Wetland 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-4	2.5 y 5/2		7.5 yr 4/6		RM	M	Silty Loam	
4-12	2.5 y 6/1		7.5 yr 4/6		RM	M	Silty Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [x] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12) **(LRR T, U)**
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes [x] No [ ]

Remarks:

Soil consisted of a depleted matrix of 5 or more with a chroma of 2 or less throughout the site.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 4 City/County: Stanly County Sampling Date: 2010-10-13

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 4

Investigator(s): Kristi Suggs & Ian Eckardt Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain / Abutting Crk Local relief (concave, convex, none): Concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☒	No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☒ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☒ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☒ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches):

Wetland Hydrology Present? Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The wetland abuts the creek located at the toe of slope from a man-made drive across the creek. Hydrology is enhanced by clogged and undersized driveway culvert that is backing up water behind the culvert, topography, and disturbance from cattle accessing the creek. The area was additionally defined by topography and drainage patterns.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 4

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum spp. (Smart weed)		☒	FAC
2. Boehmeria cylindrica (False nettle)		☒	FACW
3. Eleocharis spp. (Spikerush)		☒	FACW
4. Carex spp. (Sedge)		☐	FAC
5. Eupatorium capillifolium (Dog Fennel)		☐	FACU
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently is highly disturbed throughout the wetland due to cattle accessing the creek. Dog fennel was only present along the outer edges of the wetland area.

SOIL

Sampling Point: Wetland 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 yr 4/3						Loam	
3-5	2.5 y 4/2		10 yr 4/6		RM	PL, M	Loam	
5-9	10 yr 4/3						Silty Loam	
9-12	2.5 y 4/2		10 yr 5/6		C	PL	Silty Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☒ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Reduced areas within the soil structure were somewhat stratified. When depleted matrices were present they consisted of a color of 4 with a chroma of 2 consistently throughout the site.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 5 City/County: Stanly County Sampling Date: 2010-10-13

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 5

Investigator(s): Kristi Suggs & Ian Eckardt Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain/Toe of slope Local relief (concave, convex, none): Concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☒	No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☒ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☒ Surface Soil Cracks (B6)
- ☒ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☒ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): ______

Water Table Present? Yes ☐ No ☒ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): ______

Wetland Hydrology Present? Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Area looks to be frequented by cattle for cooling in the shade and damp earth.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 5

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus americana (American Elm)		☒	FACW
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Sapling Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Shrub Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	______ = Total Cover		

Herb Stratum (Plot size: ______)			
1. Polygonum spp. (Smart weed)		☒	FAC
2. Juncus spp. (Rush)		☐	FACW
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	______ = Total Cover		

Woody Vine Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	______	x 1 =	______
FACW species	______	x 2 =	______
FAC species	______	x 3 =	______
FACU species	______	x 4 =	______
UPL species	______	x 5 =	______
Column Totals:	______ (A)		______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently is highly disturbed due to cattle access which has limited the amount of vegetation growth.

SOIL

Sampling Point: Wetland 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5 y 4/2		7 yr 4/6		C	M	Silty Loam	
6-12	2.5 y 3/1						Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☒ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☒ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☒ **No** ☐

Remarks:

Area is frequented by cattle. Reduced matrix was present throughout the soil core with chromas of 2 and less. Organic debris was present in the sample cores.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 6 City/County: Stanly County Sampling Date: 2010-10-13

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 6

Investigator(s): Kristi Suggs & Ian Eckardt Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain/Adjacent to Crk Local relief (concave, convex, none): Concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	Is the Sampled Area within a Wetland? Yes ☒ No ☐
Hydric Soil Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☒ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☒ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☒ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☒ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☒ No ☐	Depth (inches): 0-2	
Water Table Present?	Yes ☐ No ☒	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ☒ No ☐	Depth (inches): 2-4	**Wetland Hydrology Present? Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Highly disturbed area do to cattle access.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 6

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	____ = Total Cover		
Sapling Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	____ = Total Cover		
Shrub Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	____ = Total Cover		
Herb Stratum (Plot size: ______)			
1. Polygonum spp. (Smart weed)		☒	FAC
2. Eleocharis spp. (Spikerush)		☒	FACW
3. Cynodon dactylon (Bermuda Grass)		☐	FACU
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	____ = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	____	x 1 = ____
FACW species	____	x 2 = ____
FAC species	____	x 3 = ____
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently is highly disturbed due to cattle access which has limited the amount of vegetation growth.

SOIL

Sampling Point: Wetland 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5 y 5/2		2.5 y 5/6		RM	M	Clayey Sil	
4-12	2.5 y 6/2		10 yr 5/6		C	M	Silty Loam	Majority of the sample
4-12	2.5 y 5/1	10	10 yr 5/6		RM	M	Silty Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12) **(LRR T, U)**
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? **Yes** [x] **No** [ ]

Remarks:

Area is frequented by cattle. Reduced matrix was present throughout the soil core from a depth of 4 to 12 inches with chromas of 2 and less.

Print Form

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: UT to Town Creek / Wetland 7 City/County: Stanly County Sampling Date: 2010-10-13

Applicant/Owner: Michael Baker Engineering, Inc. State: NC Sampling Point: Wetland 7

Investigator(s): Kristi Suggs & Ian Eckardt Section, Township, Range: -

Landform (hillslope, terrace, etc.): Floodplain/Toe of Slope Local relief (concave, convex, none): Concave Slope (%): -

Subregion (LRR or MLRA): MLRA 136 of LRR P Lat: - Long: - Datum: -

Soil Map Unit Name: - NWI classification: -

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (If no, explain in Remarks.)

Are Vegetation ☒, Soil ☒, or Hydrology ☒ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation ☒, Soil ☒, or Hydrology ☒ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☒ **No** ☐
Hydric Soil Present?	Yes ☒ No ☐		
Wetland Hydrology Present?	Yes ☒ No ☐		

Remarks:

Due to lack of precipitation throughout a majority of the growing season, climatic and hydrologic conditions were noted to be below normal conditions for the area at the time of sampling. The site, vegetation, and topography have been significantly disturbed by cattle access.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☒ Surface Water (A1)	☐ Water-Stained Leaves (B9)	
☐ High Water Table (A2)	☐ Aquatic Fauna (B13)	
☒ Saturation (A3)	☐ Marl Deposits (B15) **(LRR U)**	
☐ Water Marks (B1)	☐ Hydrogen Sulfide Odor (C1)	
☐ Sediment Deposits (B2)	☐ Oxidized Rhizospheres on Living Roots (C3)	
☐ Drift Deposits (B3)	☐ Presence of Reduced Iron (C4)	
☒ Algal Mat or Crust (B4)	☐ Recent Iron Reduction in Tilled Soils (C6)	
☐ Iron Deposits (B5)	☐ Thin Muck Surface (C7)	
☐ Inundation Visible on Aerial Imagery (B7)	☐ Other (Explain in Remarks)	

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☒ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☒ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☒	No ☐	Depth (inches): 0-2
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 2-4

Wetland Hydrology Present? Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Hydrology varies throughout the wetland area. Wetland is located at the back of the floodplain at the toe of slope. Area is highly disturbed from cattle accessing the area.

VEGETATION – Use scientific names of plants.

Sampling Point: Wetland 7

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus americana (American Elm)		☐	FACW
2. Liquidambar syraciflua (Sweet Gum)		☐	FAC
3. Acer rubrum (Red Maple)		☒	FAC
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense		☒	FAC
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum spp. (Smart weed)		☒	FAC
2. Eleocharis spp. (Spikerush)		☒	FACW
3. Juncus spp. (Rush)		☒	FACW
4. Carex spp. (Sedge)		☒	FAC
5. Lycopus virginicus L. (Water Horehound)		☐	OBL
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
11.		☐	
12.		☐	
	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: (If observed, list morphological adaptations below).

Area is currently is highly disturbed due to cattle access.

SOIL

Sampling Point: Wetland 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	5 y 5/1	50 +	10 yr 4/6		RM	M	Silty Loam	
4-8	5 y 5/2		10 yr 5/8		C	M	Silty Loam	
8-12	2.5 y 5/2		10 yr 4/6		RM	PL, M	Loamy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12) **(LRR T, U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☒ **No** ☐

Remarks:

Area is frequented by cattle. Reduced matrix was present throughout the soil core with a chroma of 2 or less. Gleyed matrix was present within sample in the upper 4 inches of the soil core.

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 1	**Date**	10/8/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.
- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)
☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No
Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. **Ground Surface Condition/Vegetation Condition – assessment area condition metric**

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. **Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric**

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☒A	☒A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☐C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)**

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☒C	☒C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☐D	☐D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☒A Sandy soil
☐B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☒A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☐C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☐A ≥ 50 feet
☐B From 30 to < 50 feet
☒C From 15 to < 30 feet
☐D From 5 to < 15 feet
☐E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☒Yes ☐No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☒C	☒C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☒B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select “K” for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☒I	☒I	☒I	From 0.1 to < 0.5 acre
☐J	☐J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☒F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions <u>or</u> assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☒B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☐C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☒A	☒A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☐C	☐C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☒B	☒B	Moderate density mid-story/sapling layer
	☐C	☐C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☒A	☒A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☒A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☐B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☒B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☐C Majority of canopy trees are < 6 inches DBH or no trees.

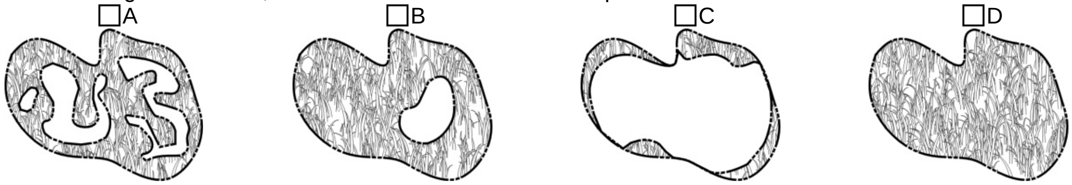
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.
☒A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes
Portions of the wetland have been recently bush-hogged prior to site visit. The ground surface shows signs of heavy equipment tracks and tilling.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 1	Date	10/8/10
Wetland Type	Headwater Forest	Assessor Name/Organization	rdt/Michael Baker Enginee

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**MEDIUM**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**HIGH**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**HIGH**
Water Quality	Condition	**HIGH**
	Condition/Opportunity	**HIGH**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **HIGH**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 2	**Date**	10/8/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)

☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☒A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☐A Sandy soil
☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☒C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), <u>and</u> within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☒A ≥ 50 feet
☐B From 30 to < 50 feet
☐C From 15 to < 30 feet
☐D From 5 to < 15 feet
☐E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☒C	☒C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☐B Evidence of saturation, without evidence of inundation
☒C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☒I	☒I	☒I	From 0.1 to < 0.5 acre
☐J	☐J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☒F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions <u>or</u> assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☐B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☒C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

Stratum	AA	WT	
Canopy	☒A	☒A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☐C	☐C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☐A	☐A	Dense herb layer
	☒B	☒B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☒A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☐B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☒B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☐C Majority of canopy trees are < 6 inches DBH or no trees.

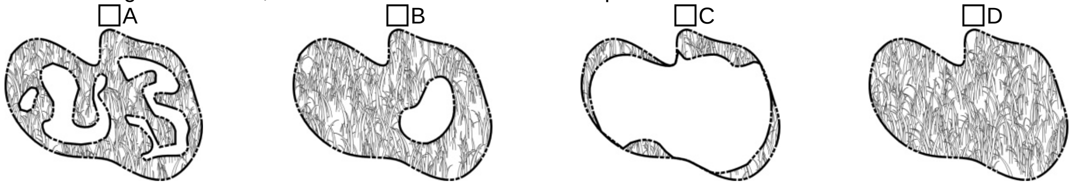
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.
☒A Overbank and overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes
Wetland is located within active pasture. Cows have highly disturbed the surface. Cow manure present in wetland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 2	Date	10/8/10
Wetland Type	Headwater Forest	Assessor Name/Organization	·dt/Michael Baker Engi

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**LOW**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**HIGH**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**HIGH**
	Condition/Opportunity	**HIGH**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **MEDIUM**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 3	**Date**	10/11/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)
☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No
Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☒A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. **Soil Texture/Structure – assessment area condition metric**

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☐A Sandy soil
☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. **Discharge into Wetland – opportunity metric**

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☒C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. **Land Use – opportunity metric**

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), <u>and</u> within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. **Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric**

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☒A ≥ 50 feet
☐B From 30 to < 50 feet
☐C From 15 to < 30 feet
☐D From 5 to < 15 feet
☐E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. **Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)**

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☒E	☒E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☐B Evidence of saturation, without evidence of inundation
☒C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select “K” for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☒I	☒I	☐I	From 0.1 to < 0.5 acre
☐J	☐J	☒J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☒F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions <u>or</u> assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☐B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☒C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☐A	☐A	Dense herb layer
	☒B	☒B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☒A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☐B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☒B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☐C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric

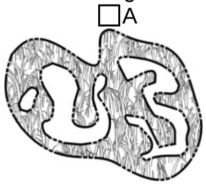
Include both natural debris and man-placed natural debris.

☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

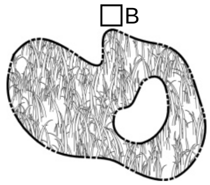
21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

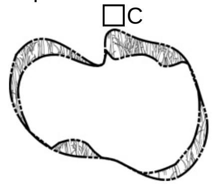
☐A



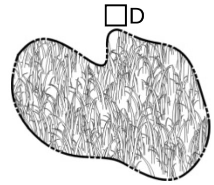
☐B



☐C



☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.

☒A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes
Wetland is located within active pasture. Cows have highly disturbed the surface. Cow manure present in wetland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 3	Date	10/10/10
Wetland Type	Headwater Forest	Assessor Name/Organization	rdt/Michael Baker Engine

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**LOW**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **LOW**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 4	**Date**	10/13/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.
- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)
☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No
Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☐A	Water storage capacity and duration are not altered.
☐B	☒B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. **Soil Texture/Structure – assessment area condition metric**

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☐A Sandy soil
☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. **Discharge into Wetland – opportunity metric**

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☒C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. **Land Use – opportunity metric**

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. **Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric**

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☐A ≥ 50 feet
☒B From 30 to < 50 feet
☐C From 15 to < 30 feet
☐D From 5 to < 15 feet
☐E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. **Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)**

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☒D	☒D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☒B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☐I	☐I	☐I	From 0.1 to < 0.5 acre
☒J	☒J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☒F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions <u>or</u> assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☐B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☒C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☐A	☐A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☒C	☒C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☒B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☐B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☒C Majority of canopy trees are < 6 inches DBH or no trees.

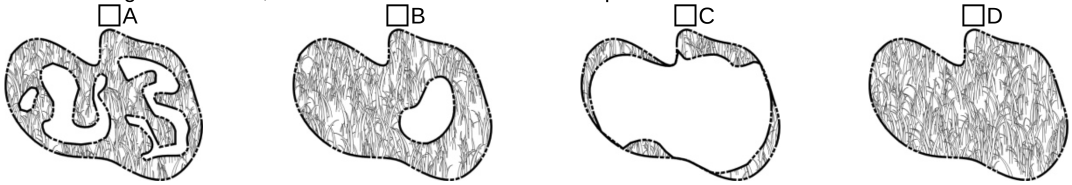
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.
☒A Overbank and overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes
The wetland abuts the creek located at the toe of slope from a man-made drive across the creek. Hydrology is enhanced by clogged and undersized driveway culvert that is backing up water behind the culvert, topography, and disturbance from cattle accessing the creek. Cows have highly disturbed the surface. Cow manure present in wetland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name: UT to Town Creek, Wetland 4 | Date: 10/13/10

Wetland Type: Headwater Forest | Assessor Name/Organization: rdt/Michael Baker Enginee

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**MEDIUM**
	Condition/Opportunity	**MEDIUM**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **MEDIUM**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 5	**Date**	10/13/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)
☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No
Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☒A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☐A Sandy soil
☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☒C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), <u>and</u> within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☐A ≥ 50 feet
☐B From 30 to < 50 feet
☐C From 15 to < 30 feet
☒D From 5 to < 15 feet
☐E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☒F	☒F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☒B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☐I	☐I	☐I	From 0.1 to < 0.5 acre
☒J	☒J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☒F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions <u>or</u> assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☐B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☒C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☐A	☐A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☒C	☒C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☒B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☐B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☒C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric

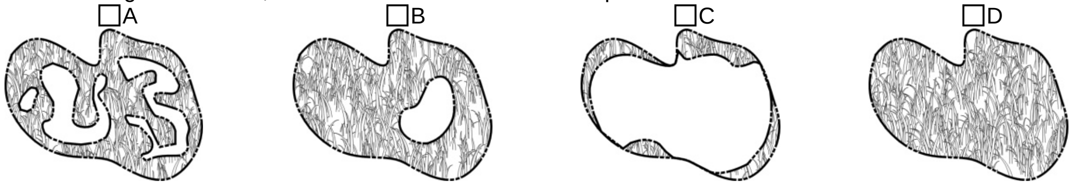
Include both natural debris and man-placed natural debris.

☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.

☒A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes

Area looks to be frequented by cattle for cooling in the shade and damp earth. Cows have highly disturbed the surface. Cow manure present in wetland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 5	Date	10/2/10
Wetland Type	Headwater Forest	Assessor Name/Organization	rdt/Michael Baker Engir

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **LOW**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 6	**Date**	10/13/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)
☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No
Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☒A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☐A Sandy soil
☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☒C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☐A ≥ 50 feet
☒B From 30 to < 50 feet
☐C From 15 to < 30 feet
☐D From 5 to < 15 feet
☐E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☒E	☒E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☒A Evidence of short-duration inundation (< 7 consecutive days)
☐B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☐I	☐I	☐I	From 0.1 to < 0.5 acre
☒J	☒J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☒F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☐B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☒C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

Stratum	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☐A	☐A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☒C	☒C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☒B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☐B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☒C Majority of canopy trees are < 6 inches DBH or no trees.

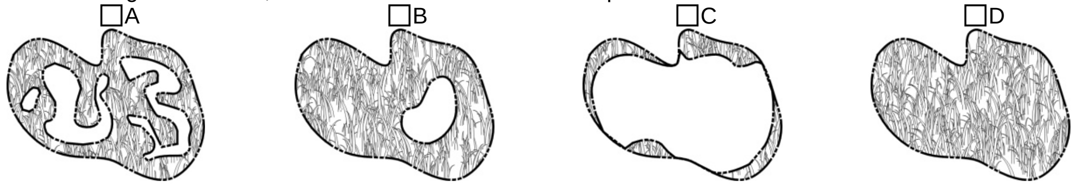
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.
☒A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes
Area looks to be frequented by cattle for cooling in the shade and damp earth. Cows have highly disturbed the surface. Cow manure present in wetland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 6	Date	10/13/10
Wetland Type	Headwater Forest	Assessor Name/Organization	rdt/Michael Baker Engir

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**MEDIUM**
	Condition/Opportunity	**MEDIUM**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **MEDIUM**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 7	**Date**	10/13/10
Wetland Type	Headwater Forest	**Assessor Name/Organization**	Ian Eckardt / Michael Baker Engineering, Inc.
Level III Ecoregion	Piedmont	**Nearest Named Water Body**	Town Creek
River Basin	Yadkin-Pee Dee	**USGS 8-Digit Catalogue Unit**	03040105
☐ **Yes** ☒ **No**	**Precipitation within 48 hrs?**	**Latitude/Longitude (deci-degrees)**	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations (select all that apply to the assessment area.)
☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWQ riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
☐ Blackwater
☒ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☐A	☐A	Not severely altered
☒B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☐A	Water storage capacity and duration are not altered.
☐B	☒B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. **Soil Texture/Structure – assessment area condition metric**

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ☐A Sandy soil
☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
☐C Loamy or clayey soils not exhibiting redoximorphic features
☐D Loamy or clayey gleyed soil
☐E Histosol or histic epipedon

4b. ☒A Soil ribbon < 1 inch
☐B Soil ribbon ≥ 1 inch

4c. ☒A No peat or muck presence
☐B A peat or muck presence

5. **Discharge into Wetland – opportunity metric**

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☐A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☒C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. **Land Use – opportunity metric**

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), <u>and</u> within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☒B	☒B	☒B	< 10% impervious surfaces
☒C	☒C	☒C	Confined animal operations (or other local, concentrated source of pollutants
☒D	☒D	☒D	≥ 20% coverage of pasture
☒E	☒E	☒E	≥ 20% coverage of agricultural land (regularly plowed land)
☐F	☐F	☐F	≥ 20% coverage of maintained grass/herb
☐G	☐G	☐G	≥ 20% coverage of clear-cut land
☐H	☐H	☐H	Little or no opportunity to improve water quality. Lack of opportunity may result from hydrologic alterations that prevent drainage or overbank flow from affecting the assessment area.

7. **Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric**

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? Descriptor E should be selected if ditches effectively bypass the buffer.
☒A ≥ 50 feet
☐B From 30 to < 50 feet
☐C From 15 to < 30 feet
☐D From 5 to < 15 feet
☐E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. **Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate for riparian wetlands only)**

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☒F	☒F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☒B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☒I	☒I	☐I	From 0.1 to < 0.5 acre
☐J	☐J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☐K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☐A	≥ 500 acres
☒B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☐F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass.

☐A No artificial edge within 150 feet in all directions
☐B No artificial edge within 150 feet in four (4) to seven (7) directions
☒C An artificial edge occurs within 150 feet in more than four (4) directions <u>or</u> assessment area is clear-cut

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☐B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☒C Vegetation severely altered from reference in composition. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☐A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☐A	☐A	Dense herb layer
	☒B	☒B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☐B Not A

19. Diameter Class Distribution – wetland type condition metric

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☐B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☒C Majority of canopy trees are < 6 inches DBH or no trees.

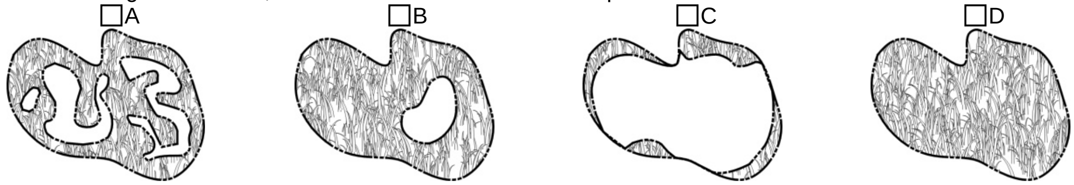
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision.
☒A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes
Area looks to be frequented by cattle for cooling in the shade and damp earth. Cows have highly disturbed the surface. Cow manure present in wetland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	UT to Town Creek, Wetland 7	Date	10/13/10
Wetland Type	Headwater Forest	Assessor Name/Organization	rdt/Michael Baker Engine

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**HIGH**
	Condition/Opportunity	**HIGH**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Conditon	**LOW**

Overall Wetland Rating **MEDIUM**

MARCUS

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

RCH 6a

NC DWQ Stream Identification Form Version 4.0

Date: 1-3-11	**Project/Site:** UT TO TOWN ~~RCH4A~~	**Latitude:**
Evaluator: IE + KS	**County:** Stanly	**Longitude:**
Total Points: 27.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Intermittent Perennial:	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 14.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

+2

-1.5

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes:

Sketch:

+0.5 - ground H2O

MARCUS

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

RCH 6b

NC DWQ Stream Identification Form Version 4.0

Date: 1-3-11	**Project/Site:** UT TOTOLAN ~~RCH 4B~~	**Latitude:**
Evaluator: IE+KS	**County:** Stanly	**Longitude:**
Total Points: 19.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Intermittent Perennial:	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 14)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 2.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 3)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes:

Sketch:

MARCUS

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

NC DWQ Stream Identification Form Version 4.0

Date: 1-3-11	Project/Site: UT To TOWN RCH 5A	Latitude:
Evaluator: IE & KS.	County: Stanly	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 19.5	**Stream Determination (circle one)** Intermittent Perennial:	Other *e.g. Quad Name:*

Never Ø
Braided Ø

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence 70/30	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

Fe Ø
+ Floodplain +3

B. Hydrology (Subtotal = 2)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris Cattle access call difficult	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 4)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes:

Sketch:

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

NC DWQ Stream Identification Form Version 4.0

Date: 1-3-11	**Project/Site:** UT to TOWN (RCH 5B)	**Latitude:**
Evaluator: KS + IE	**County:** STANLY	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 16	**Stream Determination (circle one)** **Intermittent** **Perennial:**	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 1.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 4)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes:

Sketch:

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

NC DWQ Stream Identification Form Version 4.0

RCH 4a

Date: 1-3-11	Project/Site: UT to Town RCH ~~6A~~	Latitude:
Evaluator: IE & KS	County: Stanly	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 19.5	Stream Determination (circle one) Intermittent Perennial:	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 2.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed Privet	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes: Midge larvae and frog eggs. Channel loses definition in areas of very flat topography and where drainage is braided.

Sketch:

2011 Marcus

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

NC DWQ Stream Identification Form Version 4.0

RCH 4b

Date: 1-3-11	**Project/Site:** UT TO TOWN RCH ~~6B~~	**Latitude:**
Evaluator: IE + KS	**County:** Stanly	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 14	**Stream Determination (circle one)** **Intermittent** **Perennial:**	**Other** *e.g. Quad Name:*

sheet DIFF braided +1

A. Geomorphology (Subtotal = 8.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 1)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 4.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed PRIVET	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes:

Sketch:

UT TO TOWN

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.0

NC DWQ Stream Identification Form Version 4.0

MARCUS HARWARD

Date: 1-3-11	**Project/Site:** UT TO TOWN CRK RCH 7	**Latitude:**
Evaluator: KS + IE	**County:** Stanly	**Longitude:**
Total Points: 19 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Intermittent Perennial:	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 9.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence HEAVY CATTLE	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table? VERY ROCKY	No = 0		Yes = 3	

C. Biology (Subtotal = 4)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed hydrophylla + sedge	FAC = 0.5; FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 34 of manual.

Notes:

Sketch: (1) AWZ

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action I.D.: **SAW-2013-01280** County: **Stanly** U.S.G.S. Quad: **New London**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner/Agent: **Michael Baker Engineering, Inc / Attn: Kristi Leadmon Suggs**
Address: **5550 Seventy-Seven Center Dr., Ste. 320 Charlotte, NC 28217**
Telephone No.: **704-665-2206**

Property description:
Size (acres):
Nearest Waterway: UT to Town Creek
Coordinates: 35.4328 / -80.2470

Nearest Town: New London
River Basin: Rocky Watershed; Upper Pee Dee Basin
Hydrologic Unit Code: 03040105

Location Description: The site is located west of Old Salisbury Road, southeast of its intersection with Misenheimer and Steakhouse Roads in Richfield, Stanly County, North Carolina.

Indicate Which of the Following Apply:

A. Preliminary Determination

_ Based on preliminary information, there may be waters and wetlands on the above described property. We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).). If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also, you may provide new information for further consideration by the Corps to reevaluate the JD.

B. Approved Determination

_ There are Navigable Waters of the United States within the above described property subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

X There are waters and wetlands on the above described property subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ We strongly suggest you have the waters and wetlands on your property delineated. Due to the size of your property and/or our present workload, the Corps may not be able to accomplish this wetland delineation in a timely manner. For a more timely delineation, you may wish to obtain a consultant. To be considered final, any delineation must be verified by the Corps.

X_ The waters and wetlands on your property have been delineated and the delineation has been verified by the Corps. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

_ The waters and wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on _____. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are no waters of the U.S., to include wetlands, present on the above described property which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

Action Id.: **SAW-2013-01280**

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Steve Kichefski** at **828-271-7980**.

C. Basis For Determination

The site contains wetlands as determined by the *1987 Corps of Engineers Wetland Delineation Manual* and the *Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Eastern Mountain and Piedmont Region.* These wetlands are adjacent to stream channels located on the property that exhibit indicators of ordinary high water marks. The stream channel on the property is an unnamed tributary to Town Creek which flows into the Rocky Watershed; Upper Pee Dee Basin River. UT to Town Creek flows to the Atlantic Ocean via Town Creek, Little Long Creek, Long Creek, Rocky River and the Pee Dee River. The Pee Dee River is a Section 10 navigable water at the Blewett Falls Dam.

D. Remarks: Site visit conducted on August 4, 2011 to verify JD features and updated map received August 10, 2011.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

Attached to this verification is an approved jurisdictional determination. If you are not in agreement with that approved jurisdictional determination, you can make an administrative appeal under 33 CFR 331. Enclosed you will find a request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address within 60 days of the date of the NAP.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: Steve Kichefski SLK

Issue Date: **July 17, 2013** Expiration Date: **July 17, 2018**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at our website at http://per2.nwp.usace.army.mil/survey.html to complete the survey online.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Michael Baker Engineering, Inc / Attn: Kristi Leadmon Suggs		File Number: SAW-2013-01280	Date: July 17, 2013
Attached is:			See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
	PROFFERED PERMIT (Standard Permit or Letter of permission)		B
	PERMIT DENIAL		C
X	APPROVED JURISDICTIONAL DETERMINATION		D
	PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/CECW/Pages/reg_materials.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.

- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
Steve Kichefski, Project Manager USACE, Asheville Regulatory Field Office 151 Patton Ave RM 208 Asheville, NC 28806 828-271-7980	Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn: Steve Kichefski, 69 Darlington Avenue, Wilmington, North Carolina 28403

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

Hydric Soil Investigation

UT Town Creek Mitigation Site

Stanly County, North Carolina

Prepared for:

Michael Baker Engineering
1447 South Tryon Street, Suite 200
Charlotte, NC 28203
27755 Diehl Road

Prepared by:

Thompson Environmental Consulting
WATER • WASTEWATER • WETLANDS

The Catena Group

Larry Thompson, LSS

Michael G. Wood, LSS

January 7, 2011

INTRODUCTION

Baker Engineering, Inc. is proposing the development of the UT to Town Creek Mitigation Site in Stanly County, NC. The site is located at Old Salisbury Road and Misenheimer Road and owned by the Harward family. As part of the site development process, Thompson Environmental Consulting (TEC) has been retained to perform a detailed soil evaluation that describes and classifies the soil throughout the study area and to make a determination as to its hydric status and the feasibility to provide wetland restoration potential.

METHODOLOGY

Prior to performing the evaluation, existing documentation was reviewed, including a Preliminary Hydric Soil report performed by TEC, NRCS soils maps, USGS topographic maps, etc.

The field investigation was performed on November 5 and 8, 2010. Eighty hand-turned soil auger borings were advanced on an approximately 100 x 50 foot grid. Fifteen backhoe pits were also described and their locations generally based upon the results of the auger borings. All soil descriptions are described using the USDA-NRCS standard nomenclature and included in Appendix A. Soil boring locations were navigated to, and then located with, a GPS Unit with sub-meter accuracy. Hydric soils status are generally based upon the NRCS Field Indicators of Hydric Soils (2010) and the Interim Eastern Mountains and Piedmont Regional Supplement for Wetland Delineation. Pictures of each pit are included in Appendix B.

RESULTS - SOIL UNITS

Each soil boring and pit was placed into one of four units: 1A, 1B, 2, and non-hydric. Hydric soil determinations were based upon Field Indicators of Hydric Soils in the Unities States - A Guide for Identifying and Delineating Hydric Soils (Version 7.0, 2010). The decision to use a particular indicator, in particular F19 which is noted as for testing in Land Resource Region (LRR) P in which the study site is located, was based upon the experience and knowledge of the investigators. In their estimation, this soil unit is on an active flood plain where sediments are derived from the Piedmont and deposited on the flood plain. The particular boring and pit locations are shown as points in Figures 1 and 2. If a buried hydric soil horizon was noted in the profile, an additional purple marker was placed as a background behind the point. (Note: Soil Unit determinations were based upon the existing soil surface horizon(s), not buried horizons.)

Soil Unit 1A. Soil Unit 1A is classified as hydric soil by meeting one or more of the indicators noted in Field Indicators of Hydric Soils in the Unities States - A Guide for Identifying and Delineating Hydric Soils (Version 7.0, 2010). The soils typically met the following indicator:

A11. Depleted Below Dark Surface: A layer with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less, starting within 30 cm (12 inches) of the soil surface, and having a minimum thickness of either:

a. 15 cm (6 inches), or

b. 5 cm (2 inches) if the 5 cm consists of fragmental soil material.

Loamy or clayey layer(s) above the depleted or gleyed matrix must have value of 3 or less and chroma of 2 or less. Any sandy material above the depleted or gleyed matrix must have value of 3 or less and chroma of 1 or less, and, viewed through a 10x or 15x hand lens, at least 70 percent of the visible soil particles must be masked with organic material. Observed without a hand lens, the particles appear to be close to 100 percent masked.

Soil Unit 1B. Soil Unit 1B is classified as hydric soil by meeting one or more of the indicators noted in Field Indicators of Hydric Soils in the Unities States - A Guide for Identifying and Delineating Hydric Soils (Version 7.0, 2010). The soils typically met the following indicator:

F19. Piedmont Flood Plain Soils: On active flood plains, a mineral layer at least 15 cm (6 inches) thick, starting within 25 cm (10 inches) of the soil surface, with a matrix (60 percent or more of the volume) chroma of less than 4 and 20 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.

Soil Unit 2. Soil Unit 2 is classified as not meeting any hydric soil indicators, but has morphological indicators that would classify it as having a poorly drained or somewhat poorly drained drainage classification. There are also indicators that the area has had substantial anthropogenic impacts during the recent past.

Non-Hydric Soil. This soil was determined to meet no hydric indicators.

RESULTS - MITIGATION TYPE (SOIL AREAS)

It is anticipated that the restoration effort of Priority 1 stream restoration will create a new channel with a higher elevation than the current condition, thus raising the ambient groundwater table. Based upon the proposed increase in the stream channel provided by the designer, each boring and pit was evaluated for its potential to provide wetland restoration. This information was synthesized to create Soil Areas that represent different types of wetland mitigation that are detailed below.

Jurisdictional Wetlands (Wetland Enhancement). The existing wetlands have been field delineated as indicated on Figures 1 & 2. It is anticipated that the functions and values of these wetlands will be enhanced by increasing the hydrologic regime and wetland vegetative plantings. These are described in detail in the Mitigation Plan and total 1.0 acre.

Soil Area 1A (Wetland Creation). The majority of Soil Area 1A is comprised of Soil Unit 1A and totals 1.6 acres. Soil Area 1A has hydric soil, but lacks vegetation and therefore, assumed hydrology. This Area appears to generally be "wetter" than other Soil Areas, excluding the jurisdictional wetlands, a determination which is further supported by the stream design not needing to raise the stream channel as much in this Area. In combination with the Priority 1 stream restoration, it is recommended that 0-4 inches of soil be removed, pending final design. These efforts are expected to create wetland hydrology which will support wetland vegetation and the further development of hydric soils.

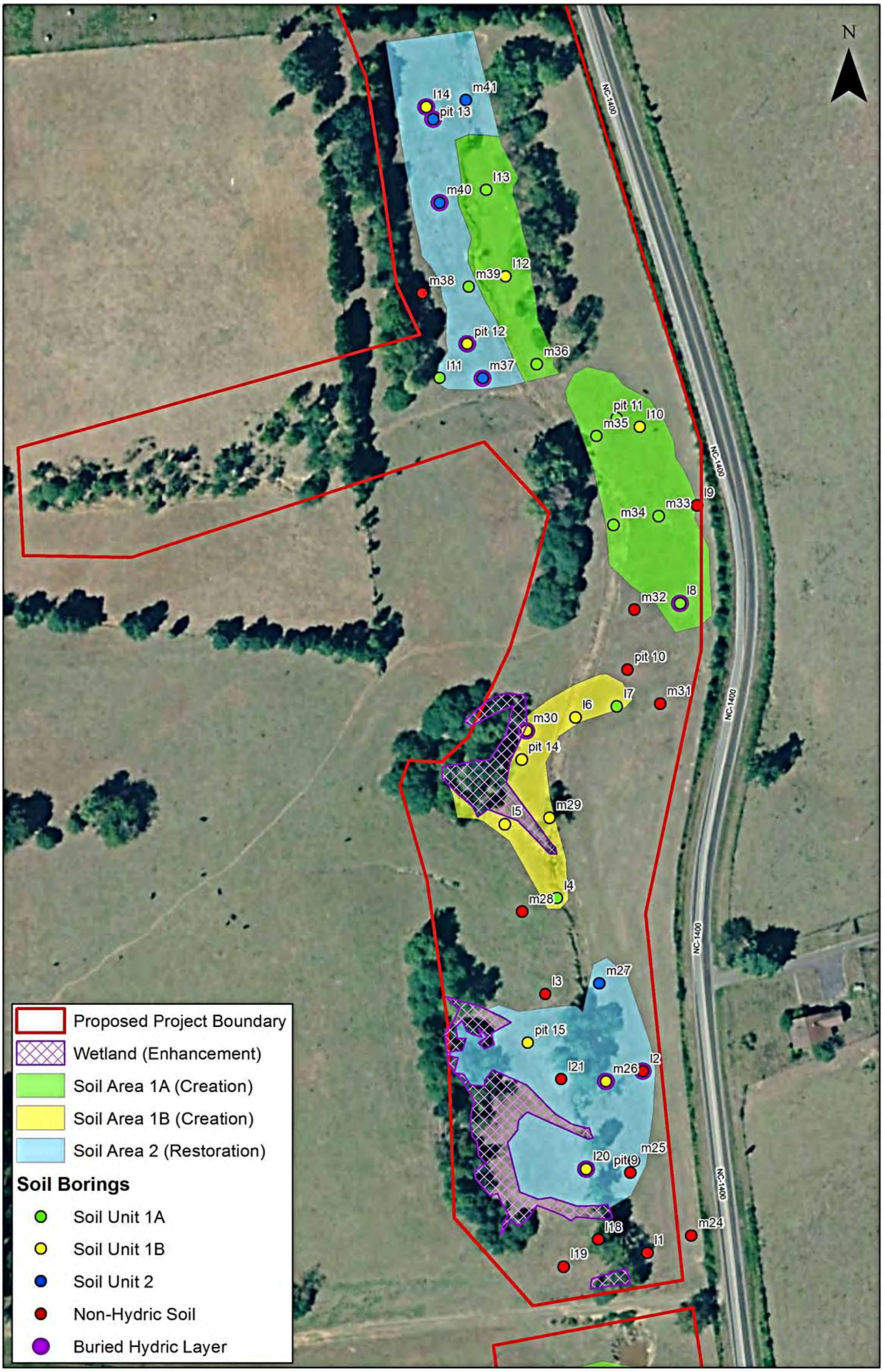
Though no buried hydric soils were generally noted in this Area, that does not preclude the possibility that these areas did at one point support jurisdictional wetlands. Nonetheless, in the absence of buried hydric horizons, this Area is classified as wetland creation. It is expected to achieve wetland hydrology for at least 12.5% of the growing season.

Soil Area 1B (Wetland Creation). The majority of Soil Area 1B is comprised of Soil Unit 1B and totals 1.1 acres. Soil Area 1B has hydric soil, but lacks vegetation and therefore, assumed hydrology. This Area appears to generally be "drier" than Soil Area 1A and the jurisdictional wetlands. Further evidence of this hydrologic regime is that the proposed stream design is raising the stream channel more in this Area. In combination with the Priority 1 stream restoration, it is recommended that 0-6 inches of soil be removed, pending final design. These efforts are expected to create wetland hydrology which will support wetland vegetation and the further development of hydric soils.

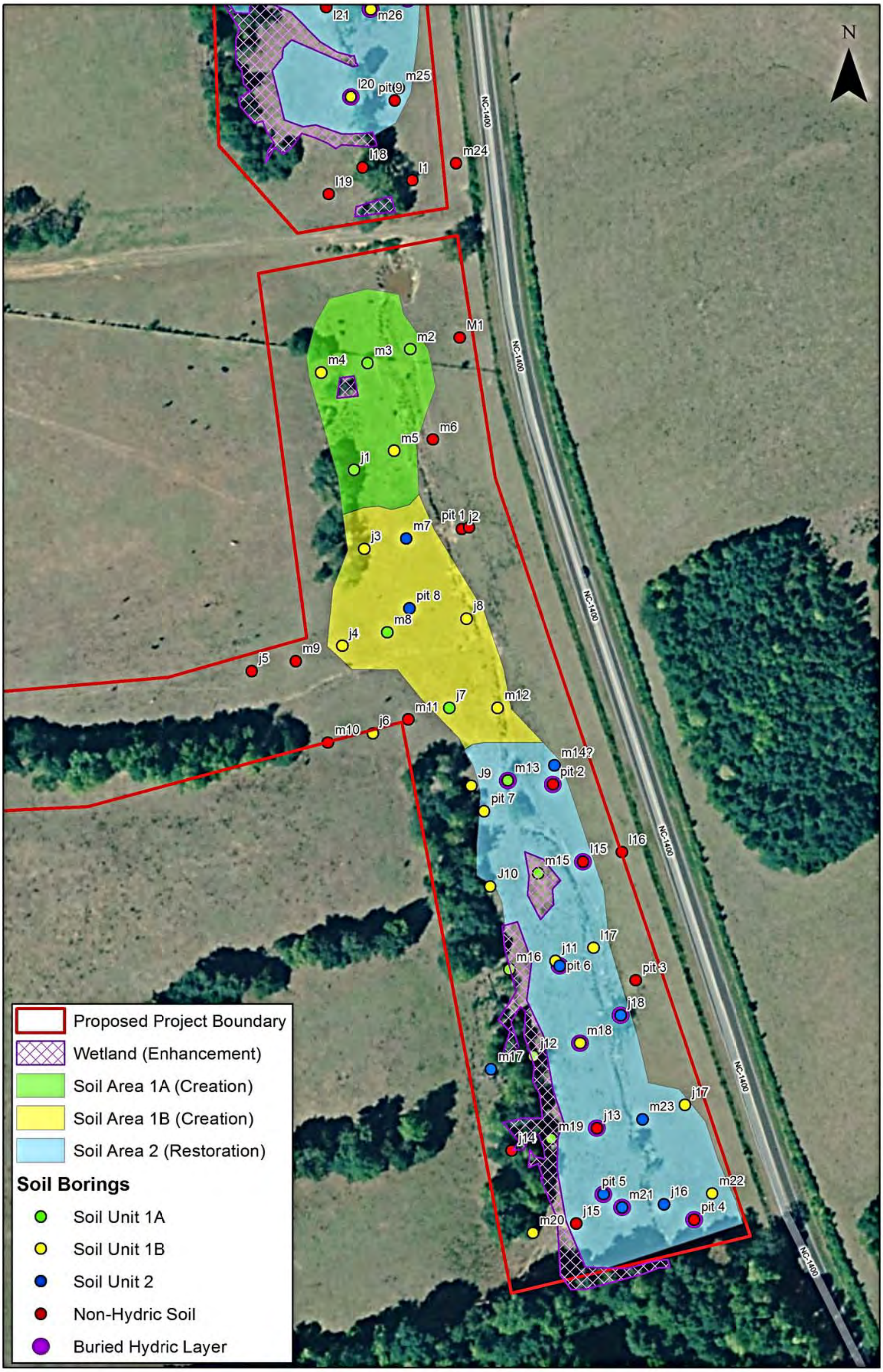
Though no buried hydric soils were generally noted in this Area, that does not preclude the possibility that these areas did at one point support jurisdictional wetlands. Nonetheless, in the absence of buried hydric horizons, this Area is classified as wetland creation. It is expected to achieve wetland hydrology for at least 5.0% of the growing season.

Soil Area 2 (Wetland Restoration). The majority of Soil Area 2 has buried hydric soil horizons, as such this area will be restored to once again support wetland conditions and totals 3.2 acres. The Priority 1 stream design generally raises the stream channel more in this area than in Soil Unit 1A and the jurisdictional wetlands. Removal of some surface soil is recommended. For the Soil Unit 2 located in the middle and southern portion of the site, it is recommended to use the adjacent wetlands as a target elevation for soil removal. For the northern Soil Unit 2, It is recommended that 0-12 inches be removed, pending final design. It is expected to achieve wetland hydrology for at least 5.0% of the growing season.

NOTE - SOIL REMOVAL. In the opinion of the investigators, there has been substantial deposition of soil throughout the study site as a result of recent anthropogenic factors. It is believed this deposition has happened incrementally since the surrounding area was cleared of its native vegetation. As such, in all areas where soil removal is recommended, it will be exposing soil that has been recently deposited. Such soil typically has nutrients and organic matter also deposited with it and already has some soil development. Hence, this soil is expected to act as a suitable top soil that will enable natural establishment of vegetation.



Thompson Environmental Consulting WATER · WASTEWATER · WETLANDS The Catena Group	**Hydric Soil Investigation** UT to Town Creek Site Stanly County, North Carolina	Date: January 2011 Scale: 0 50 100 Feet Job No: 4147	Figure 1



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The Catena Group

Hydric Soil Investigation

UT to Town Creek Site

Stanly County, North Carolina

Date: January 2011

Scale: 0 50 100 Feet

Job No: 4147

Figure 2

APPENDIX A

Soil Boring Descriptions

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 1		0-9	GR FR l	10YR 4/4	c/d 10YR 4/3				
		9-18	SBK FR cl	2.5Y 5/4	c/d 10YR 5/6				
		18-23	SBK FR cl	2.5Y 5/4	m/d 7.5YR 5/6				
		23-36+	SBK FR cl	10YR 5/6	m/d 2.5Y 6/4				
									3
M 2		0-9	SBK l FR	2.5Y 6/3	m/d 7.5YR 4/6				
		9-12	SBK l FR	2.5Y 6/3	m/d 10YR 5/6 + 7.5YR 4/6				
		12-21+	SBK cl FR	2.5Y 6/1	m/d 10YR 6/4				
									1
M 3		0-9	GR l FR	2.5Y 6/3	m/d 10YR 5/6				
		9-17+	GR cl FR	2.5Y 6/2	m/d 10YR 5/6 + 7.5YR 5/6				
		17-22	SBK SiCl FR	2.5Y 6/1	"				
									1
M 4		0-4	GR l FR	2.5Y 4/3	c/d 10YR 4/4				
		4-18	SBK SiCl FR	10YR 5/3	m/d 7.5YR 4/6 + 7.5YR 5/6				
		18-	SBK SiCl FR	10YR 5/6	m/d 10YR 4/3				
									2
M 5		0-2	GR l FR	10YR 4/4					
		2-14+	GR SiCl FR	10YR 5/3	m/d 10YR 4/6 + 5/6 + 7.5YR 5/6				
									2

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 6		0-4	GR sl FR	10YR 4/3	c/f 10YR 4/2 + 4/4				
		4-12+	SBK scl FR	10YR 5/6	c/d 10YR 5/3				3
M 7		0-3	GR Sl FR	10YR 3/3	c/f 10YR 3/2 + O R;				
		3-9	GR sl FR	2.5Y 7/4	c/d 10YR 5/6 + f/d 2.5Y 7/3				
		9-22	SBK sicl FR	10YR 5/6	c/f 10YR 5/8, c/d 2.5Y 7/4				
		22-42+	SBK sicl FR	10YR 5/6	m/f 10YR 5/4; c/p 2.5YR 5/6; c/d 2.5Y 7/2				4
M 8		0-12	GR GR l FR	2.5Y 6/2	c/d 2.5Y 6/6				
		12+	DENIAL						1
M 9		0-9	GR l FR	10YR 4/3					
		9-13+	GR GR l FR	2.5Y 6/4	NONE				
		DENIAL							3
M 10		0-4	GR l FR	10YR 4/3					
		4-15+	GR sicl FR	10YR 5/4					3

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941): .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS: .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 11		0-5	GR GRcl FR	10YR 4/3					
		5-14+	SBK SiCl FR	10YR 5/8					3
M 12		0-4	GR cl FR	10YR 5/3	m/d 7.5YR 4/6				
		4-13	GR cl FR	2.5Y 6/3	m/d 10YR 5/8				
		13-42	SBK SiCl FR	2.5Y 6/2	m/d " + 10YR 5/6				2
M 13	CREEKSIDE	0-2	10YR 4/3						
		2-14	2.5Y 4/2						
	Ab	14-25	2.5Y 5/1		c/d 2.5Y 4/3				
		25-36	2.5Y 5/1		m/d 10YR 5/6 + 5/8				
		DENIAL							1
M 14		0-14	GR SiL FR	10YR 5/4	m/d 10YR 5/6				
		14-25	SBK SiCl FR	2.5Y 6/4	m/d 10YR 6/2				
		25-32+	SBK SiCl FR	10YR 6/2	m/d 10YR 5/6 + 2.5Y 6/4				4
M 15	DEPRESSION	0-14+	GR SiCl FI	2.5Y 6/3	c/d 10YR 4/6				1

COMMENTS:

SOIL/SITE EVALUATION
(Continuation Sheet)

Sheet 4 of 9

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 16		0-9	GR SiL FR	2.5Y 6/2	m/d 10YR 5/6				
		9-14+	GR SiL FR	10YR 6/2	m/d 5YR 4/4				
									1
M 17	DISTURBED	0-9	GR GRSiL FR	10YR 5/3	m/d 7.5YR 5/4				
		9-12	SBK GR L FR	10YR 5/3	m/d " " AND 10YR 5/6				
		12-19	SBK L FR	7.5YR 4/4	m/d 2.5Y 6/4				
		19-26+	SBK L FR	10YR 5/4	m/d 2.5Y 6/4				3/4
M 18		0-11	GR SiCL FR	2.5Y 6/4	m/d 10YR 5/6; c/f 2.5Y 6/3				
		11-16	GR SiCL FR	7.5YR 5/4	m/d 2.5Y 6/3				
		16-36	SBK SiCL FR	10YR 5/6	c/f 10YR 5/4 c/d 2.5Y 6/3				
		36-43	" " "	2.5Y 6/4	m/d 10YR 5/6 c/f 2.5Y 6/3				
	~~Bh~~ Ab →	43-54+	" " "	2.5Y 6/1	m/d 10YR 5/6 f/p 7.5YR 5/8				2
M 19		0-7	GR SiCL FR	2.5Y 6/2	m/d 7.5YR 5/4				
		7-17	SBK CL FR	10YR 6/2	m/d 10YR 5/6				
		17-23	" " "	5Y 6/1	m/d " " + 8/6				
		23-27+	M C FI	5 PB	c/d 7.5YR 5/4				1
M 20		0-10	SBK SiCL FR	7.5YR 5/4	m/d 2.5Y 6/4				
		10-14	SBK GRSiCL FR	2.5Y 5/3	m/d 7.5YR 5/4 + 10YR 5/4				
		DENIAL							
	IN								2

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

Sheet 5 of 9

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 21		0-12	GR SiL FR	10YR 5/6	c/f 10YR 5/4				
	BURIED SURFACE	12-21	SBK SiCL FR	10YR 5/6	m/f 10YR 5/4	f/d	7.5YR 4/6		ABRUPT
		21-31	SBK L FR	2.5Y 6/4	m/d 7.5YR 4/6	RELICT OR			
		31-47	SBK SiCL FR	2.5Y 6/3	m/d 10YR 4/6		" "		
	BURIED SURFACE	47-55+	M L FR	2.5Y 4/2 → 4/1	LOTS OF OLD ORGANIC MATTER				3/4
M 22		0-5	GR L FR	10YR 6/4	c/d 2.5Y 6/6				
		5-13	GR L FR	2.5Y 7/3	m/d 2.5Y 6/6				
		13-20	SBK SiL FR	"	m/d 10YR 6/6				
		20-38+	SBK SiCL FR	"	m/d "		m/f 2.5Y 7/2		
									2
M 23		0-8	GR L FR	10YR 6/4					
		8-12	SBK SiCL FR	2.5Y 4/6	c/d 7.5YR 5/6				
		12-24	SBK CL FI	2.5Y 4/4	c/d 2.5Y 5/4				
		24-30	SBK C FI	2.5Y 6/2	m/d 2.5Y 5/8				
									3/4
M 24		0-1	GR L FR	10YR 4/3					11/8/10 ↓
		1-4	" " "	10YR 4/4					
		4-6	" " "	10YR 4/3					
		6+	ROCK						
									3
M 25	FIG 7.	0-10	GR-GR L FR	2.5Y 6/4	c/d 7.5YR 5/6				
		10-20		2.5Y 6/6	f/d "		c/f 2.5Y 6/4		
		20+	DENIAL						
	PIT								3/4

COMMENTS:

SOIL/SITE EVALUATION
(Continuation Sheet)

Sheet 6 of 9

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 26		0-9	GR l FR	10YR 5/3	m/d 7.5YR 4/6				
		9-25	GR l FR	2.5Y 6/3	m/d 7.5YR 5/6 + 10YR 5/6				
		25-37	sbk fsl FR	2.5Y 6/3	"		"		
		37-45	sbk cl FR	"			"		
	A8	45+	m cl FR	5Y 3/2	c/d 5Y 5/3				2
M 27		0-4	GR l FR	2.5Y 5/3	m/d 7.5YR 4/6				
		4-12	GR l FR	2.5Y 6/4	" + 10YR 5/6				
		12-16	SBK l FR	2.5Y 6/3	"				
		16-31	SBK cl FR	10YR 6/4	m/d 10YR 5/8				
		31-37	SBK cl FR	2.5Y 6/2	"				3/4
		37-45	m cl FR	10Y 6/1					
		45+	DENIAL						
M 28		0-10	GR cl FR	7.5YR 5/8					
		10-21	SBK cl FR	7.5YR 5/4	m/d 7.5YR 5/8 m/d 10YR 5/3				
		21-31	SBK c FI	2.5Y 6/2	m/d 10YR 6/8 c/d 10YR 5/6				
		31-43	SBK cl FR	2.5Y 6/1	m/d 10YR 5/6				
	49+ DENIAL	43-49	SBK sc FI	N 6/	"				3 ?
M 29		0-5	GR GRl FR	10YR 4/4					
		5-8	GR GRl FR	5Y 3/1	m/d 7.5YR 4/6, DR's				
		8-11	GR GRsl VFR	10YR 4/6	"				
		11+	DENIAL						
									2 R

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 30	Ab	0-3	GR l FR	10YR 4/4	m/d 7.5YR 4/6				
		3-10	GR l FR	2.5Y 6/4	m/d 10YR 5/6				
		10-14	GR cl FR	2.5Y 6/2	m/d 10YR 5/6				
		14-26	SBK C FI	2.5Y 6/1	"	+	10YR 5/8		
		26+	DENIAL						2↑
M 31	UPLAND UNDISTURBED	0-4	GR cl FR	7.5YR 4/4					
		4-17+	SBK C FI	7.5YR 5/6					
									3
M 32	PIT	0-3	GR sl FR	2.5Y 5/2	m/d 7.5YR 4/6 ORs				
		3-9	GR l FR	2.5Y 6/4	m/d 10YR 5/6				
		9-12	SBK cl FI	2.5Y 6/4	m/d 7.5YR 4/6 OR + 10YR 5/6				
		12	DENIAL						
									3?
M 33		0-11	GR l FR	2.5Y 6/3	m/d 7.5YR 5/6 + 4/6				
		11-17	SBK cl FR	2.5Y 6/2	"	+	m/d 2.5Y 6/3		
		17-27	SBK cl FR	2.5Y 6/2	m/d 10YR 4/4				
		27-35	SBK GR C FI	2.5Y 6/2	m/d 10YR 5/6				
		35+	DENIAL						1
M 34	3 HOLES 10" DENIAL CLOSEST TO CREEK	0-1	GR GR sl FR	7.5YR 4/6					
		1-5	GR GR cl FR	2.5Y 5/2	c/d 10YR 4/6				
									1

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 35		0-3	GR cl FR	2.5Y 5/2	m/d 7.5YR 4/4				
		3-12	GR cl FR	2.5Y 6/3	m/d 7.5YR 4/4 AND 10YR 5/6				
		12+	ROCK						
									I
M 36		0-4	GR sl FR	2.5Y 6/4	m/d 10YR 5/6				
		4-7	GR sl FR	2.5Y 6/3	m/d 10YR 5/6				
		7+	ROCK						
									I
M 37		0-11	GR sl FR	2.5Y 5/4	m/d 10YR 4/6				
		11-20	GR sl FR	2.5Y 6/4	m/f 2.5Y 6/3 m/d 10YR 5/4				f Mn
	Ab? →	20-27	SBK cl FR	2.5Y 6/3	m/d 7.5YR 4/6				
		27-36	SBK C FR	2.5Y 6/2	m/d 7.5YR 4/6				
		36	DENIAL						3/4
M 38	2 HOLES UPLAND UNDISTURBED	0-9	GR l FR	2.5Y 6/4	m/d 10YR 5/6				
									3
M 39		0-6	GR l FR	2.5Y 6/3	m/d 10YR 4/4				
		6-15	SBK l FR	2.5Y 6/2	m/d 10YR 4/4				
		15-30	SBK cl FR	2.5Y 6/2	m/d 10YR 5/6				
		30-40		2.5Y 6/1	m/d 10YR 6/6 + 5/6				
		40+	DENIAL / ROCK						I

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

Sheet 9 of 9

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
M 40		0-6	GL l FR	2.5Y 5/4	m/d 10YR 4/6				
		6-17	SBK l FR	2.5Y 6/3	m/d 10YR 4/6 + 5/6				
		17-28	cl	2.5Y 6/4	m/f 2.5Y 6/3 m/d 10YR 4/8				
	Ab →	28-35	SBK cl FI	5PB 5/1	m/d 7.5YR 4/4				
	54+ ROCK	35-54	M C FI	5PB 5/1	c/d 10YR 4/4				2/4
M 41		0-5	GR l FR	10YR 5/4	m/d MULTI COLORED				
		5-15	GR GR l FR	2.5Y 6/3	c/d 10YR 4/4 + c/d 10YR 5/6				
		15-24	SBK GR cl FR	2.5Y 6/2	c/d 10YR 6/6 + c/d 10YR 5/6				
		24+	DENIAL						
									2/4

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: U.T. TOWN CK
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941): .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS: .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
	J1	0-6	1, M, GR L	2.5Y 5/3	m/d 7.5YR 4/4				1
		6-22	1, M, SBK SiCL	2.5 5/2	m/d 7.5YR 4/6 c/d 7.5YR 4/6				
		22+	1, M, SBK SiCL	2.5 4/3	m/d 2.5Y 6/1				
	J2	0-8	1, M, GR SL	10YR 5/6	f/f 10YR 4/6				
		8-19	1, M, SBK SCL	10YR 5/6	c/f 10YR 4/4				3
		19+	1, M, SBK SCL	10YR 4/4	c/d 2.5Y 5/6 c/f 10YR 5/4				
	J3	0-8	1, f, GR SL	2.5Y 6/3	c/d 10YR 6/6				2
		8-15	1, f, GR SL	2.5Y 6/3	c/d 7.5YR 4/4 c/d 10YR 6/1				
		15+	1, f, GR SL	2.5Y 6/3	c/d 10YR 5/6 c/d 10YR 4/4				
	J4 AR	0-4	1, f, GR L	10YR 4/3	c/d 7.5Y 3/2 8%				2
		4-8	1, M, SBK SiCL	10YR 5/3	c/d 10YR 4/6 c/d 7.5YR 4/4				
	J5 AR	0-4	1, f, GR L	2.5Y 5/6					3
		4-14	1, M, SBK CL	10YR 5/6					

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: U.T. Town Ck
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
J6	AR	0-8	1,M,GR L	10YR 4/3					2
J7		0-6	1,M GR L	10YR 5/3	m/d 7.5YR 4/4				
		6-11	1,M,SBK, SiCL	10YR 5/2	m/d 7.5YR 4/6				
		11-16	1,M,SBK, SiCL	10YR 6/2	m/d 7.5YR 5/6, 5YR 5/6				1
J8	AR	0-8	1,M,GR L	2.5Y 6/3	m/d 7.5YR 4/6 c/d 10YR 6/8				2
J9		0-3	1,M,GR L	2.5Y 4/4	c,f 7.5YR 4/4				
		3-7	1,M,SBK L	2.5Y 5/3	c/d 7.5YR 4/6				2?
	AR	7-12	1,M,SBK CL	7.5YR 5/6					
J10		0-4	1,M,GR L	10YR 3/2	f,f 10YR 4/4				
		4-14	1,M,SBK L	2.5Y 6/3	m/d 7.5YR 5/8				2
		14	1,M,SBK SiCL	2.5 6/3	m/d 7.5YR 4/6				

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
	J11	0-4	1, M, GR L	2.5Y 5/4	c,d 7.5YR 4/4	c,d 7.5YR 5/6			
		4-13	1, M, SBK L	2.5Y 5/3	m,d 10YR 5/6				
		13-24	1, M, SBK SiCL	2.5Y 4/4	c,d 7.5YR 5/6				
		24-32	1, M, SBK SiCL	2.5Y 6/2	c,d 7.5YR 4/4	c,d 7.5YR 5/6			
		32-48	1, M, SBK SiCL	2.5Y 6/1	m/d 7.5YR 5/4	c,d 7.5YR 4/4			2↑
	J12	0-6	1, M, GR L	2.5Y 5/3	m,d 5.YR 5/6				
		6-19	1, M, SBK CL	5Y 5/2	c,d 7.5YR 4/4	m,d 7.5YR 5/6			1
	J13	0-9	1, M, GR L	10YR 5/6	c,d 7.5YR 4/6				
		9-23	1, M, SBK SiCL	2.5Y 5/6	c,d 7.5YR 4/6				
	Ab	23-32	1, M, SBK SiCL	2.5Y 5/3	m,d 10YR 3/3				3
		32-48	1, M, SBK CL	10YR 5/6	c,d 10Y 7/1				
	J14	0-12	1, M, GR L	7.5YR 4/4					
		12-24	1, M, SBK CL	10YR 5/4	m,d 7.5YR 4/4				
		24-30	1, M, SBK CL	2.5Y 5/6	c,d 2.5Y 6/2				
		30-36	1, M, SBK CL	10YR 5/6	c,d 10YR 4/2				3
	J15	0-9	1, M, GR L	7.5YR 5/6					
		9-18	1, M, SBK SiCL	2.5Y 5/3	m/d 7.5YR 4/4				
		18-28	1, M, SBK SiCL	10YR 5/4	m/f 10YR 5/8	7.5YR 4/4 m/d			3?
		28-36	1, M, GR SL	10YR 5/6	m/d 2.5Y 6/2				

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
J16		0-8	1,m GR L FR	2.5Y 5/4	c/d 7.5YR 4/6				
		8-20	1,M,GR L FR	2.5Y 6/4	c/d 7.5YR 4/4 c,d 7.5YR 5/6				
		20-36	1,m,SBK SiCL FR	2.5Y 6/3	m/d 7.5YR 5/6 c,d 7.5YR 4/4 c,d 10YR 5/6				
		36-47	1,CO SBK SiFR	GLEY 5/5G					
									3→4
J17		0-4	1,M,GR L FR	10YR 5/4	c/				
		4-12	1,M,GR L FR	2.5Y 6/3	c/d 10YR 4/6				
		12-41	1,M,SBK SiCL FR	2.5Y 6/3	c/d 10YR 4/4 c,d 7.5YR 4/6 c/d 10YR 5/6				
									2
J18	? Ab→	0-6	1 m gr L FR	10YR 4/4			abrupt change @12"		
		6-12	1 m sbk L FR	10YR 5/6	10YR 6/2 c/d				
		12-41+	1 m sbk SiCL FR	2.5Y 6/2	c/d 10YR 4/6				
		41+	1 co gr L/FR	2.5Y 6/2	c/d 7.5YR 5/8				
									3→4
L1		0-12	1,m,gr,L FR	7.5YR 5/6					
		12-24	1,m,sbk,Sil FR	10YR 5/6					
		24-38	1,co,sbk,c,FR	7.5YR 5/6					
		38-45	1,co sbk,c,FR	10YR 5/6	c/d 10YR 3/3				
		45"	AR						3
L2		0-8	1,m,gr,l,FR	2.5Y 6/4	7.5YR 4/6 c/d				
		8-19	1,m,gr,l,FR	10YR 5/4	7.5YR 5/6 c/d				
		19-36	1,m,sbk,l,FR	2.5Y 6/4	7.5YR 4/6				
	Ab→	36-40	1,m,gr,l,FR	"	"			* buried horz	
		40-46+	1,m,gr,l,FR	2.5Y 6/	"				3

11/8/10

COMMENTS:

SOIL/SITE EVALUATION
(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
	L3	0-10	1,m,gr,l fr	7.5YR 4/6	c/d 2.5Y 6/3				
		10-22	1,m,gr,sicl, fr	10YR 6/4	c/d 7.5YR 4/6				
		22-26	1,m,gr,l,fr	2.5Y 6/3	m/d	"			
		26-38	1,m,gr,sicl,fr	2.5Y 6/3	m/d 7.5YR 5/6				
		38-48+	massive gr,c,FI	Grey 2 6/10BG	m/d 7.5YR 5/8				3
	L4	0-6	1,m,gr,l,fr	2.5Y 5/3	c/d	10YR 3/6			
		6-26	1,m,gr,l,fr	2.5Y 5/1		"			
		26-	AR						1
	L5 (PIT)	0-10	1,m,gr,sicl fr	2.5Y 5/3	c/d	10YR 4/6			
		10-22	1,m,gr,cl,fr	2.5Y 6/2	m/d	7.5YR 5/8			
		22-36	gr,c,vfi	2.5Y 6/2	m/d	10YR 5/8			2-1
		36	AR						
	L6	0-6	1,m,gr,l,fr	2.5Y 6/3	c/d	7.5YR 3/4			2
		6+	R						
	L7	0-9	1,m,gr,l,fr	2.5Y 6/4	c/d	7.5YR 4/6			
		9-26	1,m,gr,l,fr	2.5Y 6/1	m/d	7.5YR 4/6 a 3/4			1
		26	R						

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
	L8	0-9	1,m,gr,l,FR	2.5Y 6/4	c/d	7.5YR 4/6			
		9-33	1,m,gr,l,FR	2.5Y 6/2	m/d	7.5YR 4/4			
		33-38	1,m,gr,l,FR	2.5Y 6/1	m/d	7.5YR 4/6	← buried horizon		
		38	AR						
									1
	L9	0-8	1,m,gr,l,fr	10YR 6/4					
		8-18	1,m,gr,sicl,fr	10YR 5/4	f/d	10YR 3/4			
		18-36+	1,m,sbk,c,fi	7.5YR 6/8	m/d	2.5Y 7/3			
									3
	L10 PIT	0-10	1,m,gr,l,fr	2.5Y 6/3	m/d	7.5YR 3/4			
		10-18	1,m,gr,cl,fr	2.5Y 6/3	m/d	7.5YR 3/4			
		18-21	1,m,gr,l,fr	2.5Y 6/1	c/d	7.5YR 4/6			2
		21	AR						
	L11	0-8	1,m,gr,l,fr	2.5Y 6/2	f/d	10YR 3/6			
		8-14	1,m,sbk,l,fr	2.5Y 6/2	m/d	7.5YR 4/6			
		14-30	sbk,sicl,fr	2.5Y 6/3	c/d	7.5YR 4/4			1
		30	AR						
	L12	0-10	1,m,gr,sl,fr	2.5Y 6/6	c/d	2.5Y 7/1			
		10-26	1,m,gr,l,fr	2.5Y 6/3	m/d	2.5Y 5/6			2?
		26	AR						

COMMENTS:

SOIL/SITE EVALUATION
(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZ ON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
	L13	0-9	1,m,gr,l,fr	2.5Y 5/4	m/d	7.5YR 4/6			1
		9-27	1,m,sbk,scl,fr	2.5Y 6/2	m/d	10YR 5/6			
		27	AR						
	L14	0-8	1,m,gr,l,fr	2.5Y 6/3	m/d	7.5YR 4/4			2
		8-22	1,m,sbk,l,fr	"	"	"	"		
		22-26	1,m,sbk,cl,fr	2.5Y 6/2	m/d	7.5YR 4/6			
		26-38+	1,m,gr,l,fr	5Y 5/2	c/d	5Y 3/2			(Buried A)
	L15	0-11	1,m,gr,l,fr	10YR 6/6					
		11-24	1,m,gr,l,fr	2.5Y 6/2	m/d	10YR 3/6		(Buried A)	
		24-36	sbk,scl,fi	2.5Y 6/1	m/d	10YR 5/4			3?
		36	R						
	L16	0-10	1,m,gr,l,fr	7.5YR 6/6					
		10-21	1,m,gr,l,fr	10YR 6/6	f/d	7.5YR 4/6			
		21-34	sbk,scl,fi	2.5Y 6/3	m/d	"	"		
		34-49+	sbk,c,fi	2.5Y 7/1	m/d	10YR 5/8			3
	L17	0-5	1,m,gr,l,fr	2.5Y 4/3	M/F	2.5Y 3/2		adjacent to stream bed	
		5-17	1,m,gr,grav l,fr	2.5Y 4/2					
		17	R						2

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

Sheet 8 of 8

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/5/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
	L18	0-8	gr, l, fr	10YR 5/4	f/d	7.5YR 4/6			3
		8-18	sbk, cl, fr	"		"			
		18-24	sbk, cl, fi	"	m/c	"			
		24	R						
	L19	0-7	gr, l, fr	2.5Y 5/3	m/d	7.5YR 4/4			3
		7-17	sbk, cl, fr	10YR 5/8	c/d	7.5YR 4/6 & 3/4			
		17-29	sbk, cl, fi	"	"	"	"		
		29	R						
	L20	0-7	gr, l, fr	10YR 5/4	f/d	7.5YR 4/4			2
		7-19	gr, l, fi	2.5Y 5/3	m/d	7.5YR 4/4			
		19-27	sbk, l, fr	2.5Y 6/3	c/d	7.5YR 5/6 >		Buried	
		27-38+	sbk, [illegible], fi	2.5Y 6/1	m/d	10YR 5/6			
	L21	0-6	gr, l, fr	2.5Y 5/4	f/d	7.5YR 4/4			3
		6-18	gr, l, fr	2.5Y 6/4	f/d	10YR 5/8			
		18-28	gr, l, fr (grav)	2.5Y 7/1	c/d	7.5YR 4/6			
		28-36	sbk, c, fi	2.5Y 7/1	c/d	7.5YR 4/6			
		36	AR						

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT TOWN CK
DATE OF EVALUATION: 11/3/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
PIT 1	Picture 110	0-2	GR SiL FR	10YR 5/3					
		2-9	GR L FR	2.5Y 6/4	m/d 2.5Y 4/4 c/d 7.5YR 4/6				
		9-14	SBK CL FI	10YR 5/6	m/d 2.5Y 4/3				
		14-26	SBK L FR	2.5Y 5/6	m/d " " c/d 7.5YR 5/6				
		26-38	SBK GR L FR	2.5Y 6/3	m/d 10YR 5/6				3
		38-45+	M GR L FR	2.5Y 6/2	"	"			
PIT 2	PIX 111 + 112	0-2	GR L FR	10YR 5/3					
		2-9	GR L FR	10YR 5/4	m/f 10YR 5/6 m/d 2.5Y 4/3				
		9-18	SBK L FR	2.5Y 6/4	m/d 7.5YR 4/4				
		18-26	SBK CL FR	2.5Y 6/4	c/d 2.5Y 6/2 AND 10YR 4/4 + 5/6				
		26-40	SBK SiCL FR	2.5Y 6/6	m/d 2.5Y 6/2				
	Ab →	40-48+	SBK SiCL FR	10Y 6/2	m/d 10YR 5/6				3
PIT 3	PIC 113 + 114	0-2	GR L FR	10YR 5/3					
		2-8	SBK L FR	2.5Y 6/6	m/d 10YR 5/4 + 5/6				
		8-15	SBK L FR	2.5Y 6/4	m/d 7.5YR 4/4				
		15-23	SBK L FR	2.5Y 6/3	m/d 7.5YR 4/4 AND Mn masses				
	NO Ab	23-37	SBK L FR	2.5Y 6/1	m/d 10YR 5/6 + 6/6				
		37-48+	SBK GR L FR	"	"				3

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 11/3/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
P-4	Pictures 115 & 116	0-6	gr, l, fr	7.5YR 5/4					
		6-12	sbk, l, fr	2.5Y 6/4	c/f	6/3	c/d	7.5YR	5/4
		12-18	sbk, cl, fi	10YR 6/6					
		18-29	sbk, cl, fi	10YR 5/6	f/d	10YR 6/4	c/f	10YR 5/8	
		29-37	gr, l, fr	10YR 6/6	m/d	2.5Y 6/2			
		37-47	gr, grav. l, fr	10YR 6/4	m/d	5Y 6/2	& 6/2		
		47-58	gr, grav. l, fr	5Y 6/1	m/d	10YR 4/4	c/d	10YR 6/4	
		58-62+	gr, sl, fr	5Y 5/1	m/d	10YR 4/4	root matter	buried A 6'	3
P-5	117 & 118	0-2	GR l FR	10YR 4/3					
		2-8	GR l FR	10YR 5/6	c/d 10YR 6/3				
		8-15	SBK l FR	2.5Y 6/4	m/d 10YR 4/4				
		15-32	SBK l FR	2.5Y 6/3	m/d 10YR 4/4				
	Ab3	32-40	SBK cl FI	5Y 4/1	m/d 7.5YR 4/4		old ORs		
	Ab2	40-53	SBK cl FI	5Y 6/1	m/d 10YR 5/8 & 5/6				3>4
	Original Ab1	53-60+	SBK sl FR	5B 5/1	m/d 10YR 4/4		old ORs		

COMMENTS:

SOIL/SITE EVALUATION
(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town CK
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
PIT 6	R	0-6	gr, 1, fr	10YR 6/6	c/d	7.5YR	5/4		
	120	6-12	sbk, 1, fr	2.5Y 6/4	m/d	10YR	5/4		
	4	12-22	sbk, cl, fi	2.5Y 6/4	m/d	10YR	4/4 c/f	2.5Y	6/3
	121	22-39	sbk, cl, fi	2.5Y 6/2	m/d	10YR	5/4 +	5/6	
		39-52	sbk, cl, fi	5Y 6/1	m/d	7.5YR	4/4 + 5/4	# old "OR"	
									3→4
PIT 4	Pictures	0-6	gr, 1, fr	10Y 5/1	m/d	7.5YR	5/6	OR's present	
	122	6-10	gr, 1, fr	2.5Y 6/3	m/d	10YR	5/4 +	5/6	
	4	10-24	parent mat.	10YR 5/4	extremely gravelly				
	123								2
PIT 8	Pictures	0-4	gr, 1, fr	2.5Y 6/4	c/d	10YR 5/6			
	124	4-11	gr, grav 1, fr	2.5Y 6/4	c/d	10YR 5/6	f/f	10YR	6/3
	4	11-20	sbk, 1, fi	" "	"	"	10YR 5/6 + 5/8		
	125	20-31	S	" "		c/d	10YR 5/6 + 5/8		
							c/f	~~1~~ 2.5Y 6/3	3→4 2
PIT 9	PIX	0-6	GR 1 FR	10YR 5/4					
	126 +	6-12	SBK GR l FR	10YR 6/6	m/d	10YR 5/4 +	5/4		
	127	12-24	SBK GR l FR	2.5Y 6/4	m/d	10YR 4/4 +	5/4		
	UPLAND								3

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town CK
DATE OF EVALUATION: 11/8/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
PIT 10	? - 133 ? 131 - T33 °	0 - 6	GR l FR	2.5Y 5/4	10YR 4/6 m/d				
		6 - 11	SBK l FR	2.5Y 6/4	10YR 5/6 + 4/6	m/d			
		11 - 25	SBK VGR l FR	2.5Y 6/4	m/d [illegible]				
									3
PIT 11	PIC 134 - 135	0 - 9	GR l FI	2.5Y 6/3	M/d 10YR 4/4				
		9 - 16	SBK l FR	2.5Y 6/2	m/d " "				
		16 - 25	PL-SBK VGR l FR	5Y 5/1	m/d 10YR 5/6				
		25 - 33	" " "	"			m/d	10YR 5/4	
									1
PIT 12		0 - 9	GR cl FI	2.5Y 6/4	M/d 10YR 4/4				
		9 - 13	GR sl FF	2.5Y 6/3	m/d 7.5YR 4/4		c Mn		
		13 - 26	SBK sl	2.5Y 5/2	m/d 5YR 5/8 + c/d 7.5YR 4/4				
	Ab2	26 - 36	SBK l	5Y 5/1	10YR 4/4 m/d				
		36 - 45	SBK l	10YR 5/6	M/d 2.5Y 6/3				2
	Ab1	45 - 50+	SBK l	5PB 5/1					
PIT 13	PIC 138	0 - 8	GR l FR	10YR 6/3	m/d 10YR 4/4				
		8 - 17	SBK cl FI	10YR 6/4	m/d 10YR 4/4 + 5/6				
		17 - 26	SBK l FR	10YR 5/2	m/d 10YR 4/4				
	139 Ab	26 - 33	SBK cl FR	5Y 5/1	"				
		33 - 40+	SBK l FR	5Y 5/1	"	"			
		40 - 55+	SBK cl FR	5PB 5/1	c/d 2.5Y 6/4				3→4

COMMENTS:

SOIL/SITE EVALUATION

(Continuation Sheet)

DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

PROPERTY ID #: UT Town Ck
DATE OF EVALUATION: 1/18/10
COUNTY: STANLY

PROFILE #	.1940 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY (.1941) .1941 STRUCTURE/ TEXTURE	.1941 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .1942 SOIL WETNESS/ COLOR	.1943 SOIL DEPTH	.1956 SAPRO CLASS	.1944 RESTR HORIZ	PROFILE CLASS & LTAR
P 5 T 14	Pics 140 & 141	0-2	gr, l, fr	2.5Y 5/2	m/d	7.5YR 4/4			
		2-9	gr, l, fr	2.5Y 6/3	m/d	7.5YR 4/4			
		9-17	sbk, cl, fi	2.5Y 6/3	m/d	7.5YR 4/4	c/F 2.5Y 6/2		
		17-34	sbk, scl, fr	2.5Y 6/3	m/d	7.5YR 4/4	c/F 2.5Y 6/2		
		34-42	sbk, c, fi	2.5Y 6/2	m/d	7.5YR 5/6			2
				2.					
P T T 15	Pics 142 143	0-7	gr, l, fr	2.5Y 5/2	m/d	7.5YR 4/4			
		7-12	sbk, l, fi	2.5Y 6/3	m/d	10.5YR 4/4	c/F 2.5Y 6/3 OR		
		12-27	sbk, c, fi	2.5Y 6/3	m/F	2.5Y 6/2	m/d 10YR 5/6		
		27-32	sbk, c, fi	2.5Y 5/1	m/d	10YR 5/6			
		32+	m, c, fi	SG 3/1	m/p	10YR 5/8			2

COMMENTS:

APPENDIX B

Pit Photo Logs

Pit 1

Pit 2

Pit 3

Pit 4

Pit 5

Pit 6

Pit 7

Pit 8

Pit 9

Pit 10

Pit 11

Pit 12

Pit 13

Pit 14

Pit 15

Appendix C

Categorical Exclusion Checklist

EDR Documentation

Ecosystem Enhancement PROGRAM

December 20, 2010

Chris L. Yow / Kristi Suggs
Michael Baker Engineering
1447 South Tryon Street, Suite 200
Charlotte, North Carolina 28203

Subject: Categorical Exclusion Form for
UT to Town Creek Stream and Wetland Mitigation Project
Yadkin River Basin – CU# 03040105
Stanly County, North Carolina
Contract No. 003277

Dear Chris Yow and Kristi Suggs:

Attached please find the approved Categorical Exclusion Form for the subject full delivery project. I have approved your invoice, in the amount of \$ 96,045.00 (5% of contract) for completion of the Task 1 deliverable. Please include a copy of the form in your Restoration Plan.

If you have any questions, or wish to discuss this matter further, please contact me at any time. I can be reached at (919) 715-1656, or email me at guy.pearce@ncdenr.gov.

Sincerely,

Guy C. Pearce

Guy C. Pearce
EEP Full Delivery Program Supervisor

cc: file

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	UT to Town Creek Restoration
County Name:	Stanly
EEP Number:	003277
Project Sponsor:	Michael Baker Engineering, Inc.
Project Contact Name:	Chris L. Yow / Kristi Suggs
Project Contact Address:	1447 South Tryon Street, Suite 200, Charlotte, NC 28203
Project Contact E-mail:	cyow@mbakercorp.com / ksuggs@mbakercorp.com
EEP Project Manager:	Guy Pearce

Project Description

The UT to Town Creek Restoration Project is located in northern Stanly County, approximately 1.7 miles west of New London in the Yadkin River Basin (Figure 1). The Project site includes a degraded stream system that contains the UT to Town Creek and four additional unnamed tributaries. A combination of restoration, enhancement, and/or preservation will be implemented on the site to improve and protect approximately 8,498 linear feet of stream channel. Additionally, the project plans to restore, enhance, and/or create 6.6 acres of riparian wetland. This project will be used to obtain stream and wetland mitigation credit for the NC Ecosystem Enhancement Program.

For Official Use Only

Reviewed By:

Guy C Pearce

Date 12/20/2010

Guy C Pearce

EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

12-14-10

Date

Donald Brew

For Division Administrator FHWA

Categorical Exclusion – Summary

Project Background

The UT to Town Creek Stream Restoration project is proposing to restore, enhance, and/or preserve approximately 8,498 linear feet (LF) of stream and restore, enhance, and/or create approximately 6.6 acres of riparian wetlands along UT to Town Creek, in Stanly County, NC for the purpose of obtaining stream and wetland mitigation credit for the NC Ecosystem Enhancement Program (EEP). The recent land use of the site has been primarily agricultural, both cropland and pasture for cattle. The historic agricultural land uses and degraded nature of the site present a significant opportunity for water quality and ecosystem improvements.

The National Environmental Policy Act of 1969 (NEPA) requires agencies to use an interdisciplinary approach in planning and decision-making for actions that will have an impact on the environment. The Federal Highway Administration (FHWA) and NC Department of Transportation (NCDOT) have determined that EEP projects will not involve significant impacts and therefore a Categorical Exclusion (CE) is the appropriate type of environmental document for this project. FHWA has also determined that stream restoration projects are considered land disturbing activities; therefore, Parts 2 and 3 of the EEP CE checklist and a summary of the findings applicable to the environmental regulations associated for this project are included. Supporting documentation is included in the Appendix.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

Environmental Data Resources, Inc (EDR) prepared the following reports: a Radius Map Report with Geocheck, a historical topography report, and a historical aerial report on September 8, 2010 and a City Directory Abstract on September 10, 2010. Based on the EDR reports, the project site and/or adjacent sites have never been designated as commercial or industrial and there are no known or potential hazardous waste sites within or adjacent to the project area. The EDR reports are included in the Appendix A.

National Historic Preservation Act (Section 106)

Michael Baker Engineering, Inc. (Baker) requested a review and comment from the State Historic Preservation Office (SHPO) and the Tribal Historic Preservation Office (THPO) on any possible issues that might emerge with respect to architectural or archaeological resources from the restoration project on September 20, 2010. SHPO's review of the project on October 7, 2010 found no historic resources that would be affected by the project. THPO did not provide comment in reference to the project. All correspondence on this issue is included in the Appendix B.

Uniform Relocation Assistance and Real Property Act

Prior to signing the Option Agreement for the Conservation Easement, the property owner of the land involved in the restoration project was notified that Baker does not have condemnation authority and as to the fair market value of the land involved. Copies of the Option Agreement are included in the Appendix C.

Endangered Species Act (ESA)

Baker reviewed both the NC Natural Heritage Program (NCNHP) and the US Fish and Wildlife Service (USFWS) lists of rare and protected animal and plant species and found that two federally listed species are known to occur in Stanly County: the Bald eagle (*Haliaeetus leucocephalus*) and Schweinitz's sunflower (*Helianthus schweinitzii*).

Suitable habitat does not exist for the bald eagle since the project site is more than 0.5 miles from open water, the preferred nesting distance of the bald eagle. Suitable habitat does exist for Schweinitz's sunflower in woodland openings and adjacent agricultural land. A pedestrian survey of the project area was conducted on September 28, 2010 during blooming season. Schweinitz's sunflower was not observed in or adjacent to the project area during the field survey; therefore, it is anticipated that project construction will have "no effect" on the bald eagle or the Schweinitz's sunflower.

The USFWS was notified of the project on October 1, 2010. Baker has not received any comments from the USFWS at this time. Correspondence on this issue is included in the Appendix D.

<u>Farmland Protection Policy Act (FPPA)</u>

On September 24, 2010, Baker submitted the AD-1006 form for the UT to Town Creek site to the Stanly County Natural Resources Conservation Service (NRCS) office. The NRCS responded November 15, 2010, with the determination that implementation of this restoration project would result in the conversion of 18.8 acres of prime farmland soils. Baker submitted the completed AD-1006 form to the Stanly County NRCS office and the Assistant State Soil Scientist in the Raleigh Office on November 16, 2010. All correspondence on this issue is included in Appendix E.

<u>Fish and Wildlife Coordination Act (FWCA)</u>

A letter was sent by Baker to the NC Wildlife Resources Commission (NCWRC) and the USFWS on October 1, 2010 requesting their comment and review on the UT to Town Creek Stream Restoration Project. NCWRC responded on October 22, 2010 stating they did not "anticipate the project to result in significant adverse impacts to aquatic and terrestrial wildlife resources". Baker has not received any comments from the USFWS on this issue. Copies of all correspondence are included in Appendix D.

<u>Migratory Bird Treaty Act (MBTA)</u>

A letter was sent by Baker to the USFWS on October 1, 2010 requesting their comment and review on the UT to Town Creek Stream Restoration Project in relation to migratory birds. Baker did not receive any comments from the USFWS on this issue. All correspondence with the USFWS is included in the Appendix D.

Marcus John Harward Property
28978 Misenheimer Rd.
New London, NC 28127

Inquiry Number: 2864039.5
September 08, 2010

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography September 08, 2010

Target Property:

28978 Misenheimer Rd.

New London, NC 28127

Year	***Scale***	***Details***	***Source***
1961	Aerial Photograph. Scale: 1"=1000'	Panel #: 35080-D3, Richfield, NC;/Flight Date: October 04, 1961	EDR
1977	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-D3, Richfield, NC;/Flight Date: January 29, 1977	EDR
1984	Aerial Photograph. Scale: 1"=1000'	Panel #: 35080-D3, Richfield, NC;/Flight Date: April 25, 1984	EDR
1998	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-D3, Richfield, NC;/Flight Date: March 11, 1998	EDR
2006	Aerial Photograph. Scale: 1"=604'	Panel #: 35080-D3, Richfield, NC;/Flight Date: January 01, 2006	EDR

INQUIRY #: 2864039.5

YEAR: 1961

= 1000'

N


INQUIRY #: 2864039.5
YEAR: 1977
= 750'
N


INQUIRY #: 2864039.5
YEAR: 1984
= 1000'
N


INQUIRY #: 2864039.5
YEAR: 1998
= 750'
N


INQUIRY #: 2864039.5
YEAR: 2006
= 604'
N

Marcus John Harward Property
28978 Misenheimer Rd.
New London, NC 28127

Inquiry Number: 2864039.4
September 08, 2010

EDR Historical Topographic Map Report

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800.352.0050
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EDR Historical Topographic Map Report

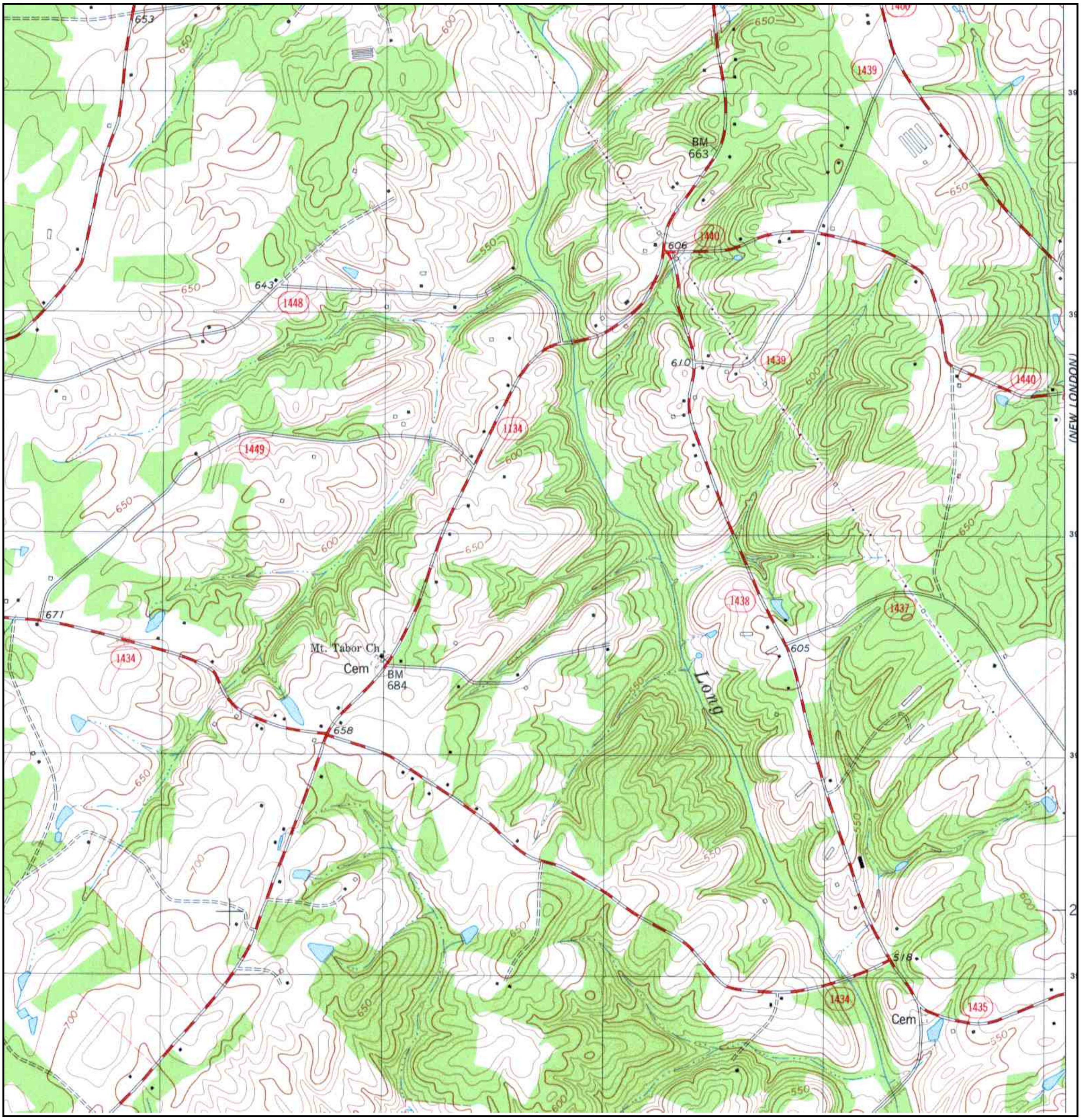
Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Historical Topographic Map

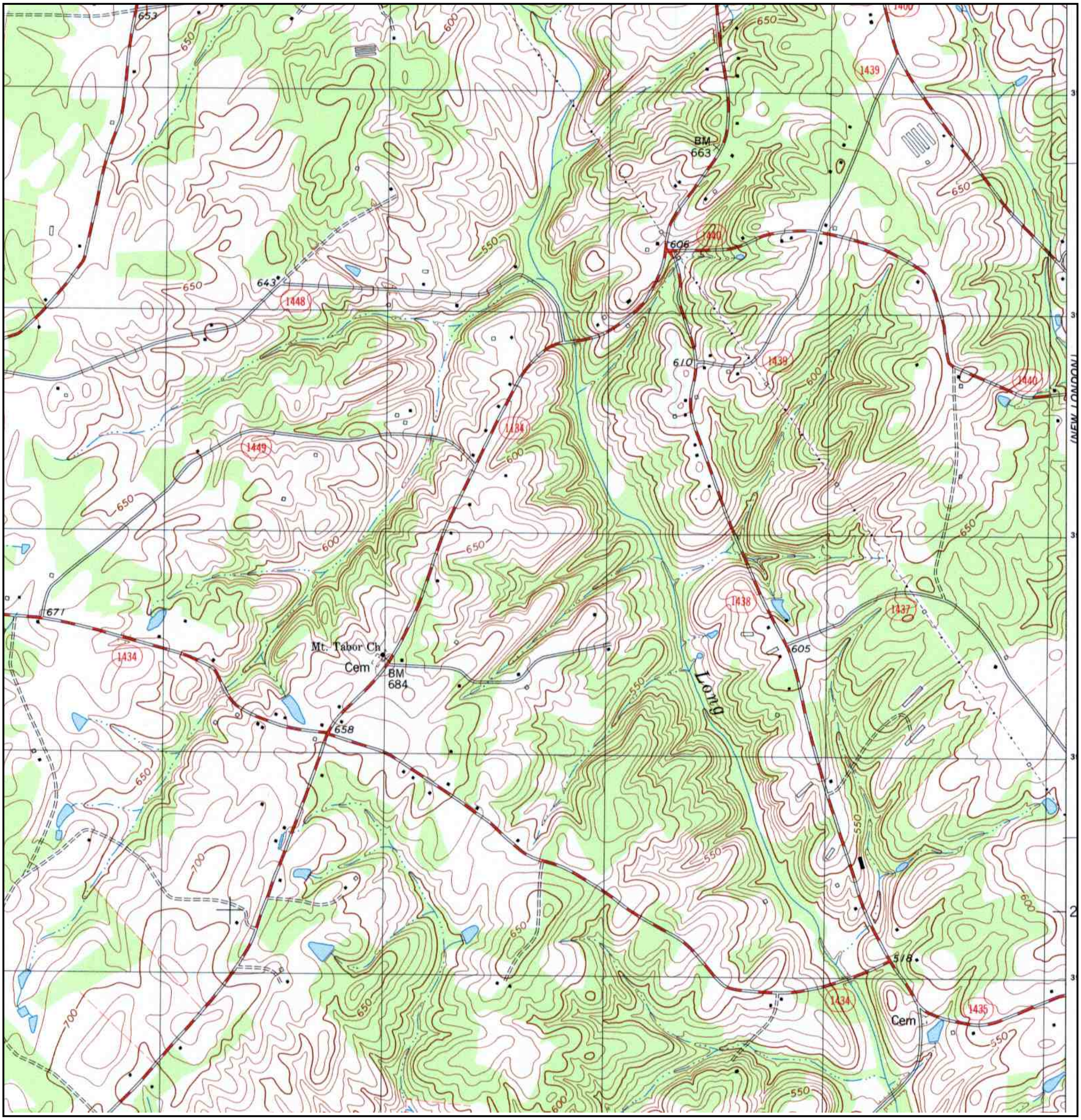
N ↑			
	TARGET QUAD NAME: MOUNT PLEASANT MAP YEAR: 1957 SERIES: 15 SCALE: 1:62500	SITE NAME: Marcus John Harward Property ADDRESS: 28978 Misenheimer Rd. New London, NC 28127 LAT/LONG: 35.4311 / -80.2505	CLIENT: Baker Engineering & NY, Inc. CONTACT: Kristi Suggs INQUIRY#: 2864039.4 RESEARCH DATE: 09/08/2010

Historical Topographic Map



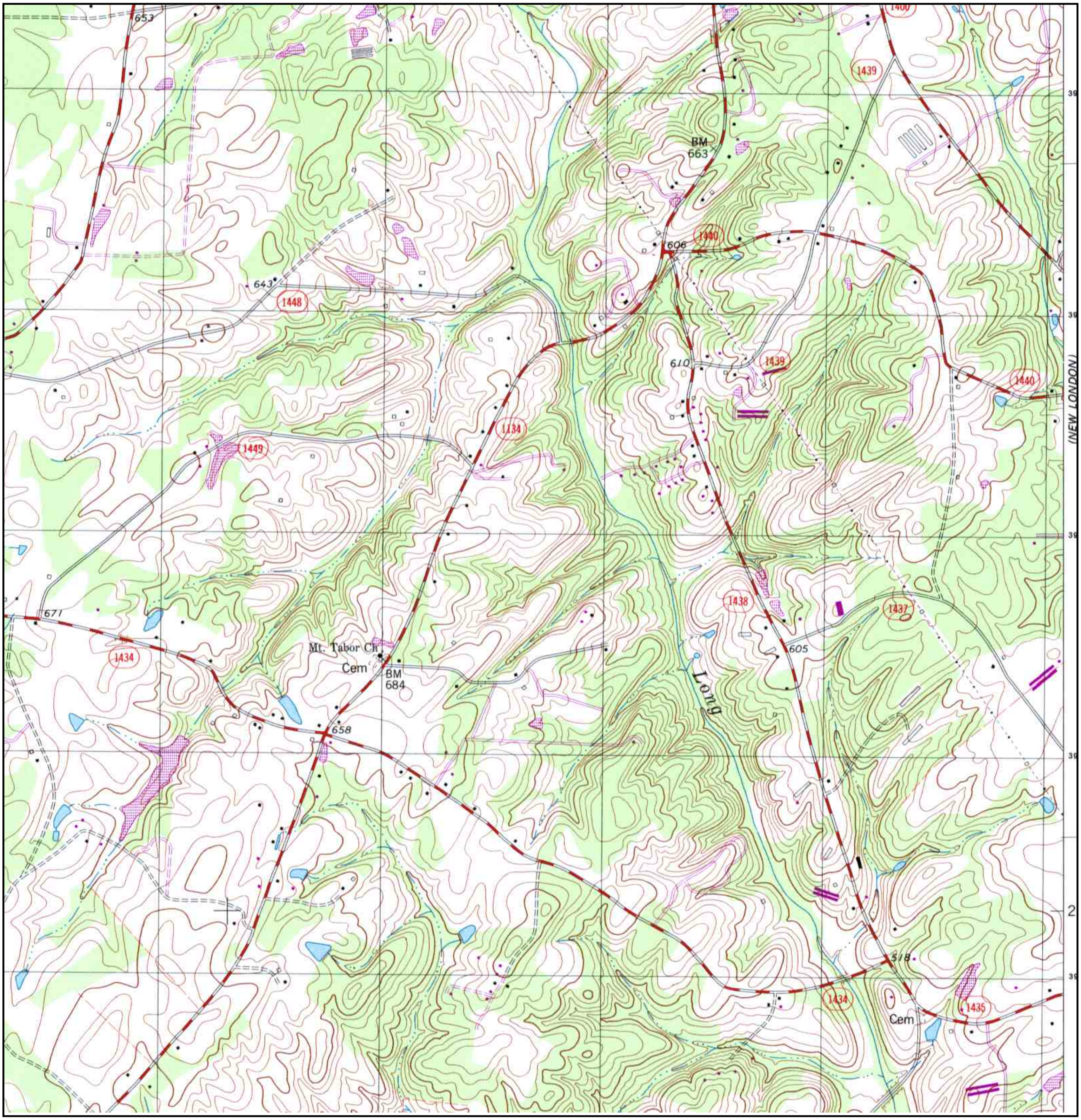
N	TARGET QUAD NAME: RICHFIELD MAP YEAR: 1981 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marcus John Harward Property ADDRESS: 28978 Misenheimer Rd. New London, NC 28127 LAT/LONG: 35.4311 / -80.2505	CLIENT: Baker Engineering & NY, Inc. CONTACT: Kristi Suggs INQUIRY#: 2864039.4 RESEARCH DATE: 09/08/2010

Historical Topographic Map



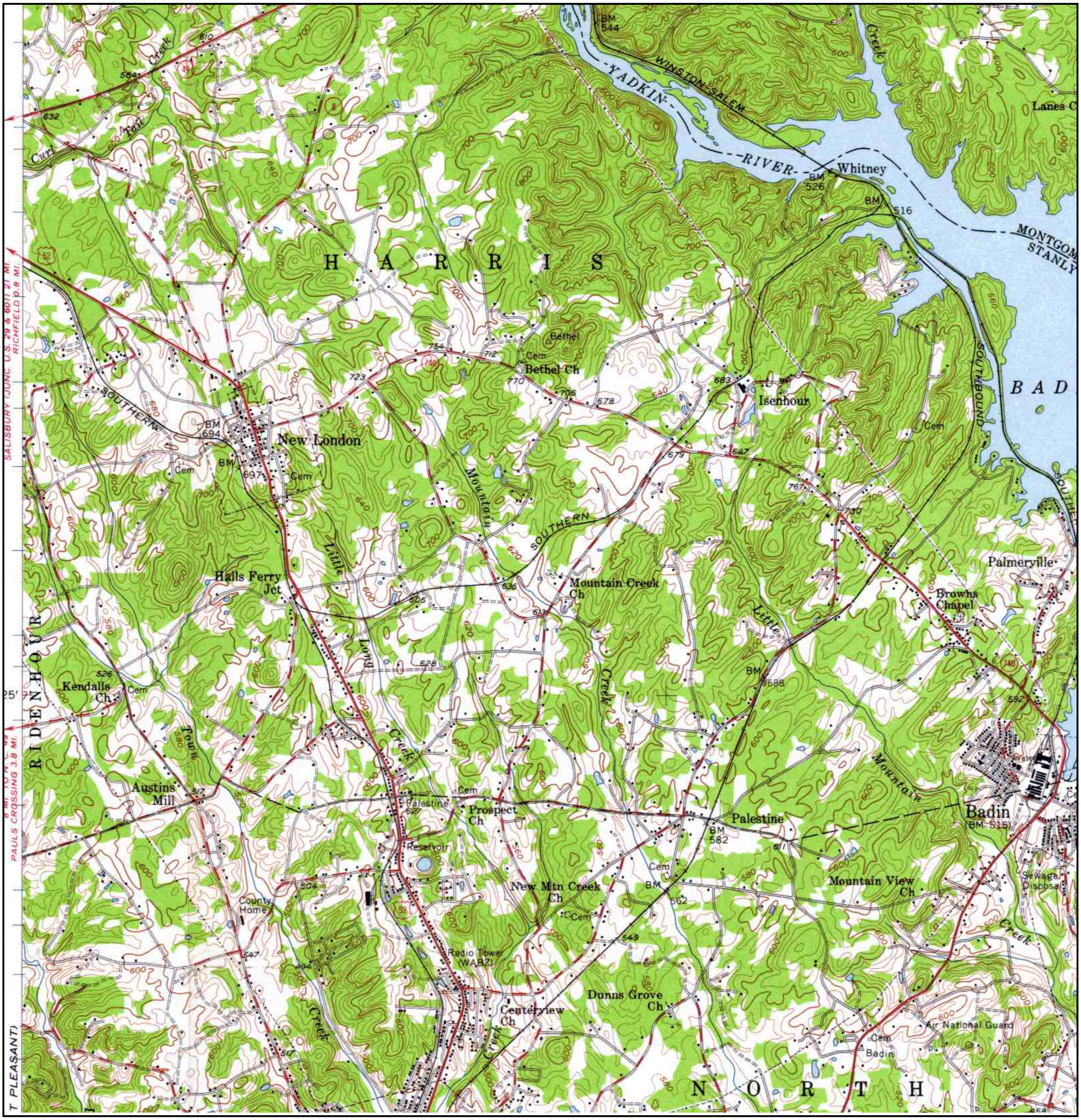
N	TARGET QUAD NAME: RICHFIELD MAP YEAR: 1983 PHOTOINSPECTED: 1981 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marcus John Harward Property ADDRESS: 28978 Misenheimer Rd. New London, NC 28127 LAT/LONG: 35.4311 / -80.2505	CLIENT: Baker Engineering & NY, Inc. CONTACT: Kristi Suggs INQUIRY#: 2864039.4 RESEARCH DATE: 09/08/2010

Historical Topographic Map



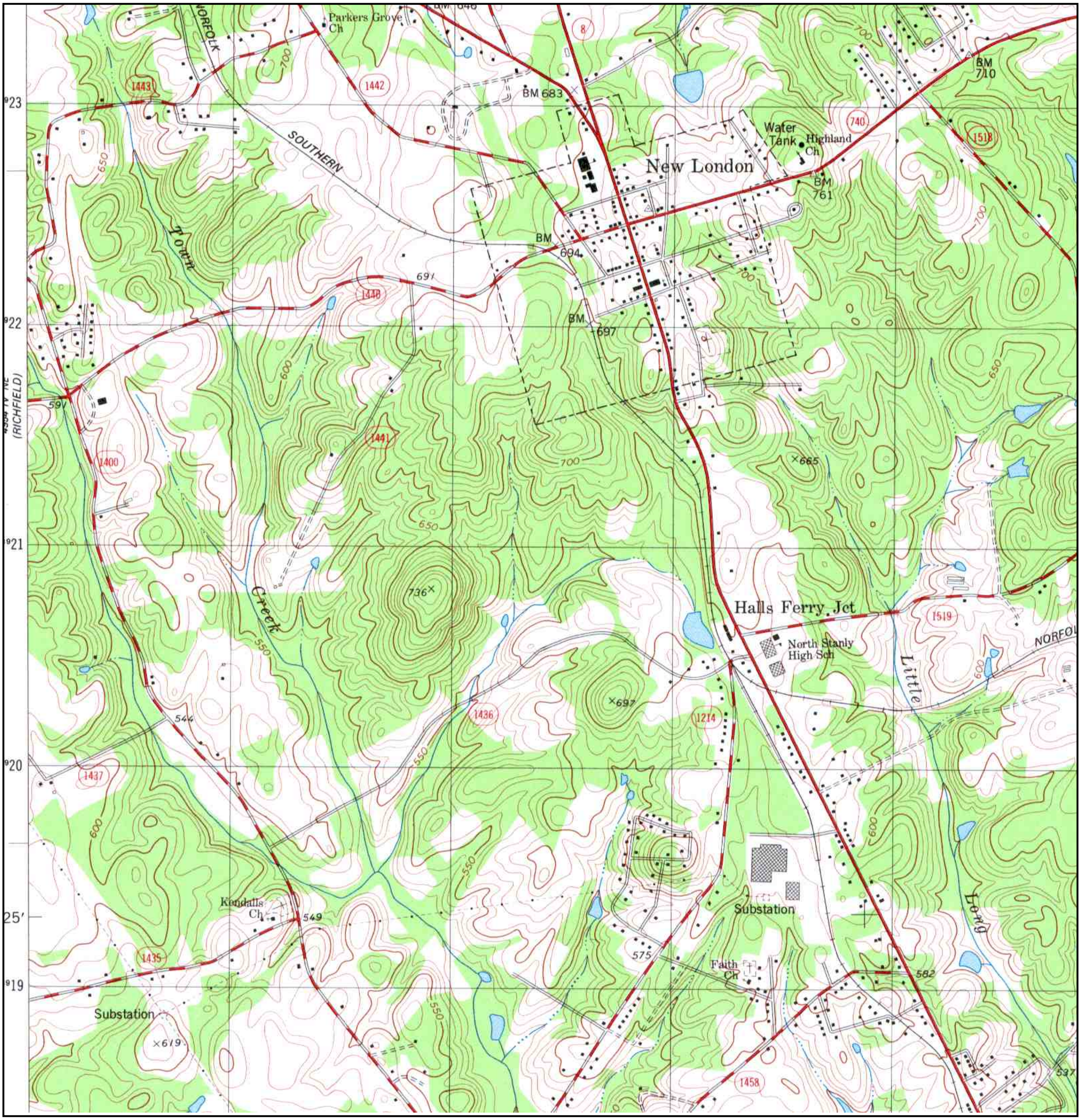
N			
	TARGET QUAD NAME: RICHFIELD MAP YEAR: 1993 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marcus John Harward Property ADDRESS: 28978 Misenheimer Rd. New London, NC 28127 LAT/LONG: 35.4311 / -80.2505	CLIENT: Baker Engineering & NY, Inc. CONTACT: Kristi Suggs INQUIRY#: 2864039.4 RESEARCH DATE: 09/08/2010

Historical Topographic Map



N	ADJOINING QUAD			CLIENT:	Baker Engineering & NY, Inc.
	NAME: ALBEMARLE	SITE NAME:	Marcus John Harward Property	CONTACT:	Kristi Suggs
	MAP YEAR: 1957	ADDRESS:	28978 Misenheimer Rd. New London, NC 28127	INQUIRY#:	2864039.4
	SERIES: 15			RESEARCH DATE:	09/08/2010
	SCALE: 1:62500	LAT/LONG:	35.4311 / -80.2505		

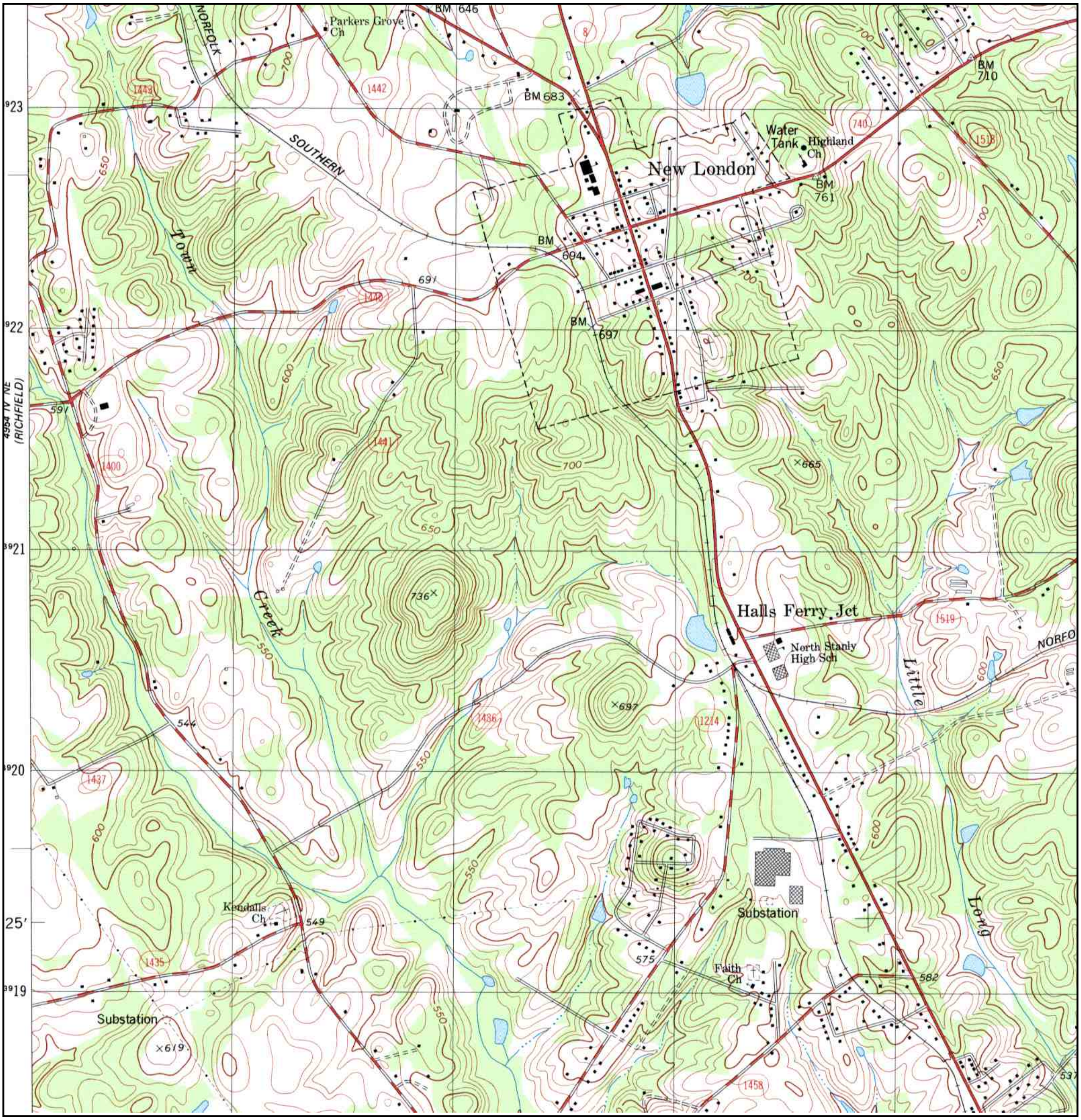
Historical Topographic Map



ADJOINING QUAD					
NAME:	NEW LONDON	SITE NAME:	Marcus John Harward Property	CLIENT:	Baker Engineering & NY, Inc.
MAP YEAR:	1980			CONTACT:	Kristi Suggs
		ADDRESS:	28978 Misenheimer Rd. New London, NC 28127	INQUIRY#:	2864039.4
SERIES:	7.5			RESEARCH DATE:	09/08/2010
SCALE:	1:24000	LAT/LONG:	35.4311 / -80.2505		

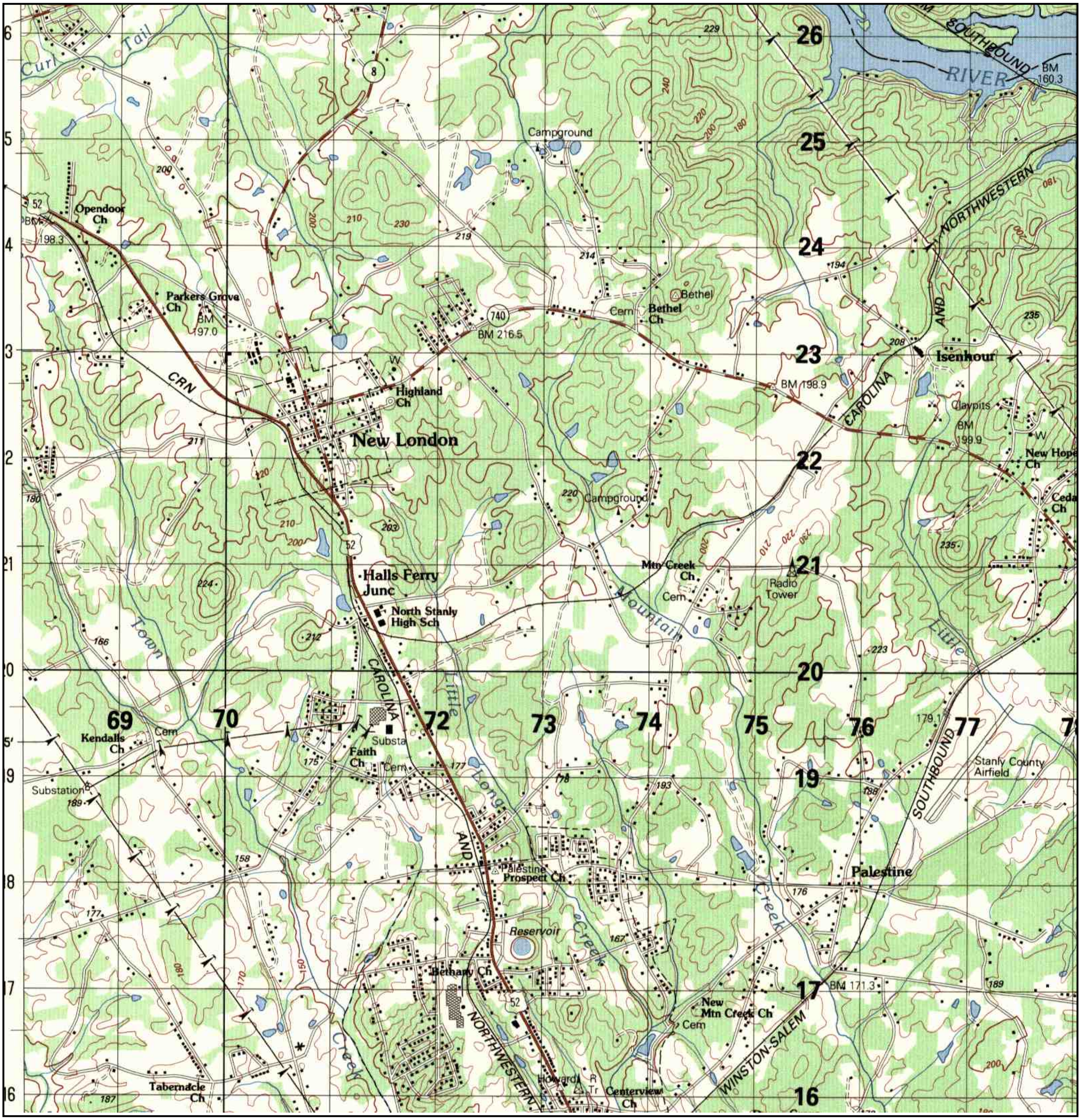
N

Historical Topographic Map



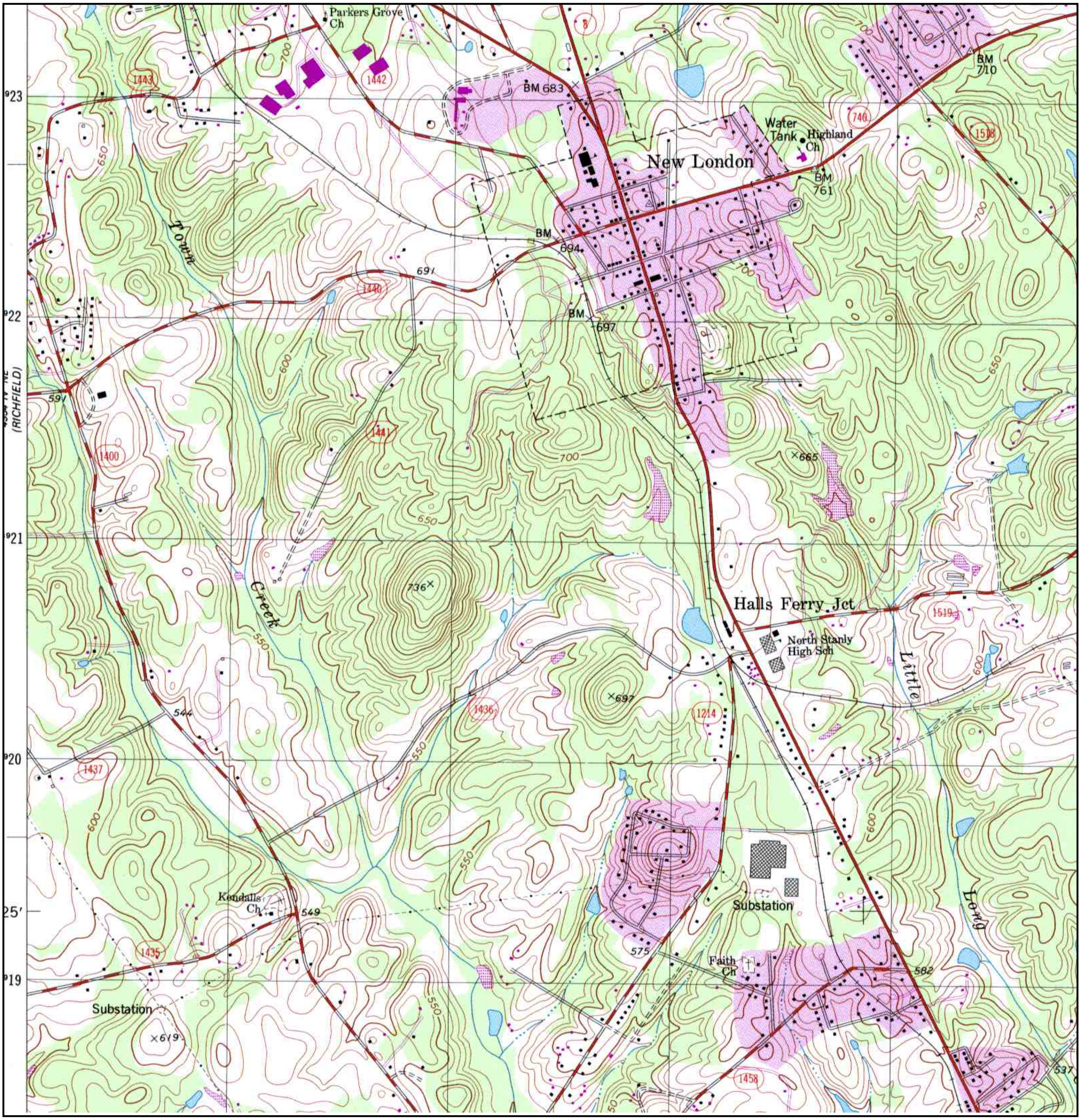
N	ADJOINING QUAD		
	NAME: NEW LONDON MAP YEAR: 1983 PHOTOINSPECTED: 1980 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marcus John Harward Property ADDRESS: 28978 Misenheimer Rd. New London, NC 28127 LAT/LONG: 35.4311 / -80.2505	CLIENT: Baker Engineering & NY, Inc. CONTACT: Kristi Suggs INQUIRY#: 2864039.4 RESEARCH DATE: 09/08/2010

Historical Topographic Map



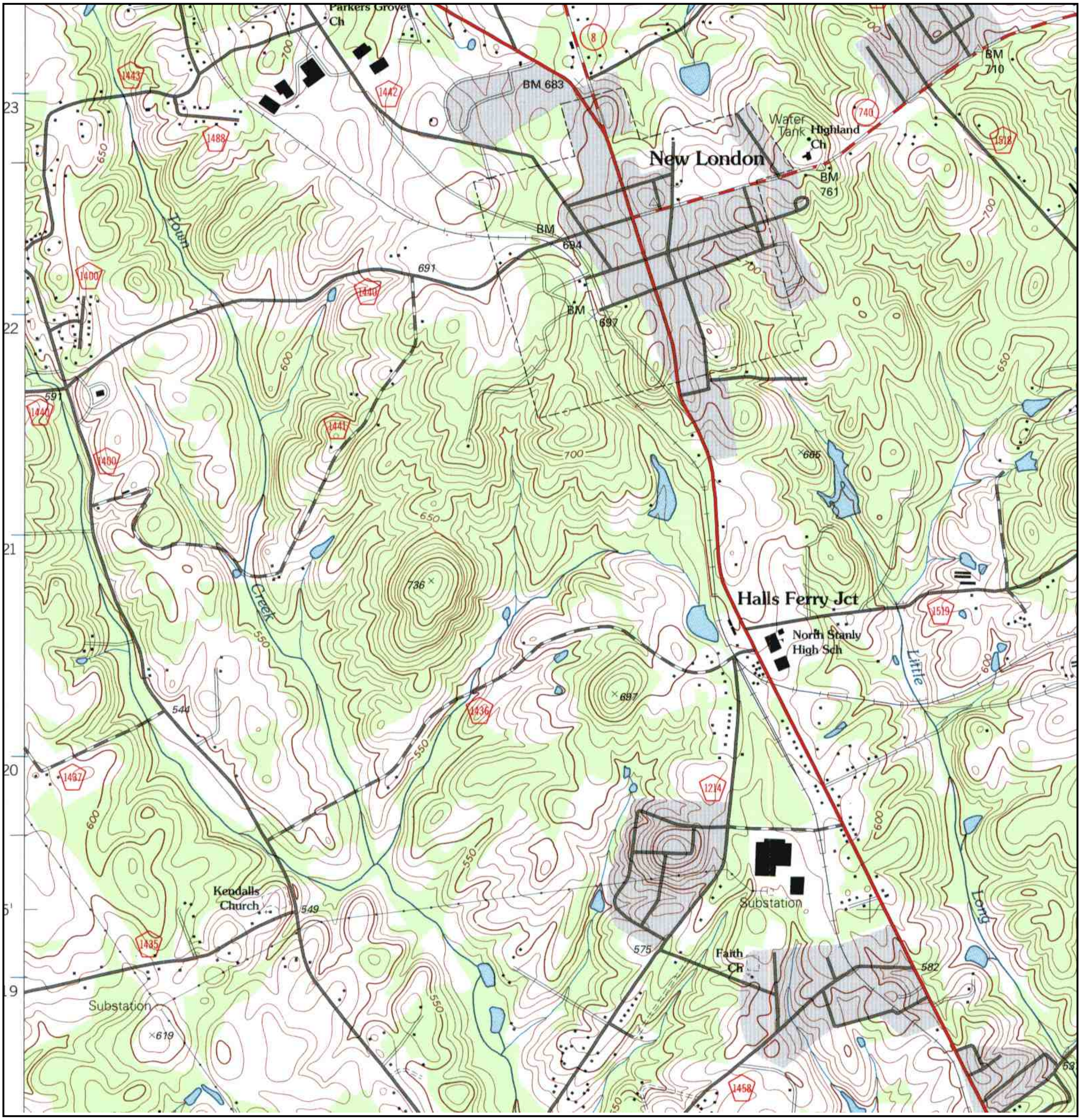
N	ADJOINING QUAD NAME: ALBEMARLE MAP YEAR: 1984 SERIES: 15 SCALE: 1:50000	SITE NAME: Marcus John Harward Property ADDRESS: 28978 Misenheimer Rd. New London, NC 28127 LAT/LONG: 35.4311 / -80.2505	CLIENT: Baker Engineering & NY, Inc. CONTACT: Kristi Suggs INQUIRY#: 2864039.4 RESEARCH DATE: 09/08/2010

Historical Topographic Map



N	ADJOINING QUAD NAME: NEW LONDON	SITE NAME:	Marcus John Harward Property	CLIENT:	Baker Engineering & NY, Inc.
	MAP YEAR: 1993	ADDRESS:	28978 Misenheimer Rd. New London, NC 28127	CONTACT:	Kristi Suggs
	SERIES: 7.5	LAT/LONG:	35.4311 / -80.2505	INQUIRY#:	2864039.4
	SCALE: 1:24000			RESEARCH DATE:	09/08/2010

Historical Topographic Map



N	ADJOINING QUAD NAME: NEW LONDON MAP YEAR: 1994 SERIES: 7.5 SCALE: 1:24000	SITE NAME:	Marcus John Harward Property	CLIENT:	Baker Engineering & NY, Inc.
		ADDRESS:	28978 Misenheimer Rd. New London, NC 28127	CONTACT:	Kristi Suggs
		LAT/LONG:	35.4311 / -80.2505	INQUIRY#:	2864039.4
				RESEARCH DATE:	09/08/2010

Marcus John Harward Property
28978 Misenheimer Rd.
New London, NC 28127

Inquiry Number: 2864039.6
September 10, 2010

The EDR-City Directory Abstract

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
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800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

2009 Enhancements to EDR City Directory Abstract

New for 2009, the EDR City Directory Abstract has been enhanced with additional information and features. These enhancements will make your city directory research process more efficient, flexible, and insightful than ever before. The enhancements will improve the options for selecting adjoining properties, and will speed up your review of the report.

City Directory Report. Three important enhancements have been made to the EDR City Directory Abstract:

1. *Executive Summary.* The report begins with an Executive Summary that lists the sources consulted in the preparation of the report. Where available, a parcel map is also provided within the report, showing the locations of properties researched.

2. *Page Images.* Where available, the actual page source images will be included in the Appendix, so that you can review them for information that may provide additional insight. EDR has copyright permission to include these images.

3. *Findings Listed by Location.* Another useful enhancement is that findings are now grouped by address. This will significantly reduce the time you need to review your abstracts. Findings are provided under each property address, listed in reverse chronological order and referencing the source for each entry.

Options for Selecting Adjoining Properties. Ensuring that the right adjoining property addresses are searched is one of the biggest challenges that environmental professionals face when conducting city directory historical research. EDR's new enhancements make it easier for you to meet this challenge. Now, when you place an order for the EDR City Directory Abstract, you have the following choices for determining which addresses should be researched.

1. *You Select Addresses and EDR Selects Addresses.* Use the "Add Another Address" feature to specify the addresses you want researched. Your selections will be supplemented by addresses selected by EDR researchers using our established research methods. Where available, a digital map will be shown, indicating property lines overlaid on a color aerial photo and their corresponding addresses. Simply use the address list below the map to check off which properties shown on the map you want to include. You may also select other addresses using the "Add Another Address" feature at the bottom of the list.

2. *EDR Selects Addresses.* Choose this method if you want EDR's researchers to select the addresses to be researched for you, using our established research methods.

3. *You Select Addresses.* Use this method for research based solely on the addresses you select or enter into the system.

4. *Hold City Directory Research Option.* If you choose to select your own adjoining addresses, you may pause production of your EDR City Directory Abstract report until you have had a chance to look at your other EDR reports and sources. Sources for property addresses include: your Certified Sanborn Map Report may show you the location of property addresses; the new EDR Property Tax Map Report may show the location of property addresses; and your field research can supplement these sources with additional address information. To use this capability, simply click "Hold City Directory research" box under "Other Options" at the bottom of the page. Once you have determined what addresses you want researched, go to your EDR Order Status page, select the EDR City Directory Abstract, and enter the addresses and submit for production.

Questions? Contact your EDR representative at 800-352-0050. For more information about all of EDR's 2009 report and service enhancements, visit www.edrnet.com/2009enhancements

EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.’s (EDR) City Directory Abstract is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR’s City Directory Abstract includes a search and abstract of available city directory data. For each address, the directory lists the name of the corresponding occupant at five year intervals.

RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. An "X" indicates where information was identified in the source and provided in this report.

Year	*Source*	*TP*	*Adjoining*	*Text Abstract*	*Source Image*
2010	Polk's City Directory	X	X	X	-
2005	Polk's City Directory	X	X	X	-
2000	Polk's City Directory	X	X	X	-
1997	Polk's City Directory	-	X	X	-

FINDINGS

TARGET PROPERTY INFORMATION

ADDRESS

28978 Misenheimer Rd.
New London, NC   28127

FINDINGS DETAIL

Target Property research detail.

Year	*Uses*	*Source*
2010	Residential	Polk's City Directory
2005	Residential	Polk's City Directory
2000	Residential	Polk's City Directory

FINDINGS

ADJOINING PROPERTY DETAIL

The following Adjoining Property addresses were researched for this report. Detailed findings are provided for each address.

Misenheimer Rd.

Misenheimer Rd.

Year	***Uses***	***Source***
2010	No address listings beyond the Target Property	Polk's City Directory
2005	No address listings beyond the Target Property	Polk's City Directory
2000	No address listings beyond the Target Property	Polk's City Directory
1997	No address listings beyond 28973 Misenheimer Rd	Polk's City Directory

28824 Misenheimer Rd.

Year	***Uses***	***Source***
2010	Residential	Polk's City Directory
2005	Residential	Polk's City Directory
2000	Residential	Polk's City Directory
1997	Residential	Polk's City Directory

28842 Misenheimer Rd.

Year	***Uses***	***Source***
2010	Residential	Polk's City Directory
2005	Apartments	Polk's City Directory
2000	Apartments	Polk's City Directory
1997	Apartments	Polk's City Directory

28973 Misenheimer Rd.

Year	***Uses***	***Source***
2010	Residential	Polk's City Directory
2005	Residential	Polk's City Directory
2000	Residential	Polk's City Directory
1997	Residential	Polk's City Directory

FINDINGS

TARGET PROPERTY: ADDRESS NOT IDENTIFIED IN RESEARCH SOURCE

The following Target Property addresses were researched for this report, and the addresses were not identified in the research source.

Address Researched	Address Not Identified in Research Source
28978 Misenheimer Rd.	1997

ADJOINING PROPERTY: ADDRESSES NOT IDENTIFIED IN RESEARCH SOURCE

The following Adjoining Property addresses were researched for this report, and the addresses were not identified in research source.

Address Researched	Address Not Identified in Research Source
Misenheimer Rd.	No Years Found
28824 Misenheimer Rd.	No Years Found
28842 Misenheimer Rd.	No Years Found
28973 Misenheimer Rd.	No Years Found

Marcus John Harward Property
28978 Misenheimer Rd.
New London, NC 28127

Inquiry Number: 2864039.2s
September 08, 2010

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

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GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

28978 MISENHEIMER RD.
NEW LONDON, NC 28127

COORDINATES

Latitude (North):	35.431100 - 35˚ 25' 52.0''
Longitude (West):	80.250500 - 80˚ 15' 1.8''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	568034.7
UTM Y (Meters):	3920911.2
Elevation:	608 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	35080-D3 RICHFIELD, NC
Most Recent Revision:	2002
East Map:	35080-D2 NEW LONDON, NC
Most Recent Revision:	1994

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	2005, 2006, 2008
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL - National Priority List

EXECUTIVE SUMMARY

Proposed NPL - - - - - - - - - - - - - - - Proposed National Priority List Sites
NPL LIENS - - - - - - - - - - - - - - - - - - Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL - - - - - - - - - - - - - - - - National Priority List Deletions

Federal CERCLIS list

CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY - - - - - - - - - Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP - - - - - - - - - - - - - - - CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS - - - - - - - - - - - - - - - - - Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF - - - - - - - - - - - - - - - - RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG - - - - - - - - - - - - - - - - - - RCRA - Large Quantity Generators
RCRA-SQG - - - - - - - - - - - - - - - - - - RCRA - Small Quantity Generators
RCRA-CESQG - - - - - - - - - - - - - - - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS - - - - - - - - - Engineering Controls Sites List
US INST CONTROL - - - - - - - - - - Sites with Institutional Controls

Federal ERNS list

ERNS - Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS - Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS - Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF - List of Solid Waste Facilities
OLI - Old Landfill Inventory

State and tribal leaking storage tank lists

LUST - Regional UST Database

EXECUTIVE SUMMARY

LUST TRUST - - - - - State Trust Fund Database
INDIAN LUST - - - - - Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST - - - - - Petroleum Underground Storage Tank Database
AST - - - - - AST Database
INDIAN UST - - - - - Underground Storage Tanks on Indian Land
FEMA UST - - - - - Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL - - - - - No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

VCP - - - - - Responsible Party Voluntary Action Sites
INDIAN VCP - - - - - Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS - - - - - Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS - - - - - A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9 - - - - - Torres Martinez Reservation Illegal Dump Site Locations
ODI - - - - - Open Dump Inventory
HIST LF - - - - - Solid Waste Facility Listing
INDIAN ODI - - - - - Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL - - - - - Clandestine Drug Labs
US HIST CDL - - - - - National Clandestine Laboratory Register

Local Land Records

LIENS 2 - - - - - CERCLA Lien Information
LUCIS - - - - - Land Use Control Information System

Records of Emergency Release Reports

HMIRS - - - - - Hazardous Materials Information Reporting System

Other Ascertainable Records

RCRA-NonGen - - - - - RCRA - Non Generators
DOT OPS - - - - - Incident and Accident Data

EXECUTIVE SUMMARY

DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
IMD	Incident Management Database
UIC	Underground Injection Wells Listing
DRYCLEANERS	Drycleaning Sites
NPDES	NPDES Facility Location Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
PCB TRANSFORMER	PCB Transformer Registration Database
COAL ASH	Coal Ash Disposal Sites
COAL ASH DOE	Sleam-Electric Plan Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

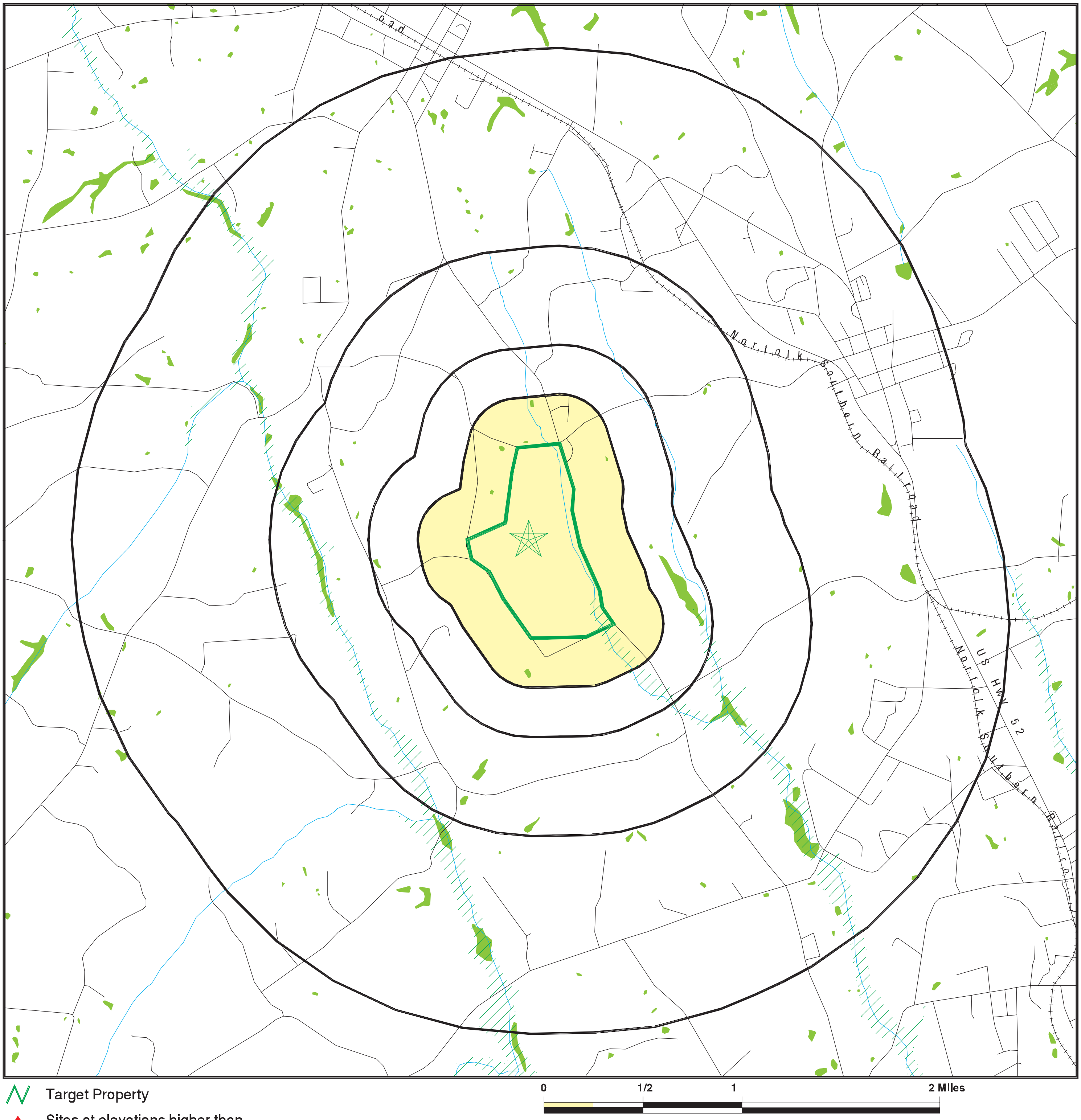
Unmappable (orphan) sites are not considered in the foregoing analysis.

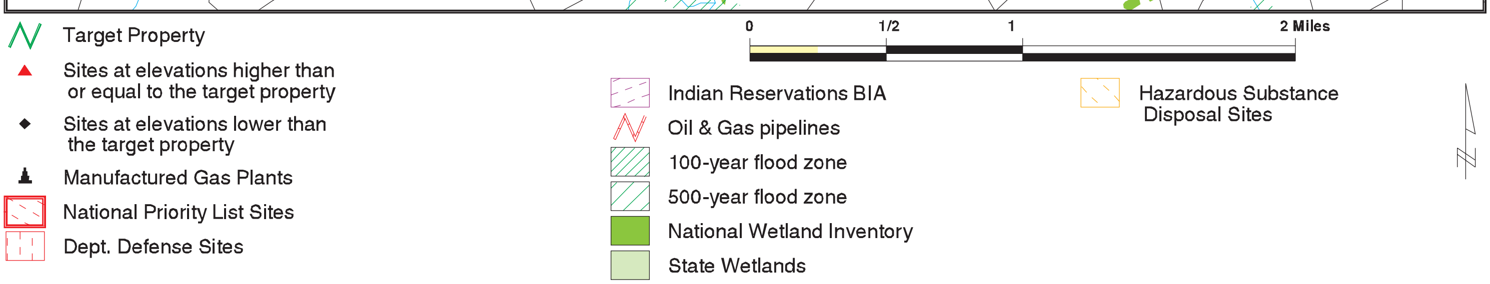
EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
HWY 52	FTTS, HIST FTTS, FINDS
FAMILY BOAT CENTER BADIN LAKE	SHWS
BLM	SWF/LF
B.B. OIL INC	IMD, LUST
COX'S GROCERY	IMD, LUST, UST
BLUE DOOR STATION	IMD, LUST
B.B. EXXON	IMD, LUST
DOBY TRUST - PALMER FARM	IMD, LUST
PALMER FARMS	LUST TRUST
HW CULP LUMBER COMPANY	UST
ALMONDS GROCERY	UST
RUSSELL'S ELECTRIC SHOP	UST
HIGHWAY 49 SPORTING GOODS	UST
NEW LONDON MAIN	UST
KENDALL VALLEY EXXON	UST
SUNNYBROOK FARMS. INC.	UST
BRS INC	UST
GALLOWAY 76	UST
RICHFIELD BP 200	UST
CROOK OIL CO	AST
HWY 53 FINCH RD	RCRA-NonGen, FINDS
H W CULP LUMBER CO	RCRA-CESQG, FINDS
BADIN LAKE FAMILY BOAT CENTER	IMD
AT&T COMM.-NEW LONDON RELAY	IMD
TUCKERTOWN WTP	NPDES

OVERVIEW MAP - 2864039.2s

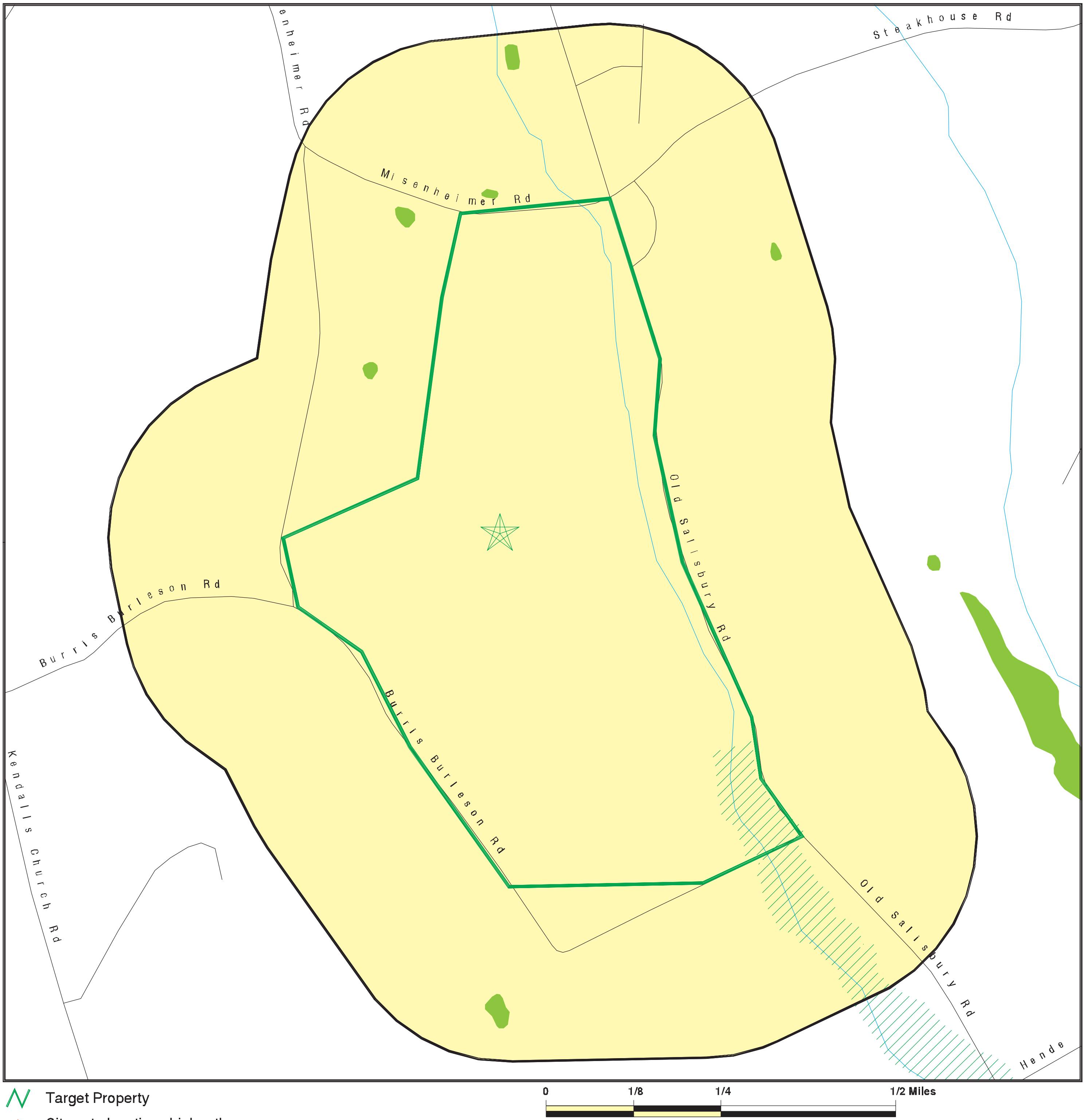




This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Marcus John Harward Property	CLIENT:	Baker Engineering & NY, Inc.
ADDRESS:	28978 Misenheimer Rd.	CONTACT:	Kristi Suggs
	New London NC 28127	INQUIRY #:	2864039.2s
LAT/LONG:	35.4311 / 80.2505	DATE:	September 08, 2010 12:22 pm

DETAIL MAP - 2864039.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Marcus John Harward Property	CLIENT:	Baker Engineering & NY, Inc.
ADDRESS:	28978 Misenheimer Rd.	CONTACT:	Kristi Suggs
	New London NC 28127	INQUIRY #:	2864039.2s
LAT/LONG:	35.4311 / 80.2505	DATE:	September 08, 2010 12:24 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
NPL LIENS		0.500	0	0	0	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.500	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		1.000	0	0	0	0	NR	0
FEDERAL FACILITY		1.500	0	0	0	0	0	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		1.000	0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS		1.500	0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		1.000	0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG		0.750	0	0	0	0	NR	0
RCRA-SQG		0.750	0	0	0	0	NR	0
RCRA-CESQG		0.750	0	0	0	0	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		1.000	0	0	0	0	NR	0
US INST CONTROL		1.000	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.500	0	0	0	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS		1.500	0	0	0	0	0	0
State- and tribal - equivalent CERCLIS								
SHWS		1.500	0	0	0	0	0	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF		1.000	0	0	0	0	NR	0
OLI		1.000	0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST		1.000	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST TRUST		1.000	0	0	0	0	NR	0
INDIAN LUST		1.000	0	0	0	0	NR	0
State and tribal registered storage tank lists								
UST		0.750	0	0	0	0	NR	0
AST		0.750	0	0	0	0	NR	0
INDIAN UST		0.750	0	0	0	0	NR	0
FEMA UST		0.750	0	0	0	0	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL		1.000	0	0	0	0	NR	0
State and tribal voluntary cleanup sites								
VCP		1.000	0	0	0	0	NR	0
INDIAN VCP		1.000	0	0	0	0	NR	0
State and tribal Brownfields sites								
BROWNFIELDS		1.000	0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9		1.000	0	0	0	0	NR	0
ODI		1.000	0	0	0	0	NR	0
HIST LF		1.000	0	0	0	0	NR	0
INDIAN ODI		1.000	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.500	0	0	0	NR	NR	0
US HIST CDL		0.500	0	0	0	NR	NR	0
Local Land Records								
LIENS 2		0.500	0	0	0	NR	NR	0
LUCIS		1.000	0	0	0	0	NR	0
Records of Emergency Release Reports								
HMIRS		0.500	0	0	0	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.750	0	0	0	0	NR	0
DOT OPS		0.500	0	0	0	NR	NR	0
DOD		1.500	0	0	0	0	0	0
FUDS		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
ROD		1.500	0	0	0	0	0	0
UMTRA		1.000	0	0	0	0	NR	0
MINES		0.750	0	0	0	0	NR	0
TRIS		0.500	0	0	0	NR	NR	0
TSCA		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
HIST FTTS		0.500	0	0	0	NR	NR	0
SSTS		0.500	0	0	0	NR	NR	0
ICIS		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
RADINFO		0.500	0	0	0	NR	NR	0
FINDS		0.500	0	0	0	NR	NR	0
RAATS		0.500	0	0	0	NR	NR	0
IMD		1.000	0	0	0	0	NR	0
UIC		0.500	0	0	0	NR	NR	0
DRYCLEANERS		0.750	0	0	0	0	NR	0
NPDES		0.500	0	0	0	NR	NR	0
INDIAN RESERV		1.500	0	0	0	0	0	0
SCRD DRYCLEANERS		1.000	0	0	0	0	NR	0
PCB TRANSFORMER		0.500	0	0	0	NR	NR	0
COAL ASH		1.000	0	0	0	0	NR	0
COAL ASH DOE		0.500	0	0	0	NR	NR	0
COAL ASH EPA		1.000	0	0	0	0	NR	0

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants		1.500	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
	NO SITES FOUND		

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
BADIN LAKE	S105516882	BADIN LAKE FAMILY BOAT CENTER	HWY 49 & HWY 8	28127	IMD
BADIN LAKE	S109015436	FAMILY BOAT CENTER BADIN LAKE	HWY 49 & HWY 8	28127	SHWS
NEW LONDON	S102328405	AT&T COMM.-NEW LONDON RELAY	HC 2554 & HWY 49	28127	IMD
NEW LONDON	U001191269	HW CULP LUMBER COMPANY	44091ST OLD S & PO BOX 235	28127	UST
NEW LONDON	U001190932	ALMONDS GROCERY	HWY 740	28127	UST
NEW LONDON	U001190886	RUSSELL'S ELECTRIC SHOP	HWY 8 & 49	28137	UST
NEW LONDON	U001194490	HIGHWAY 49 SPORTING GOODS	36488 NC 8/49 HWY	28127	UST
NEW LONDON	U001194299	NEW LONDON MAIN	BLAINE ROAD HWY	28127	UST
NEW LONDON	S108281172	TUCKERTOWN WTP	36576 NC HWY 49 N	28127	NPDES
NEW LONDON	U001190885	KENDALL VALLEY EXXON	OLD SALISBURY RD	28127	UST
NEW LONDON	1004747150	H W CULP LUMBER CO	44091 OLD US 52 HWY	28127	RCRA-CESQG, FINDS
NEW LONDON	S109164235	BLM	STREET	28127	SWF/LF
RICHFIELD	A100187876	CROOK OIL CO	RT 1	28137	AST
RICHFIELD	U001191526	SUNNYBROOK FARMS. INC.	RT 2	28137	UST
RICHFIELD	U003563112	BRS INC	HWY 49	28137	UST
RICHFIELD	S105702926	B.B. OIL INC	128 HWY 49 N	28137	IMD, LUST
RICHFIELD	U003160907	COX'S GROCERY	HWY 49	28137	IMD, LUST, UST
RICHFIELD	S101643244	BLUE DOOR STATION	HWY 49 & HWY 8	28137	IMD, LUST
RICHFIELD	1005624487		HWY 52	28137	FTTS, HIST FTTS, FINDS
RICHFIELD	U001190942	GALLOWAY 76	HWY 52	28137	UST
RICHFIELD	1004747437		HWY 53 FINCH RD	28137	RCRA-NonGen, FINDS
RICHFIELD	S107672043	B.B. EXXON	NC HWY 49	28137	IMD, LUST
RICHFIELD	U003562260	RICHFIELD BP 200	207 N HWY 49	28137	UST
RICHFIELD	S101166742	DOBY TRUST - PALMER FARM	OLD SALISBURY HWY	28137	IMD, LUST
RICHFIELD	S105218789	PALMER FARMS	OLD SALISBURY HWY	28137	LUST TRUST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 03/31/2010
Date Data Arrived at EDR: 04/02/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 10

Source: EPA
Telephone: N/A
Last EDR Contact: 07/14/2010
Next Scheduled EDR Contact: 10/25/2010
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 03/31/2010
Date Data Arrived at EDR: 04/02/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 10

Source: EPA
Telephone: N/A
Last EDR Contact: 07/14/2010
Next Scheduled EDR Contact: 10/25/2010
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/16/2010
Next Scheduled EDR Contact: 11/29/2010
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/31/2010
Date Data Arrived at EDR: 04/02/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 10

Source: EPA
Telephone: N/A
Last EDR Contact: 07/14/2010
Next Scheduled EDR Contact: 10/25/2010
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 01/29/2010
Date Data Arrived at EDR: 02/09/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 62

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 09/02/2010
Next Scheduled EDR Contact: 10/11/2010
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPAa??s Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 01/15/2010
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 07/21/2010
Next Scheduled EDR Contact: 10/25/2010
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 09/02/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 19

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 09/02/2010
Next Scheduled EDR Contact: 12/13/2010
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/25/2010
Date Data Arrived at EDR: 03/31/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 57

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 08/16/2010
Next Scheduled EDR Contact: 11/29/2010
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 08/19/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 08/19/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 08/19/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 08/19/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/20/2009	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/20/2010	Telephone: 703-603-0695
Date Made Active in Reports: 04/12/2010	Last EDR Contact: 06/14/2010
Number of Days to Update: 82	Next Scheduled EDR Contact: 09/27/2010
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/20/2009	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/20/2010	Telephone: 703-603-0695
Date Made Active in Reports: 04/12/2010	Last EDR Contact: 06/14/2010
Number of Days to Update: 82	Next Scheduled EDR Contact: 09/27/2010
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 07/09/2010	Source: National Response Center, United States Coast Guard
Date Data Arrived at EDR: 07/09/2010	Telephone: 202-267-2180
Date Made Active in Reports: 08/17/2010	Last EDR Contact: 07/09/2010
Number of Days to Update: 39	Next Scheduled EDR Contact: 10/18/2010
	Data Release Frequency: Annually

State- and tribal - equivalent NPL

HSDS: Hazardous Substance Disposal Site

Locations of uncontrolled and unregulated hazardous waste sites. The file includes sites on the National Priority List as well as those on the state priority list.

Date of Government Version: 04/06/2006	Source: North Carolina Center for Geographic Information and Analysis
Date Data Arrived at EDR: 02/28/2007	Telephone: 919-754-6580
Date Made Active in Reports: 04/13/2007	Last EDR Contact: 08/11/2010
Number of Days to Update: 44	Next Scheduled EDR Contact: 11/22/2010
	Data Release Frequency: Biennially

State- and tribal - equivalent CERCLIS

SHWS: Inactive Hazardous Sites Inventory

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 07/08/2010	Source: Department of Environment, Health and Natural Resources
Date Data Arrived at EDR: 07/12/2010	Telephone: 919-733-2801
Date Made Active in Reports: 08/05/2010	Last EDR Contact: 06/21/2010
Number of Days to Update: 24	Next Scheduled EDR Contact: 10/04/2010
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: List of Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 07/09/2010
Date Data Arrived at EDR: 07/09/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 27

Source: Department of Environment and Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 07/09/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Semi-Annually

OLI: Old Landfill Inventory

Old landfill inventory location information. (Does not include no further action sites and other agency lead sites).

Date of Government Version: 07/08/2010
Date Data Arrived at EDR: 07/12/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 24

Source: Department of Environment & Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 07/09/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LUST: Regional UST Database

This database contains information obtained from the Regional Offices. It provides a more detailed explanation of current and historic activity for individual sites, as well as what was previously found in the Incident Management Database. Sites in this database with Incident Numbers are considered LUSTs.

Date of Government Version: 05/14/2010
Date Data Arrived at EDR: 05/19/2010
Date Made Active in Reports: 06/14/2010
Number of Days to Update: 26

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 08/17/2010
Next Scheduled EDR Contact: 11/29/2010
Data Release Frequency: Quarterly

LUST TRUST: State Trust Fund Database

This database contains information about claims against the State Trust Funds for reimbursements for expenses incurred while remediating Leaking USTs.

Date of Government Version: 07/16/2010
Date Data Arrived at EDR: 07/22/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 14

Source: Department of Environment and Natural Resources
Telephone: 919-733-1315
Last EDR Contact: 07/22/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Semi-Annually

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 11/04/2009
Date Data Arrived at EDR: 05/04/2010
Date Made Active in Reports: 07/07/2010
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/11/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 05/19/2010
Date Data Arrived at EDR: 05/21/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 80

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Semi-Annually

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 05/27/2010
Date Data Arrived at EDR: 05/28/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 05/24/2010
Date Data Arrived at EDR: 05/27/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 74

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 05/04/2010
Date Data Arrived at EDR: 05/05/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 22

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Quarterly

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 05/03/2010
Date Data Arrived at EDR: 05/05/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 22

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

State and tribal registered storage tank lists

UST: Petroleum Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 04/30/2010
Date Data Arrived at EDR: 05/18/2010
Date Made Active in Reports: 06/14/2010
Number of Days to Update: 27

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 05/18/2010
Next Scheduled EDR Contact: 11/29/2010
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AST: AST Database
Facilities with aboveground storage tanks that have a capacity greater than 21,000 gallons.

Date of Government Version: 07/07/2010
Date Data Arrived at EDR: 07/07/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 29

Source: Department of Environment and Natural Resources
Telephone: 919-715-6183
Last EDR Contact: 07/07/2010
Next Scheduled EDR Contact: 10/11/2010
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/11/2010
Date Data Arrived at EDR: 02/11/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 60

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 05/19/2010
Date Data Arrived at EDR: 05/21/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 80

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Semi-Annually

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 05/04/2010
Date Data Arrived at EDR: 05/05/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 22

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 05/24/2010
Date Data Arrived at EDR: 05/27/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 74

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/01/2008
Date Data Arrived at EDR: 12/30/2008
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 76

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/11/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 05/27/2010
Date Data Arrived at EDR: 05/28/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 73

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Quarterly

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/03/2010
Date Data Arrived at EDR: 05/05/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 22

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Semi-Annually

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/19/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: No Further Action Sites With Land Use Restrictions Monitoring

A land use restricted site is a property where there are limits or requirements on future use of the property due to varying levels of cleanup possible, practical, or necessary at the site.

Date of Government Version: 06/29/2010
Date Data Arrived at EDR: 07/06/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 30

Source: Department of Environment, Health and Natural Resources
Telephone: 919-733-2801
Last EDR Contact: 06/21/2010
Next Scheduled EDR Contact: 10/04/2010
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP: Responsible Party Voluntary Action Sites
Responsible Party Voluntary Action site locations.

Date of Government Version: 06/29/2010
Date Data Arrived at EDR: 07/06/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 30

Source: Department of Environment and Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 06/21/2010
Next Scheduled EDR Contact: 10/04/2010
Data Release Frequency: Semi-Annually

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 04/02/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 07/08/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Projects Inventory
A brownfield site is an abandoned, idled, or underused property where the threat of environmental contamination has hindered its redevelopment. All of the sites in the inventory are working toward a brownfield agreement for cleanup and liabitliy control.

Date of Government Version: 09/30/2009
Date Data Arrived at EDR: 07/21/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 15

Source: Department of Environment and Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 07/13/2010
Next Scheduled EDR Contact: 10/25/2010
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 06/24/2010
Date Data Arrived at EDR: 06/25/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 06/25/2010
Next Scheduled EDR Contact: 10/11/2010
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 07/28/2010
Next Scheduled EDR Contact: 09/20/2010
Data Release Frequency: Varies

HIST LF: Solid Waste Facility Listing
A listing of solid waste facilities.

Date of Government Version: 11/06/2006
Date Data Arrived at EDR: 02/13/2007
Date Made Active in Reports: 03/02/2007
Number of Days to Update: 17

Source: Department of Environment & Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 01/19/2009
Next Scheduled EDR Contact: 04/19/2009
Data Release Frequency: Quarterly

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 09/07/2010
Next Scheduled EDR Contact: 11/22/2010
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 05/07/2010
Date Data Arrived at EDR: 06/18/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 60

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/08/2010
Next Scheduled EDR Contact: 09/20/2010
Data Release Frequency: Quarterly

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 05/06/2010
Date Data Arrived at EDR: 05/11/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 90

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 08/02/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 09/08/2010
Next Scheduled EDR Contact: 12/06/2010
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 04/06/2010
Date Data Arrived at EDR: 04/07/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 50

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 07/09/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Annually

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 08/19/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 01/12/2010
Date Data Arrived at EDR: 02/09/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 62

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 08/11/2010
Next Scheduled EDR Contact: 11/22/2010
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 07/22/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 09/30/2009
Date Made Active in Reports: 12/01/2009
Number of Days to Update: 62

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 08/12/2010
Next Scheduled EDR Contact: 09/27/2010
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 04/11/2010
Date Data Arrived at EDR: 04/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 28

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 07/08/2010
Next Scheduled EDR Contact: 10/18/2010
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 06/01/2010
Date Data Arrived at EDR: 06/16/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 62

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 06/16/2010
Next Scheduled EDR Contact: 09/27/2010
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 01/05/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 05/08/2009
Number of Days to Update: 1

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 09/01/2010
Next Scheduled EDR Contact: 12/13/2010
Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/07/2010
Date Data Arrived at EDR: 06/09/2010
Date Made Active in Reports: 08/30/2010
Number of Days to Update: 82

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 06/09/2010
Next Scheduled EDR Contact: 09/20/2010
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 01/13/2010
Date Made Active in Reports: 02/18/2010
Number of Days to Update: 36

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 09/01/2010
Next Scheduled EDR Contact: 12/13/2010
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002
Date Data Arrived at EDR: 04/14/2006
Date Made Active in Reports: 05/30/2006
Number of Days to Update: 46

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 07/07/2010
Next Scheduled EDR Contact: 10/11/2010
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/30/2010
Next Scheduled EDR Contact: 12/13/2010
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/30/2010
Next Scheduled EDR Contact: 12/13/2010
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 01/06/2010
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 08/16/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 04/24/2010
Date Data Arrived at EDR: 04/29/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 18

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 06/25/2010
Next Scheduled EDR Contact: 10/11/2010
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB’s who are required to notify the EPA of such activities.

Date of Government Version: 02/01/2010
Date Data Arrived at EDR: 04/22/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 109

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 07/30/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 03/18/2010
Date Data Arrived at EDR: 04/06/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 51

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 06/14/2010
Next Scheduled EDR Contact: 09/27/2010
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/13/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/14/2010
Next Scheduled EDR Contact: 10/25/2010
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/14/2010	Source: EPA
Date Data Arrived at EDR: 04/16/2010	Telephone: (404) 562-9900
Date Made Active in Reports: 05/27/2010	Last EDR Contact: 07/07/2010
Number of Days to Update: 41	Next Scheduled EDR Contact: 09/27/2010
	Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995	Source: EPA
Date Data Arrived at EDR: 07/03/1995	Telephone: 202-564-4104
Date Made Active in Reports: 08/07/1995	Last EDR Contact: 06/02/2008
Number of Days to Update: 35	Next Scheduled EDR Contact: 09/01/2008
	Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2007	Source: EPA/NTIS
Date Data Arrived at EDR: 02/25/2010	Telephone: 800-424-9346
Date Made Active in Reports: 05/12/2010	Last EDR Contact: 08/24/2010
Number of Days to Update: 76	Next Scheduled EDR Contact: 12/06/2010
	Data Release Frequency: Biennially

IMD: Incident Management Database

Groundwater and/or soil contamination incidents

Date of Government Version: 07/21/2006	Source: Department of Environment and Natural Resources
Date Data Arrived at EDR: 08/01/2006	Telephone: 919-733-3221
Date Made Active in Reports: 08/23/2006	Last EDR Contact: 07/09/2010
Number of Days to Update: 22	Next Scheduled EDR Contact: 10/18/2010
	Data Release Frequency: Quarterly

UIC: Underground Injection Wells Listing

A listing of uncerground injection wells locations.

Date of Government Version: 05/25/2010	Source: Department of Environment & Natural Resources
Date Data Arrived at EDR: 05/27/2010	Telephone: 919-733-3221
Date Made Active in Reports: 06/14/2010	Last EDR Contact: 08/16/2010
Number of Days to Update: 18	Next Scheduled EDR Contact: 11/29/2010
	Data Release Frequency: Varies

DRYCLEANERS: Drycleaning Sites

Potential and known drycleaning sites, active and abandoned, that the Drycleaning Solvent Cleanup Program has knowledge of and entered into this database.

Date of Government Version: 06/24/2010
Date Data Arrived at EDR: 07/08/2010
Date Made Active in Reports: 08/05/2010
Number of Days to Update: 28

Source: Department of Environment & Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 07/08/2010
Next Scheduled EDR Contact: 10/11/2010
Data Release Frequency: Varies

NPDES: NPDES Facility Location Listing
General information regarding NPDES(National Pollutant Discharge Elimination System) permits.

Date of Government Version: 06/07/2010
Date Data Arrived at EDR: 06/09/2010
Date Made Active in Reports: 06/14/2010
Number of Days to Update: 5

Source: Department of Environment & Natural Resources
Telephone: 919-733-7015
Last EDR Contact: 08/23/2010
Next Scheduled EDR Contact: 11/22/2010
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 07/22/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 05/12/2010
Date Data Arrived at EDR: 05/13/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 96

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 08/23/2010
Next Scheduled EDR Contact: 11/08/2010
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 07/22/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: N/A

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 01/01/2008
Date Data Arrived at EDR: 02/18/2009
Date Made Active in Reports: 05/29/2009
Number of Days to Update: 100

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 08/10/2010
Next Scheduled EDR Contact: 11/15/2010
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 11/09/2009
Date Data Arrived at EDR: 12/18/2009
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/14/2010
Next Scheduled EDR Contact: 09/27/2010
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 07/21/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Sites
A listing of coal combustion products distribution permits issued by the Division for the treatment, storage, transportation, use and disposal of coal combustion products.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/04/2009
Date Made Active in Reports: 08/17/2009
Number of Days to Update: 13

Source: Department of Environment & Natural Resources
Telephone: 919-807-6359
Last EDR Contact: 08/23/2010
Next Scheduled EDR Contact: 11/22/2010
Data Release Frequency: Varies

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 09/11/2009
Number of Days to Update: 16

Source: Department of Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 08/25/2010
Next Scheduled EDR Contact: 12/06/2010
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/22/2010
Date Made Active in Reports: 08/26/2010
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 07/22/2010
Next Scheduled EDR Contact: 11/01/2010
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 04/30/2010
Date Data Arrived at EDR: 05/13/2010
Date Made Active in Reports: 06/21/2010
Number of Days to Update: 39

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 08/11/2010
Next Scheduled EDR Contact: 11/22/2010
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 12/01/2009
Date Made Active in Reports: 12/14/2009
Number of Days to Update: 13

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 08/23/2010
Next Scheduled EDR Contact: 12/06/2010
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/19/2010
Date Made Active in Reports: 08/26/2010
Number of Days to Update: 38

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 08/30/2010
Next Scheduled EDR Contact: 12/13/2010
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/06/2010
Date Made Active in Reports: 07/26/2010
Number of Days to Update: 20

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 06/21/2010
Next Scheduled EDR Contact: 10/04/2010
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association’s annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Health & Human Services
Telephone: 919-662-4499

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Department of Environment & Natural Resources
Telephone: 919-733-2090

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

MARCUS JOHN HARWARD PROPERTY
28978 MISENHEIMER RD.
NEW LONDON, NC 28127

TARGET PROPERTY COORDINATES

Latitude (North):	35.43110 - 35˚ 25’ 52.0’’
Longitude (West):	80.2505 - 80˚ 15’ 1.8’’
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	568034.7
UTM Y (Meters):	3920911.2
Elevation:	608 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	35080-D3 RICHFIELD, NC
Most Recent Revision:	2002
East Map:	35080-D2 NEW LONDON, NC
Most Recent Revision:	1994

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

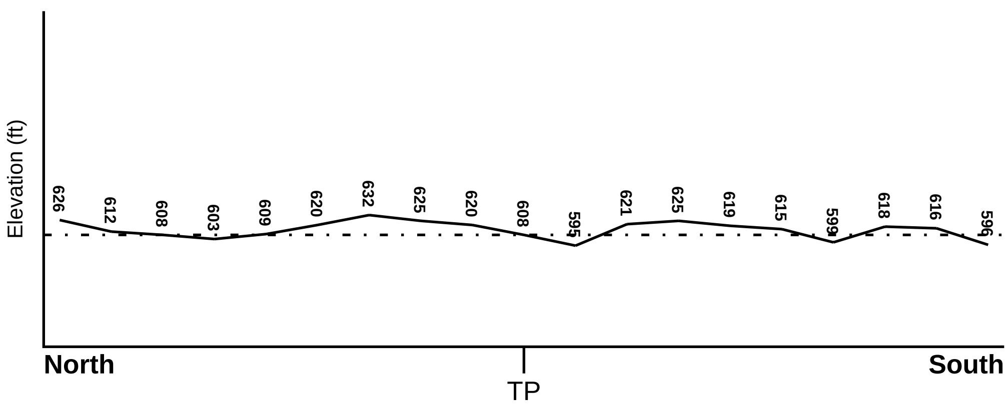
TOPOGRAPHIC INFORMATION

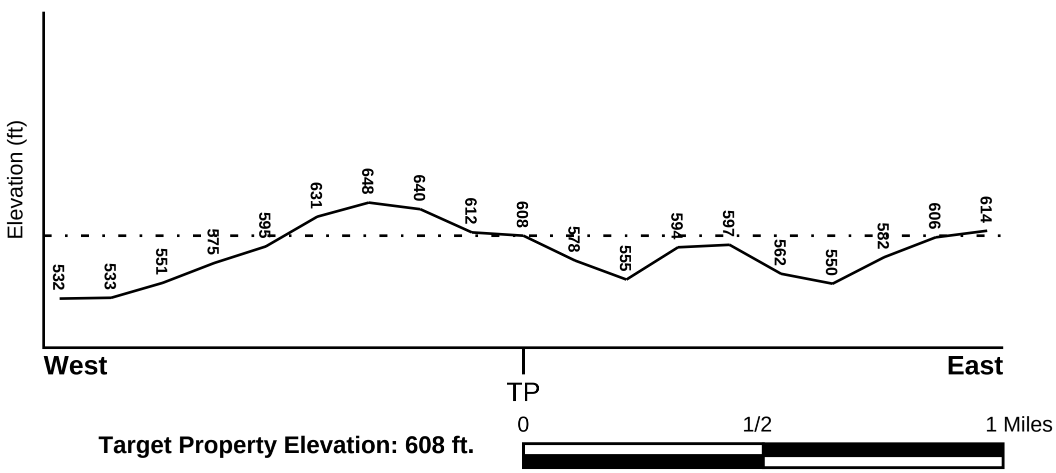
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General East

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 608 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
STANLY, NC	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 37167C - FEMA DFIRM Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
RICHFIELD	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era:	Paleozoic
System:	Cambrian
Series:	Cambrian volcanic rocks
Code:	Cv *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Volcanic Rocks

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name:	HERNDON
Soil Surface Texture:	silt loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel:	HIGH
Depth to Bedrock Min:	> 60 inches
Depth to Bedrock Max:	> 60 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	9 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 2.00 Min: 0.60	Max: 6.50 Min: 4.50
2	9 inches	48 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Elastic silt.	Max: 2.00 Min: 0.60	Max: 5.50 Min: 3.60
3	48 inches	68 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Elastic silt.	Max: 2.00 Min: 0.60	Max: 5.50 Min: 3.60

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: sandy loam
gravelly - silt loam
stony - silt loam
clay loam
channery - silt loam
loam

Surficial Soil Types: sandy loam
gravelly - silt loam
stony - silt loam
clay loam
channery - silt loam
loam

Shallow Soil Types: silty clay loam
sandy clay
silt loam
loam
clay loam
very channery - silt loam

Deeper Soil Types: silty clay loam
weathered bedrock
unweathered bedrock
sandy clay loam
clay

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.500
Federal FRDS PWS	Nearest PWS within 0.500 miles
State Database	1.500

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	USGS2260114	1/8 - 1/4 Mile North
2	USGS2259882	1 - 2 Miles WNW
A3	USGS2260086	1 - 2 Miles SW
A4	USGS2260084	1 - 2 Miles SW
A5	USGS2260085	1 - 2 Miles SW
6	USGS2260068	1 - 2 Miles SSW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP

No PWS System Found

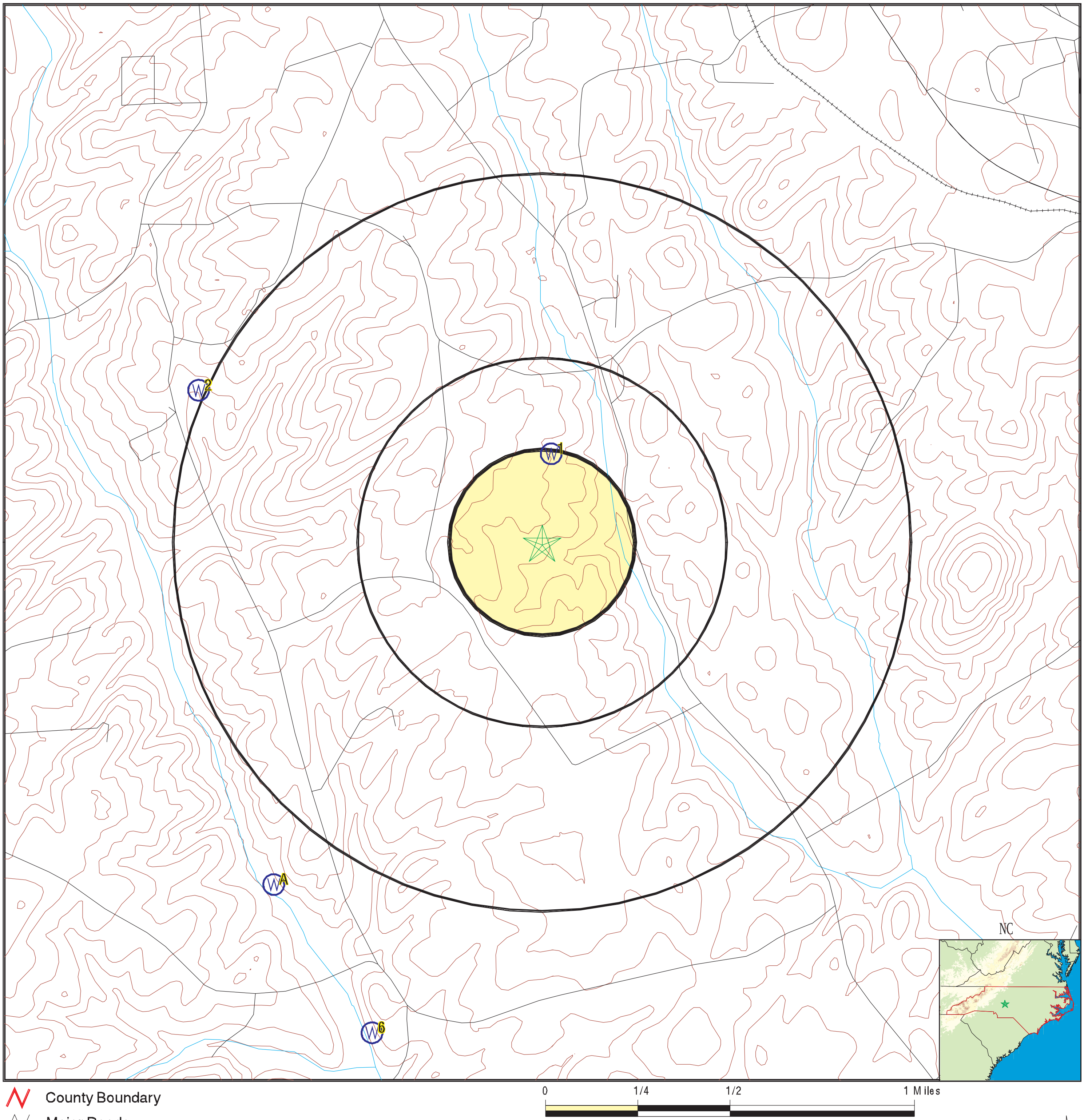
Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP

No Wells Found

PHYSICAL SETTING SOURCE MAP - 2864039.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location

Wildlife Areas
Natural Areas
Rare & Endangered Species

SITE NAME:	Marcus John Harward Property	CLIENT:	Baker Engineering & NY, Inc.
ADDRESS:	28978 Misenheimer Rd.	CONTACT:	Kristi Suggs
	New London NC 28127	INQUIRY #:	2864039.2s
LAT/LONG:	35.4311 / 80.2505	DATE:	September 08, 2010 12:24 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **North** **1/8 - 1/4 Mile** **Higher**	**FED USGS**	**USGS2260114**

Agency cd:	USGS	Site no:	352604080150101
Site name:	ST-42		
Latitude:	352604	EDR Site id:	USGS2260114
Longitude:	0801501	Dec lat:	35.43458569
Dec lon:	-80.25005714	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	37
State:	37	County:	167
Country:	US	Land net:	Not Reported
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	Not Reported		
Altitude method:	Not Reported		
Altitude accuracy:	Not Reported		
Altitude datum:	Not Reported		
Hydrologic:	Not Reported		
Topographic:	Hilltop		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	EST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ARGILLITE		
Well depth:	89.0	Hole depth:	Not Reported
Source of depth data:	reporting agency (generally USGS)		
Project number:	453709900		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1965-00-00	Ground water data end date:	1965-00-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1965	40	

2 **WNW** **1 - 2 Miles** **Lower**	**FED USGS**	**USGS2259882**

Agency cd:	USGS	Site no:	352613080160201
Site name:	ST-43		
Latitude:	352613	EDR Site id:	USGS2259882
Longitude:	0801602	Dec lat:	35.4370856
Dec lon:	-80.26700201	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	37
State:	37	County:	167
Country:	US	Land net:	Not Reported
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	Not Reported		
Altitude method:	Not Reported		
Altitude accuracy:	Not Reported		
Altitude datum:	Not Reported		
Hydrologic:	Not Reported		
Topographic:	Hillside (slope)		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	EST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ARGILLITE		
Well depth:	116.0	Hole depth:	Not Reported
Source of depth data:	reporting agency (generally USGS)		
Project number:	453709900		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

A3
SW
1 - 2 Miles
Lower

FED USGS **USGS2260086**

Agency cd:	USGS	Site no:	352503080154903
Site name:	ST-58		
Latitude:	352503	EDR Site id:	USGS2260086
Longitude:	0801549	Dec lat:	35.41764153
Dec lon:	-80.26339126	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	37
State:	37	County:	167
Country:	US	Land net:	Not Reported
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	Not Reported		
Altitude method:	Not Reported		
Altitude accuracy:	Not Reported		
Altitude datum:	Not Reported		
Hydrologic:	Not Reported		
Topographic:	Valley flat		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	EST

Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	EPICLASTIC METAVOLCANIC ROCK		
Well depth:	115.0	Hole depth:	Not Reported
Source of depth data:	reporting agency (generally USGS)		
Project number:	453709900		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1965-00-00	Ground water data end date:	1965-00-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1965	30	

A4
SW
1 - 2 Miles
Lower

FED USGS **USGS2260084**

Agency cd:	USGS	Site no:	352503080154901
Site name:	ST-56		
Latitude:	352503	EDR Site id:	USGS2260084
Longitude:	0801549	Dec lat:	35.41764153
Dec lon:	-80.26339126	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	37
State:	37	County:	167
Country:	US	Land net:	Not Reported
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	Not Reported		
Altitude method:	Not Reported		
Altitude accuracy:	Not Reported		
Altitude datum:	Not Reported		
Hydrologic:	Not Reported		
Topographic:	Valley flat		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	EST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	EPICLASTIC METAVOLCANIC ROCK		
Well depth:	330.0	Hole depth:	Not Reported
Source of depth data:	reporting agency (generally USGS)		
Project number:	453709900		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1965-00-00	Ground water data end date:	1965-00-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1965	60	

A5
SW
1 - 2 Miles
Lower

FED USGS **USGS2260085**

Agency cd:	USGS	Site no:	352503080154902
Site name:	ST-57		
Latitude:	352503	EDR Site id:	USGS2260085
Longitude:	0801549	Dec lat:	35.41764153
Dec lon:	-80.26339126	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	37
State:	37	County:	167
Country:	US	Land net:	Not Reported
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	Not Reported		
Altitude method:	Not Reported		
Altitude accuracy:	Not Reported		
Altitude datum:	Not Reported		
Hydrologic:	Not Reported		
Topographic:	Hilltop		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	EST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	EPICLASTIC METAVOLCANIC ROCK		
Well depth:	230.0	Hole depth:	Not Reported
Source of depth data:	reporting agency (generally USGS)		
Project number:	453709900		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

6
SSW
1 - 2 Miles
Lower

FED USGS **USGS2260068**

Agency cd:	USGS	Site no:	352442080153201
Site name:	ST-59		
Latitude:	352442	EDR Site id:	USGS2260068
Longitude:	0801532	Dec lat:	35.41180832
Dec lon:	-80.25866904	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	37
State:	37	County:	167
Country:	US	Land net:	Not Reported
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	Not Reported		
Altitude method:	Not Reported		
Altitude accuracy:	Not Reported		
Altitude datum:	Not Reported		
Hydrologic:	Not Reported		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	EST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	EPICLASTIC METAVOLCANIC ROCK		
Well depth:	110.0	Hole depth:	Not Reported
Source of depth data:	reporting agency (generally USGS)		
Project number:	453709900		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: NC Radon

Radon Test Results

County	Result Type	Total Sites	Avg pCi/L	Range pCi/L	Result Type
STANLY	Statistical	5	0.86	0.30-2.00	Non-Statistical
STANLY	37	2.56	0.00-12.30		

Federal EPA Radon Zone for STANLY County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for STANLY COUNTY, NC

Number of sites tested: 3

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.400 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	1.167 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5’ Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5’ Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5’ Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Department of Environment & Natural Resources
Telephone: 919-733-2090

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

North Carolina Public Water Supply Wells
Source: Department of Environmental Health
Telephone: 919-715-3243

OTHER STATE DATABASE INFORMATION

NC Natural Areas: Significant Natural Heritage Areas
Source: Center for Geographic Information and Analysis
Telephone: 919-733-2090
A polygon converage identifying sites (terrestrial or aquatic that have particular biodiversity significance. A site's significance may be due to the presenceof rare species, rare or hight quality natural communities, or other important ecological features.

NC Game Lands: Wildlife Resources Commission Game Lands
Source: Center for Geographic Information and Analysis
Telephone: 919-733-2090
All publicly owned game lands managed by the North Carolina Wildlife Resources Commission and as listed in Hunting and Fishing Maps.

NC Natural Heritage Sites: Natural Heritage Element Occurrence Sites
Source: Center for Geographic Information and Analysis
Telephone: 919-733-2090
A point coverage identifying locations of rare and endangered species, occurrences of exemplary or unique natural ecosystems (terrestrial or aquatic), and special animal habitats (e.g., colonial waterbird nesting sites).

RADON

State Database: NC Radon
Source: Department of Environment & Natural Resources
Telephone: 919-733-4984
Radon Statistical and Non Statiscal Data

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

STREET AND ADDRESS INFORMATION

Marcus John Harward Property
28978 Misenheimer Rd.
New London, NC 28127

Inquiry Number: 2864039.3
September 08, 2010

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

9/08/10

Site Name:	Client Name:
Marcus John Harward Property	Baker Engineering & NY, Inc.
28978 Misenheimer Rd.	1447 S. Tryon Street
New London, NC 28127	Charlotte, NC 28203
EDR Inquiry # 2864039.3	Contact: Kristi Suggs

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by Baker Engineering & NY, Inc. were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name:	Marcus John Harward Property
Address:	28978 Misenheimer Rd.
City, State, Zip:	New London, NC 28127
Cross Street:	
P.O. #	NA
Project:	120857 Task 1.0
Certification #	A342-47A6-9980

Sanborn® Library search results
Certification # A342-47A6-9980

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Appendix D

Regulatory Agency Correspondence

Baker

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

September 20, 2010

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: EEP Wetland and Stream mitigation project in Stanly County

Dear Ms. Gledhill-Earley,

The Ecosystem Enhancement Program (EEP) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential wetland and stream restoration project on the attached site (USGS site maps with approximate property lines, areas of potential ground disturbance, and locations of and photographs of structures (if applicable) are enclosed).

The UT to Town Creek Stream Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Several sections of channel have been identified as significantly degraded.

No architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. The project site is located on a 154-acre cattle farm and the majority of the site has historically been disturbed due to agricultural purposes. Cattle hoof shear and minimal vegetated root mass on the stream banks have provided excess sediment to the stream from bank erosion and bacteria and nutrients from animal waste. Enclosed are current photos of the site.

We ask that you review this site based on the attached information to determine the presence of any historic properties.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kristi Suggs

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203

Enclosures

cc: Guy Pearce, EEP Full Deliverable Supervisor
1652 Mail Service Center
Raleigh, NC 27699-1652

RECEIVED OCT 1 1 2010

North Carolina Department of Cultural Resources

State Historic Preservation Office
Peter B. Sandbeck, Administrator

Beverly Eaves Perdue, Governor
Linda A. Carlisle, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

October 7, 2010

Kristi Leadmon Suggs
Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, NC 28203

Re: Unnamed Tributary to Town Creek EEP Wetland and Stream Mitigation, Stanly County, ER 10-1789

Dear Ms. Leadmon Suggs:

Thank you for your letter of September 20, 2010, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Peter Sandbeck

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

September 20, 2010

Tyler Howe
Tribal Historic Preservation Specialist
Eastern Band of Cherokee Indians
Tribal Historic Preservation Office
P.O. Box 455
Cherokee, NC 28719

Subject: EEP Wetland and Stream mitigation project in Stanly County

Dear Mr. Howe,

The Ecosystem Enhancement Program (EEP) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential wetland and stream restoration project on the attached site (USGS site maps with approximate property lines, areas of potential ground disturbance, and locations of and photographs of structures (if applicable) are enclosed).

A similar letter has been sent to the North Carolina State Preservation Office for compliance with Section 106 of the Historic Preservation Act.

The UT to Town Creek Stream Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Several sections of channel have been identified as significantly degraded.

No architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. The project site is located on a 154-acre cattle farm and the majority of the site has historically been disturbed due to agricultural purposes**.** Cattle hoof shear and minimal vegetated root mass on the stream banks have provided excess sediment to the stream from bank erosion and bacteria and nutrients from animal waste. Enclosed are current photos of the site.

We ask that you review this site based on the attached information to determine if you know of any existing resources that we need to know about. In addition, please let us know what the level your future involvement with this project needs to be (if any).

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced EEP Project Manager with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203

Enclosures

cc: Guy Pearce, EEP Full Deliverable Supervisor
1652 Mail Service Center
Raleigh, NC 27699-1652

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

October 1, 2010

Marella Buncick
US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801

Subject: UT to Town Creek; EEP Wetland and Stream mitigation project in Stanly County

Dear Ms. Buncick,

The UT to Town Creek Stream Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project site is located on a 154-acre cattle farm and the majority of the site has historically been disturbed due to agricultural purposes**.** Cattle hoof shear and minimal vegetated root mass on the stream banks have provided excess sediment to the stream from bank erosion and bacteria and nutrients from animal waste. Enclosed are current photos of the site.

We have already obtained an updated species list for Stanly County from your web site (http://nc-es.fws.gov/es/countyfr.html). The threatened or endangered species for this county are: the *Helianthus schweinitzii* (Schweinitz's sunflower) and the *Haliaeetus leucocephalus* (Bald Eagle). We are requesting that you please provide any known information for each species in the county. The USFWS will be contacted if suitable habitat for any listed species is found or if we determine that the project may affect one or more federally listed species or designated critical habitat.

Please provide comments on any possible issues that might emerge with respect to endangered species, migratory birds or other trust resources from the construction of a wetland and/or stream restoration project on the subject property. A USGS map showing the approximate property lines and areas of potential ground disturbance is enclosed.

If we have not heard from you in 30 days we will assume that our species list is correct, that you do not have any comments regarding associated laws, and that you do not have any information relevant to this project at the current time.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203
Phone (704) 319-7882, Email: ksuggs@mbakercorp.com

Enclosures

cc: Guy Pearce, EEP Full Deliverable Supervisor
1652 Mail Service Center
Raleigh, NC 27699-1652

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

November 3, 2010

Marella Buncick
US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801

Subject: UT to Town Creek; EEP Wetland and Stream mitigation project in Stanly County

Dear Ms. Buncick,

The UT to Town Creek Stream Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project site is located on a system of unnamed tributaries to Town Creek that have been identified as significantly degraded due to livestock and agricultural purposes. We first notified your office of the UT to Town Creek Project on October 1, 2010.

We performed a pedestrian survey of the site on Sept. 28, 2010 for both the threatened/endangered and protected species for this county: the *Helianthus schweinitzii* (Schweinitz's sunflower) and the *Haliaeetus leucocephalus* (Bald Eagle). No federal protected species were observed in or adjacent to the project area during this field survey. No suitable habitat was found for the Bald Eagle; therefore we believe that the Project's restoration efforts will have no affect on the bald eagle. As for the Schweinitz's sunflower, only marginal habitat was present; therefore, based on the field survey finding no species present and insufficient habitat, we believe that the Project's restoration efforts will have no affect on the Schweinitz's sunflower.

We would like your concurrence on the biological conclusions drawn on the Bald Eagle and the Schweinitz's sunflower. We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203
Phone (704) 319-7882, Email: ksuggs@mbakercorp.com

cc: Guy Pearce, EEP Full Deliverable Supervisor
1652 Mail Service Center
Raleigh, NC 27699-1652

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

October 1, 2010

Shannon Deaton
North Carolina Wildlife Resource Commission
Division of Inland Fisheries
1721 Mail Service Center
Raleigh, NC 27699

Subject: UT to Town Creek; EEP Wetland and Stream mitigation project in Stanly County

Dear Ms. Deaton,

The purpose of this letter is to request review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with a potential wetland and stream restoration project on the attached site (USGS site maps with approximate property lines and areas of potential ground disturbance are enclosed).

The UT to Town Creek Stream Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. The project site is located on a 154-acre cattle farm and the majority of the site has historically been disturbed due to agricultural purposes**.** Cattle hoof shear and minimal vegetated root mass on the stream banks have provided excess sediment to the stream from bank erosion and bacteria and nutrients from animal waste.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203
Phone (704) 319-7882, Email: ksuggs@mbakercorp.com

Enclosures

cc: Guy Pearce, EEP Full Deliverable Supervisor
1652 Mail Service Center
Raleigh, NC 27699-1652

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

22 October 2010

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon Street, Suite 200
Charlotte, NC 28203

Subject: UT Town Creek; EEP Wetland and Stream Mitigation Project – Stanly County, North Carolina.

Dear Ms. Leadmon Suggs:

Biologists with the North Carolina Wildlife Resources Commission have reviewed the subject information. Our comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d) and North Carolina General Statutes (G.S. 113-131 et seq.).

The proposed project includes stream channel and wetlands restoration along an unnamed tributary to Town Creek. Town Creek is a tributary to Little Long Creek in the Yadkin-Pee Dee River basin. A portion of the proposed stream restoration site parallels a road. While it appears a riparian buffer will be maintained between the road and stream restoration site, additional measures may be needed to minimize the impact of stormwater runoff from the road on downstream aquatic habitat.

Stream and wetland restoration projects often improve water quality and aquatic habitat. We recommend establishing native, forested buffers in riparian areas to protect water quality, improve terrestrial habitat, and provide a travel corridor for wildlife species. Provided natural channel design methods are used and measures are taken to minimize erosion and sedimentation from construction/restoration activities, we do not anticipate the project to result in significant adverse impacts to aquatic and terrestrial wildlife resources.

Thank you for the opportunity to review this proposed project. If we can provide further assistance, please contact our office at (336) 449-7625.

Sincerely,

Shari L Bryant

Shari L. Bryant
Piedmont Region Coordinator
Habitat Conservation Program

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

October 1, 2010

Nathan Lowder
District Conservationist
USDA Natural Resources Conservation Service
Albemarle Service Center
26032C Newt Rd.
Albemarle, NC 28001-7461

Subject: UT to Town Creek; EEP Wetland and Stream mitigation project in Stanly County

Dear Mr. Lowder:

The purposed of this letter is to request your assistance in completing a Farmland Conversion Impact Rating form for the Project site. Enclosed please find a copy of the form, a Vicinity map, a USGS Topographic Map, and a Soils Map of the Project Area. For this Restoration project, ground disturbing activities are indicated by the areas bounded in black on the enclosed soil maps. These areas include 3.4 acres of Tarrus Channery Silt Loam, 15.4 acres of Oakboro Silt Loam, 0.01 acres of Kirksey Silt Loam, 3.9 acres of Goldston Very Channery Loam, and 6.1 acres of Badin Channery Silt Loam. Based on our evaluation, we estimate that 28.8 acres of Prime Farmland will be converted to non-agricultural use by this action.

We know that you have more familiarity with the region and we will be happy to make any changes to the form that you deem appropriate. Please return the form to us with your determinations and we will fill out the remainder of the form.

If you have any questions, please feel free to contact me at (704) 319-7882 or ksuggs@mbakercorp.com. Thank you for your assistance in this matter.

Sincerely,

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203

Enclosures

cc: Guy Pearce, EEP Full Deliverable Supervisor
1652 Mail Service Center
Raleigh, NC 27699-1652

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
4407 Bland Road, Suite 117
Raleigh, North Carolina 27609

Milton Cortes, Assistant State Soil Scientist
Phone: (919) 873-2171

E-mail: milton.cortes@nc.usda.gov

November 15, 2010

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S Tryon St., Ste. 200
Charlotte, NC 28203

Dear Ms. Leadmon

The following information is in response to your request asking for information on farmlands in the UT to Town Creek; EEP Wetland and Stream mitigation project in Stanley County.

Projects are subject to Farmland Protection Policy Act (FPPA) requirements if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use and are completed by a Federal agency or with assistance from a Federal agency. For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land.

Farmland, as previously defined, does not include land already in or committed to urban development or water storage. Other farmland "already in" urban development includes all land that has been designated for commercial or industrial use or residential use that is not intended at the same time to protect farmland in a,

1. Zoning code or ordinance adopted by the state or local unit of government or;
2. A comprehensive land use plan which has expressly been either adopted or reviewed in its entirety by the unit of local government in whose jurisdiction it is operative within 10 years preceding the implementation of the project or;
3. See over for more information.

The area in question meets one or more of the Farmland criteria as described in the second paragraph. The project is subject to the FPPA. Enclosed are the completed a Farmland Conversion Impact Rating form (AD1006), according to Federal Register 7CFR Part 658, Farmland Protection Policy Act; 1-1-99 Edition.

If you have any questions, please contact me at number above.

Sincerely,

Milton Cortes
Assistant State Soil Scientist

Assistant State Soil Scientist

Projects and Activities

Projects are subject to FPPA requirements if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use and are completed by a Federal agency or with assistance from a Federal agency.

Assistance from a Federal agency includes:

- Acquiring or disposing of land.
- Providing financing or loans.
- Managing property.
- Providing technical assistance

Activities that may be subject to FPPA include:

- State highway construction projects, (through the Federal Highway Administration)
- Airport expansions
- Electric cooperative construction projects
- Railroad construction projects
- Telephone company construction projects
- Reservoir and hydroelectric projects
- Federal agency projects that convert farmland
- Other projects completed with Federal assistance.

Activities not subject to FPPA include:

- Federal permitting and licensing
- Projects planned and completed without the assistance of a Federal agency
- Projects on land already in urban development or used for water storage
- Construction within an existing right-of-way purchased on or before August 4, 1984
- Construction for national defense purposes
- Construction of on-farm structures needed for farm operations
- Surface mining, where restoration to agricultural use is planned
- Construction of new minor secondary structures such as a garage or storage shed.

Michael Baker Engineering, Inc.
1447 South Tryon Street
Suite 200
Charlotte, North Carolina
Phone: 704-334-4454
Fax: 704-334-4492

November 16, 2010

Milton Cortes
Assistant State Soil Scientist
USDA Natural Resources Conservation Service
4407 Bland Road, Suite 117
Raleigh, NC 27609

Subject: USDA Farmland Conversion Impact Rating Form for UT to Town Creek EEP Wetland and Stream mitigation project in Stanly County

Dear Mr. Cortes:

Thank you for your assistance in completing a Farmland Conversion Impact Rating form for the UT to Town Creek site. Enclosed please find a copy of the completed form.

We know that you have more familiarity with the site, so we will be happy to make any changes to the form that you deem appropriate. Please return the form to us if changes are needed, via email or fax, whichever is more convenient. If needed, our fax number is (704) 334-4492. Otherwise we will send a copy of the completed form to the NC Ecosystem Enhancement Program as part of the categorical exclusion document.

If you have any questions, please feel free to contact me at (704) 319-7882 or ksuggs@mbakercorp.com. Thank you for your assistance in this matter.

Sincerely,

Kristi R. Leadmon Suggs
Michael Baker Engineering, Inc.
1447 S. Tryon St., Ste. 200
Charlotte, NC 28203

Enclosure

Cc: Nathan Lowder, Stanly Co. District Conservationist
USDA Natural Resources Conservation Service
Albemarle Service Center, 26032C Newt Rd.
Albemarle, NC 28001-7461

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request September 24, 2010
Name of Project UT to Town Creek Restoration	Federal Agency Involved FHWA
Proposed Land Use Stream and Wetland Restoration	County and State Stanley, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS / Person Completing Form: Milton Cortes, Raleigh NC

Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☒	NO ☐	Acres Irrigated	Average Farm Size 150 acres
Major Crop(s) Corn	Farmable Land In Govt. Jurisdiction Acres: 198,232 % 76.5%		Amount of Farmland As Defined in FPPA Acres: 162,996 % 55%	
Name of Land Evaluation System Used Stanley Co.	Name of State or Local Site Assessment System N/A		Date Land Evaluation Returned by NRCS	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		28.8			
B. Total Acres To Be Converted Indirectly		0			
C. Total Acres In Site		28.8			
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		18.8			
B. Total Acres Statewide Important or Local Important Farmland		6.1			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0.0153			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value		63			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)		64			
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	15			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	18			
4. Protection Provided By State and Local Government	(20)	20			
5. Distance From Urban Built-up Area	(15)	10			
6. Distance To Urban Support Services	(15)	10			
7. Size Of Present Farm Unit Compared To Average	(10)	10			
8. Creation Of Non-farmable Farmland	(10)	0			
9. Availability Of Farm Support Services	(5)	5			
10. On-Farm Investments	(20)	10			
11. Effects Of Conversion On Farm Support Services	(10)	0			
12. Compatibility With Existing Agricultural Use	(10)	0			
TOTAL SITE ASSESSMENT POINTS	160	108			
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	64			
Total Site Assessment *(From Part VI above or local site assessment)*	160	108			
TOTAL POINTS *(Total of above 2 lines)*	260	172			

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side)

Form AD-1006 (03-02)

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

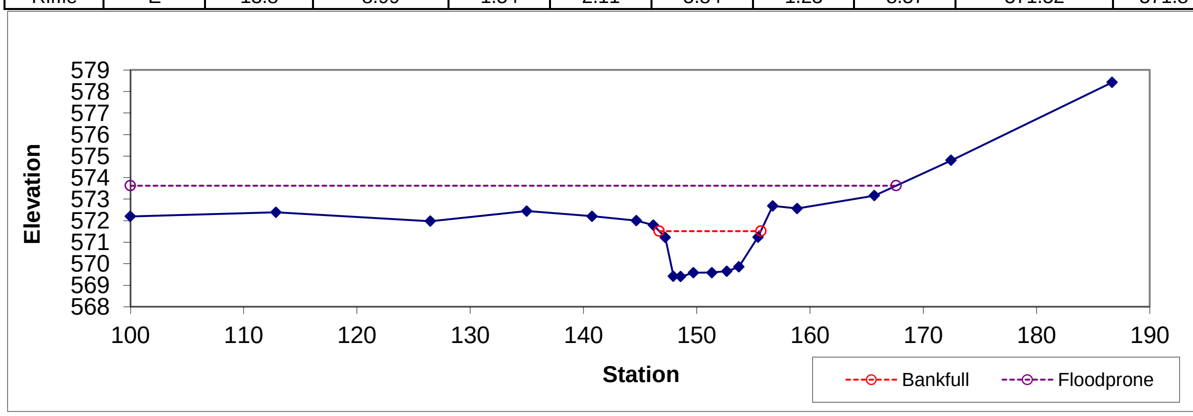
NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

Appendix E

Geomorphic Data

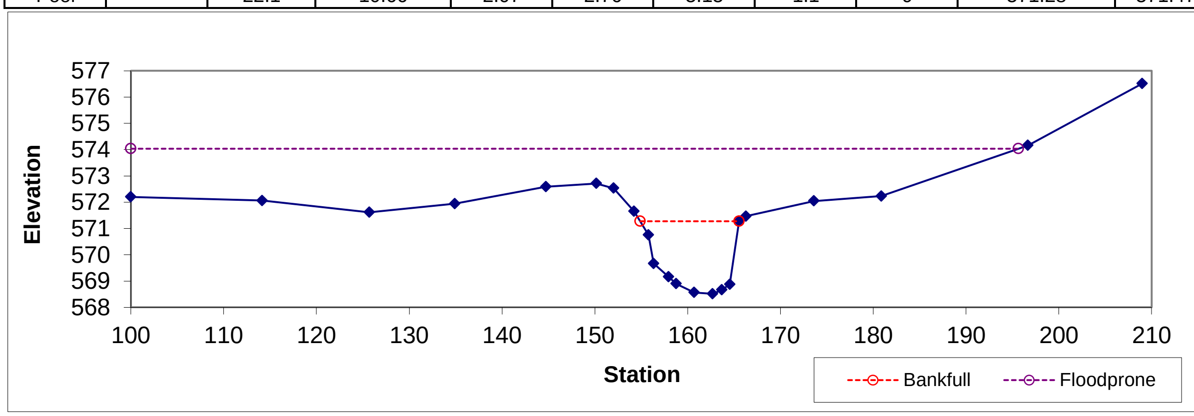
Cross-section Data: UT to Town Creek Reach 1 X1

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	13.8	8.99	1.54	2.11	5.84	1.23	8.57	571.52	571.8



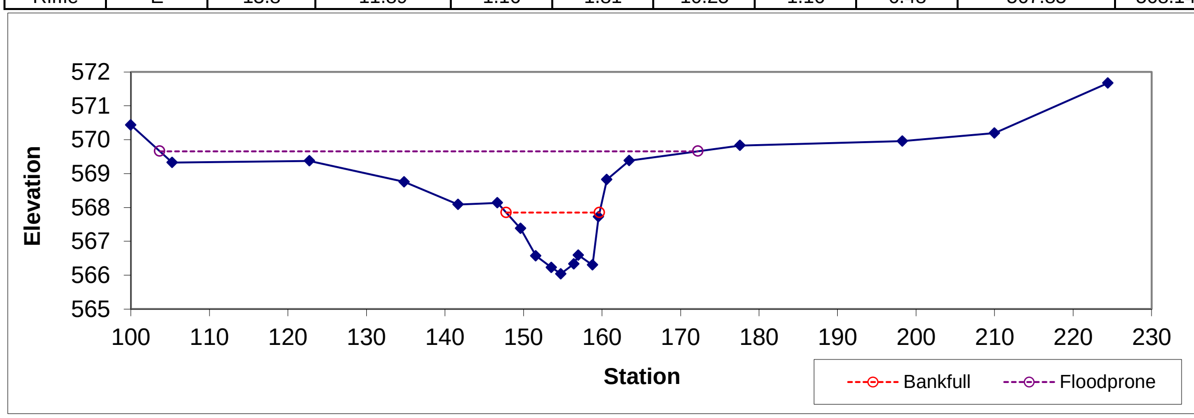
Cross-section Data: UT to Town Creek Reach 1 X2

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		22.1	10.66	2.07	2.76	5.15	1.1	9	571.28	571.47



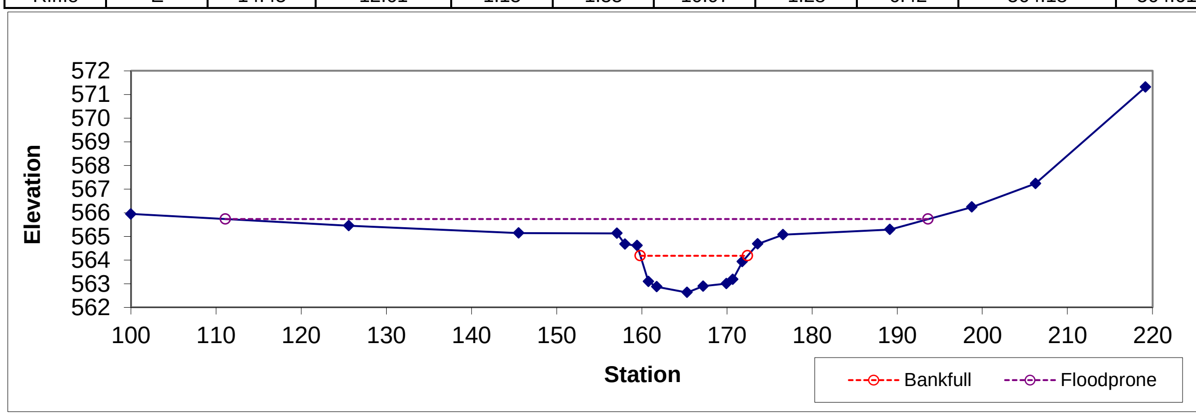
Cross-section Data: UT to Town Creek Reach 1 X3

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	13.8	11.89	1.16	1.81	10.25	1.16	6.48	567.85	568.14



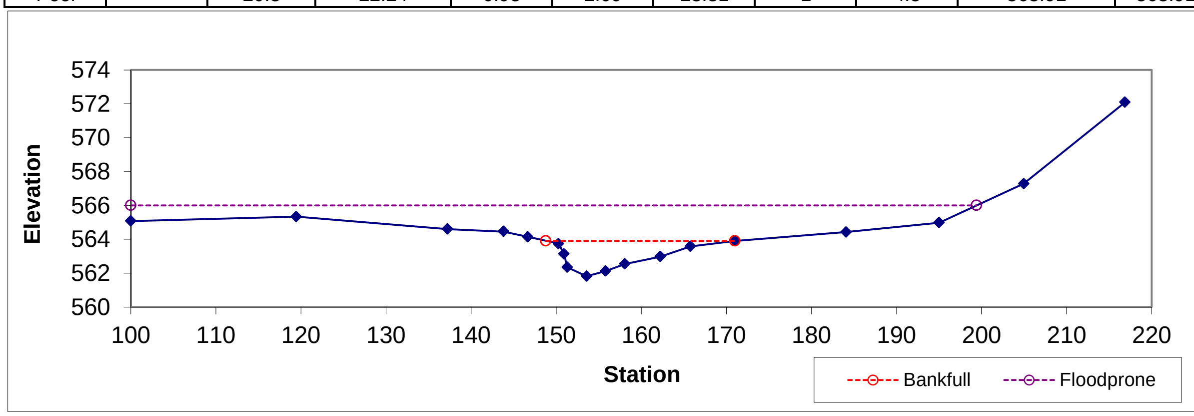
Cross-section Data: UT to Town Creek Reach 2 X4

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	14.45	12.61	1.15	1.55	10.97	1.28	6.42	564.18	564.61



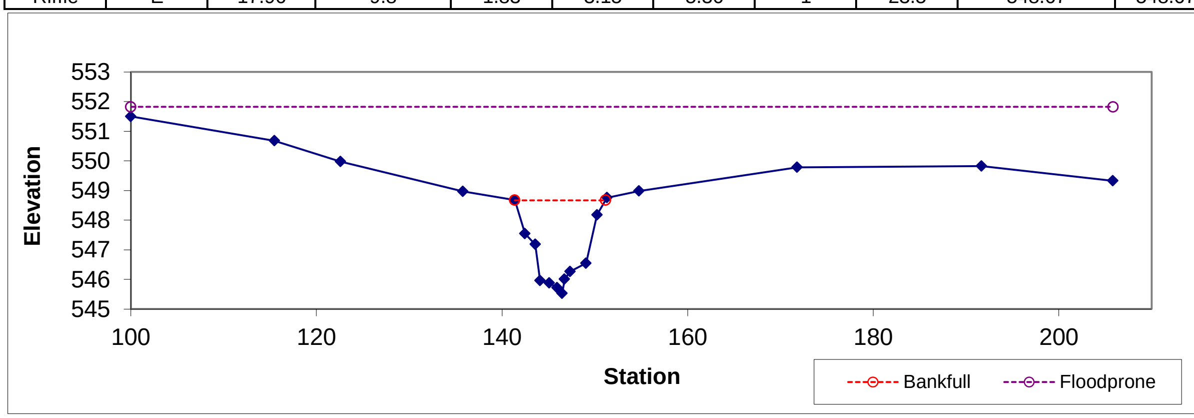
Cross-section Data: UT to Town Creek Reach 2 X5

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		20.8	22.24	0.93	2.09	23.81	1	4.5	563.91	563.91



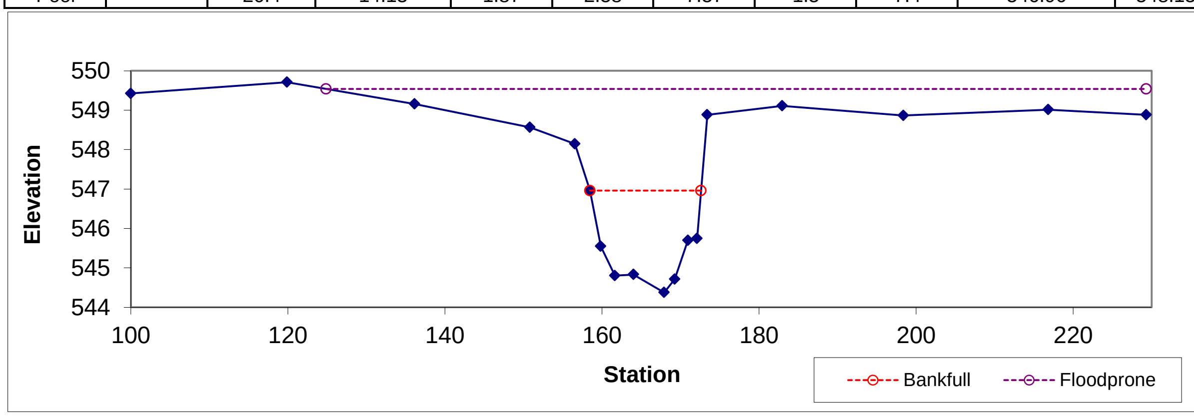
Cross-section Data: UT to Town Creek Reach 3 X6

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	17.96	9.8	1.83	3.15	5.36	1	23.5	548.67	548.67



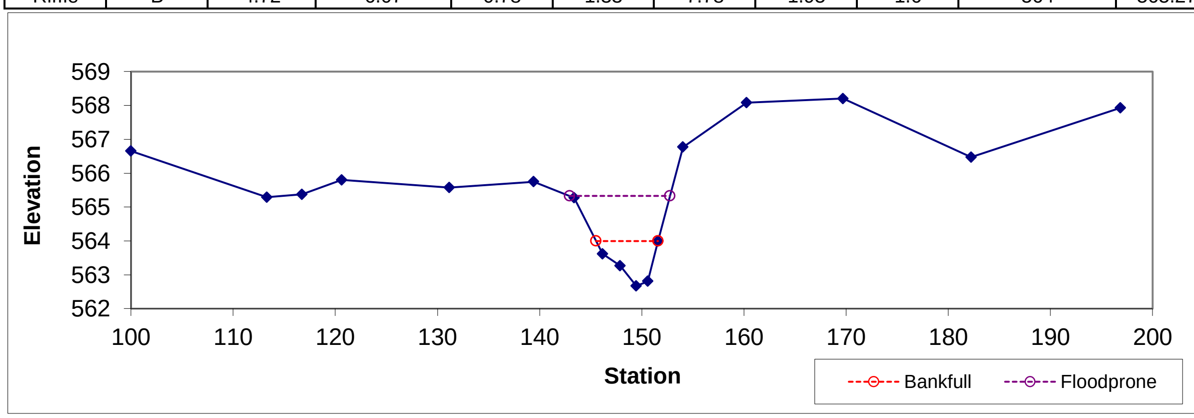
Cross-section Data: UT to Town Creek Reach 3 X7

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		26.4	14.13	1.87	2.58	7.57	1.5	7.4	546.96	548.15



Cross-section Data: UT to Town Creek Reach 6 X8

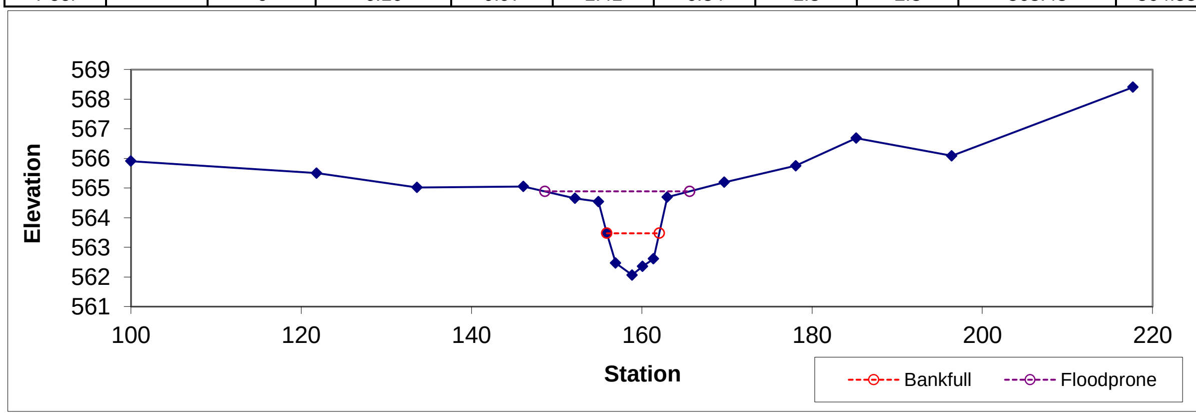
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	4.72	6.07	0.78	1.33	7.78	1.95	1.6	564	565.27



UT TO TOWN CREEK RESTORATION SITE - OPTION A
MICHAEL BAKER ENGINEERING, INC.
EEP CONTRACT NO. 003277; PROJECT NO. 94648
DECEMBER 2014

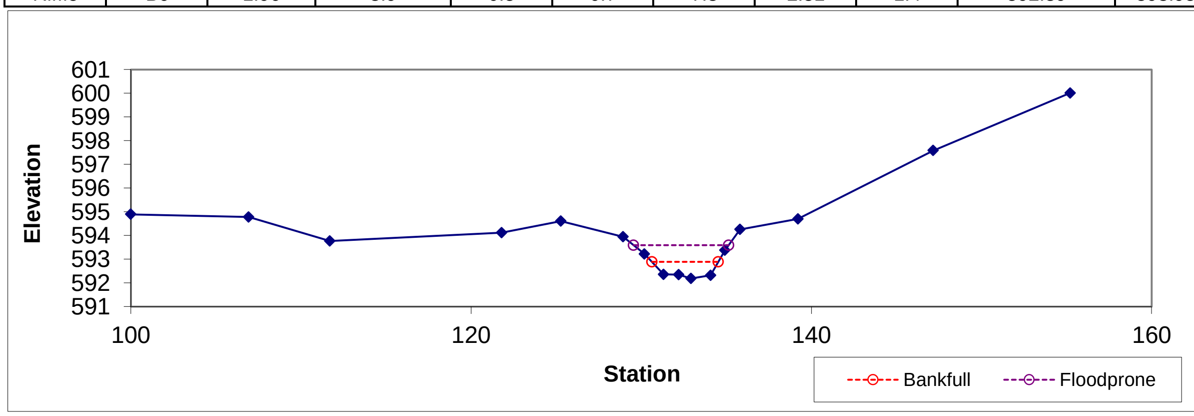
Cross-section Data: UT to Town Creek Reach 6 X9

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		6	6.16	0.97	1.41	6.34	1.8	2.8	563.48	564.55



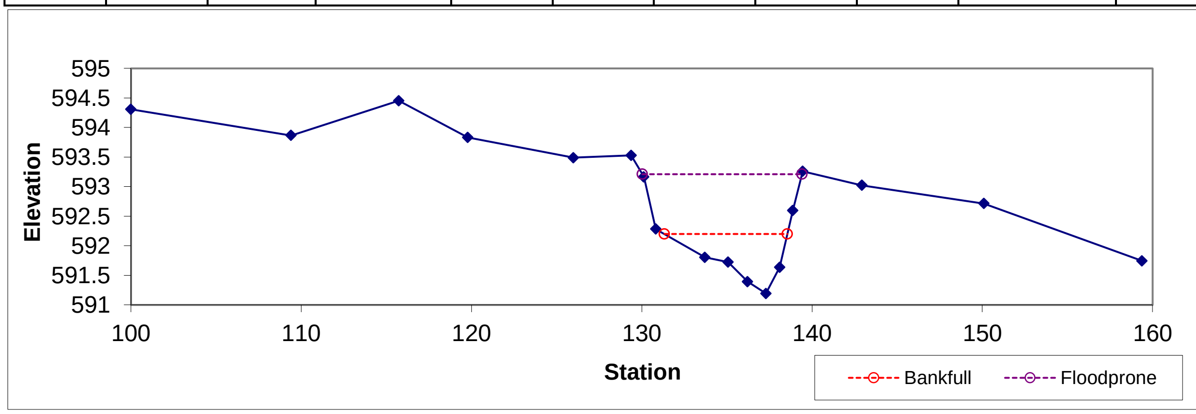
Cross-section Data: UT to Town Creek Reach 5 X10

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	1.96	3.9	0.5	0.7	7.8	2.51	1.4	592.89	593.95



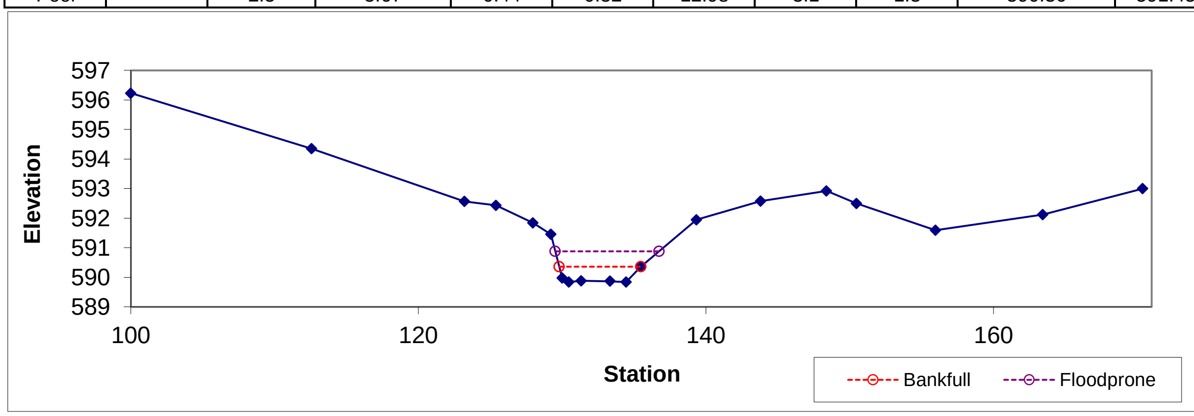
Cross-section Data: UT to Town Creek Reach 5 X11

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		3.5	7.22	0.49	1.01	14.77	2.1	1.3	592.2	593.26



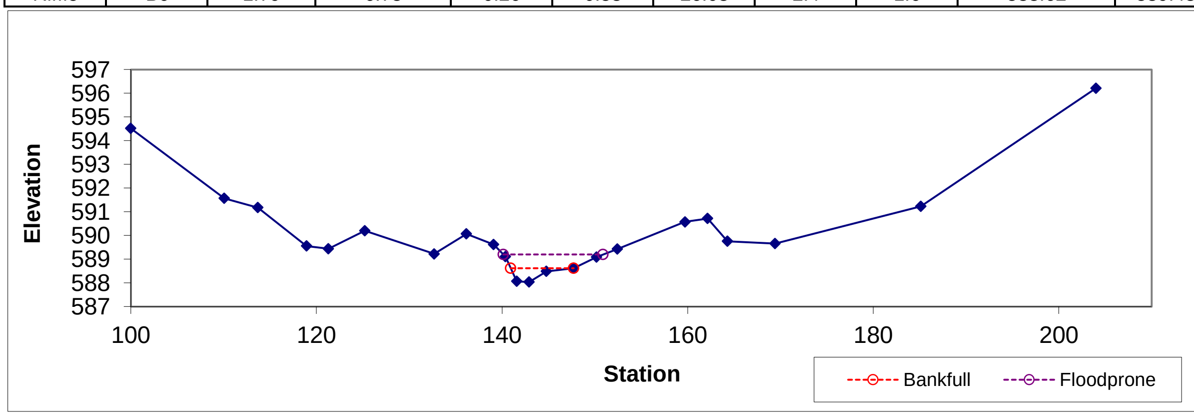
Cross-section Data: UT to Town Creek Reach 4 X12

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		2.5	5.67	0.44	0.52	12.98	3.1	1.3	590.36	591.45



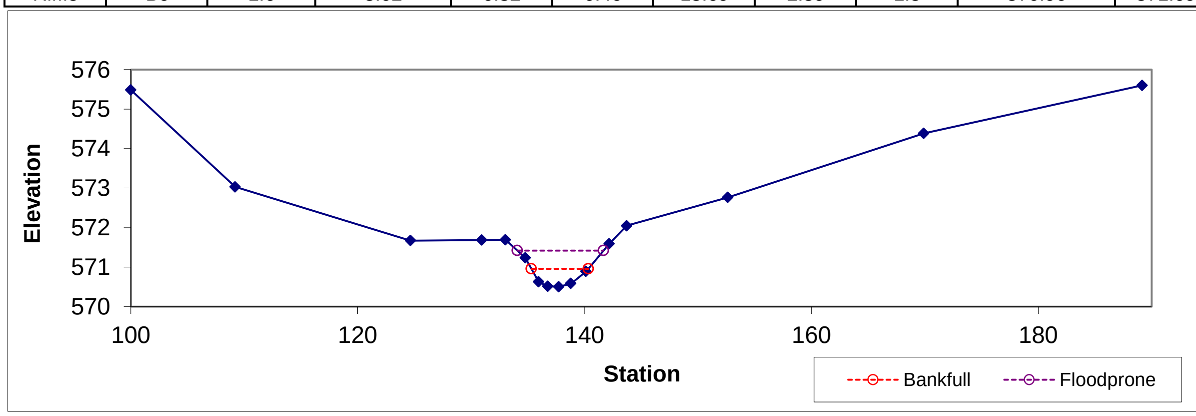
Cross-section Data: UT to Town Creek Reach 4 X13

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	1.79	6.78	0.26	0.58	26.08	2.4	1.6	588.62	589.43



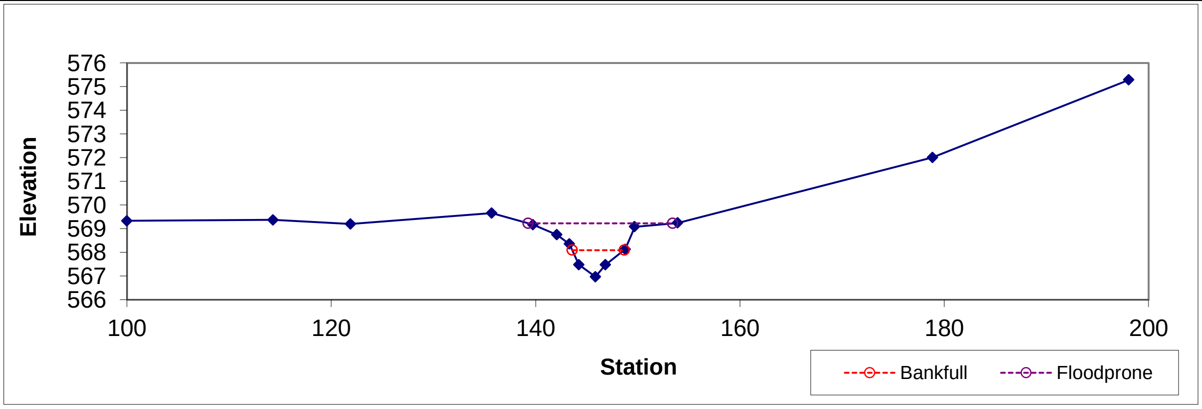
Cross-section Data: UT to Town Creek Reach 7 X14

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	1.6	5.02	0.32	0.46	15.69	2.59	1.5	570.96	571.69



Cross-section Data: UT to Town Creek Reach 7 X15

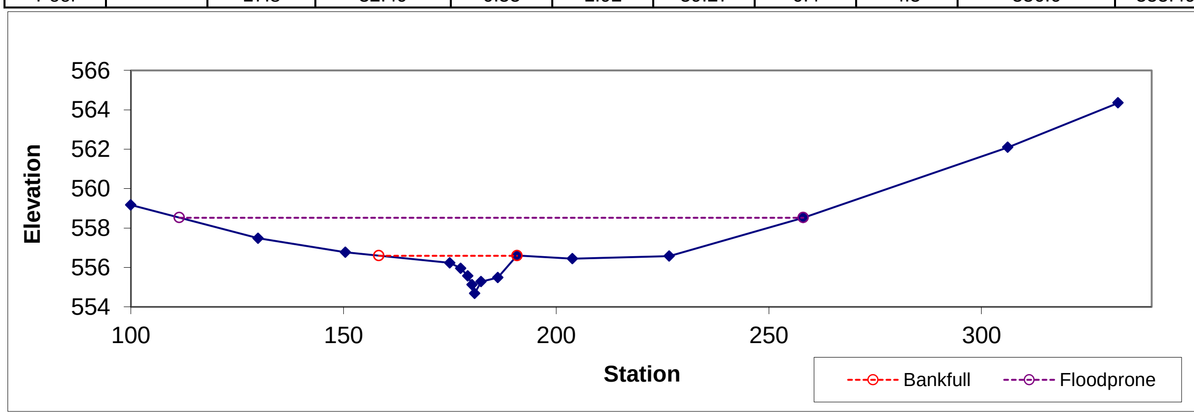
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		3.1	5.11	0.6	1.13	8.55	1.9	2.8	568.1	569.09



UT TO TOWN CREEK RESTORATION SITE - OPTION A
MICHAEL BAKER ENGINEERING, INC.
EEP CONTRACT NO. 003277; PROJECT NO. 94648
DECEMBER 2014

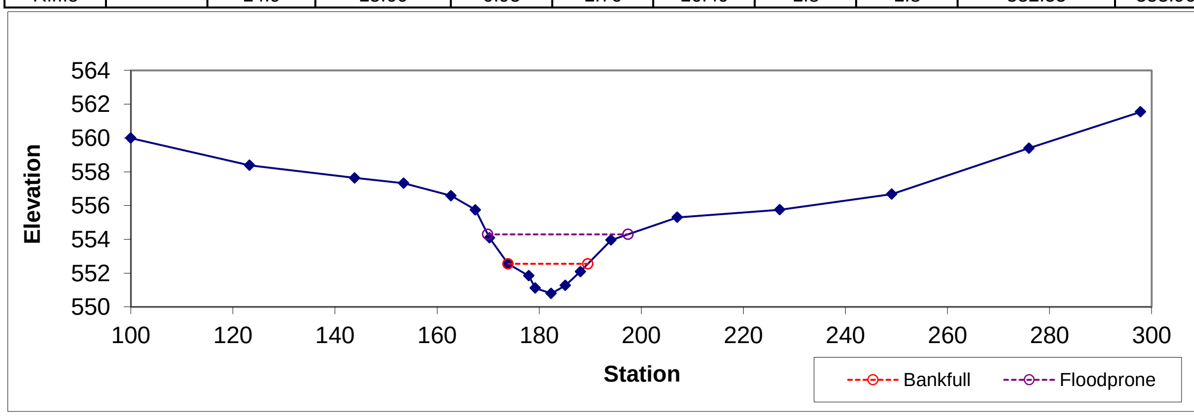
Cross-section Data: UT to Town Creek Reach 2 X16

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		17.8	32.49	0.55	1.92	59.27	0.4	4.5	556.6	555.49



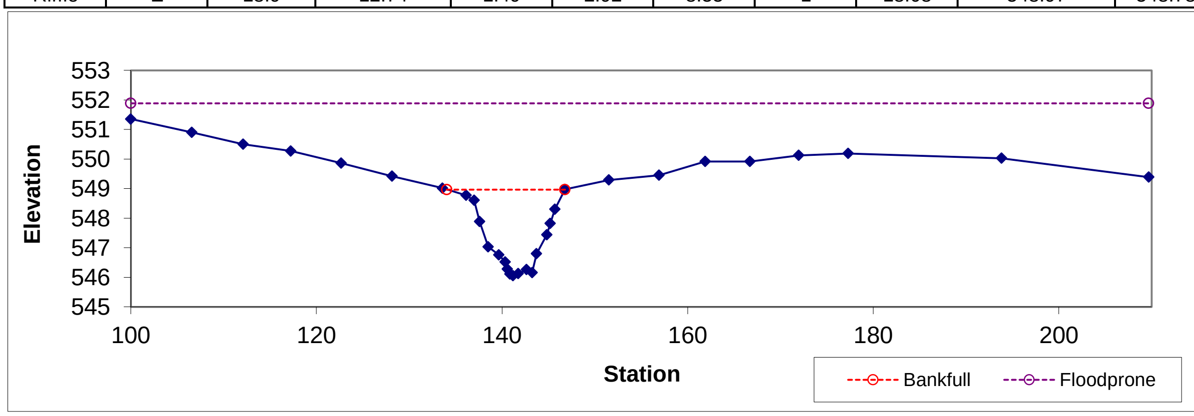
Cross-section Data: UT to Town Creek Reach 2 X17

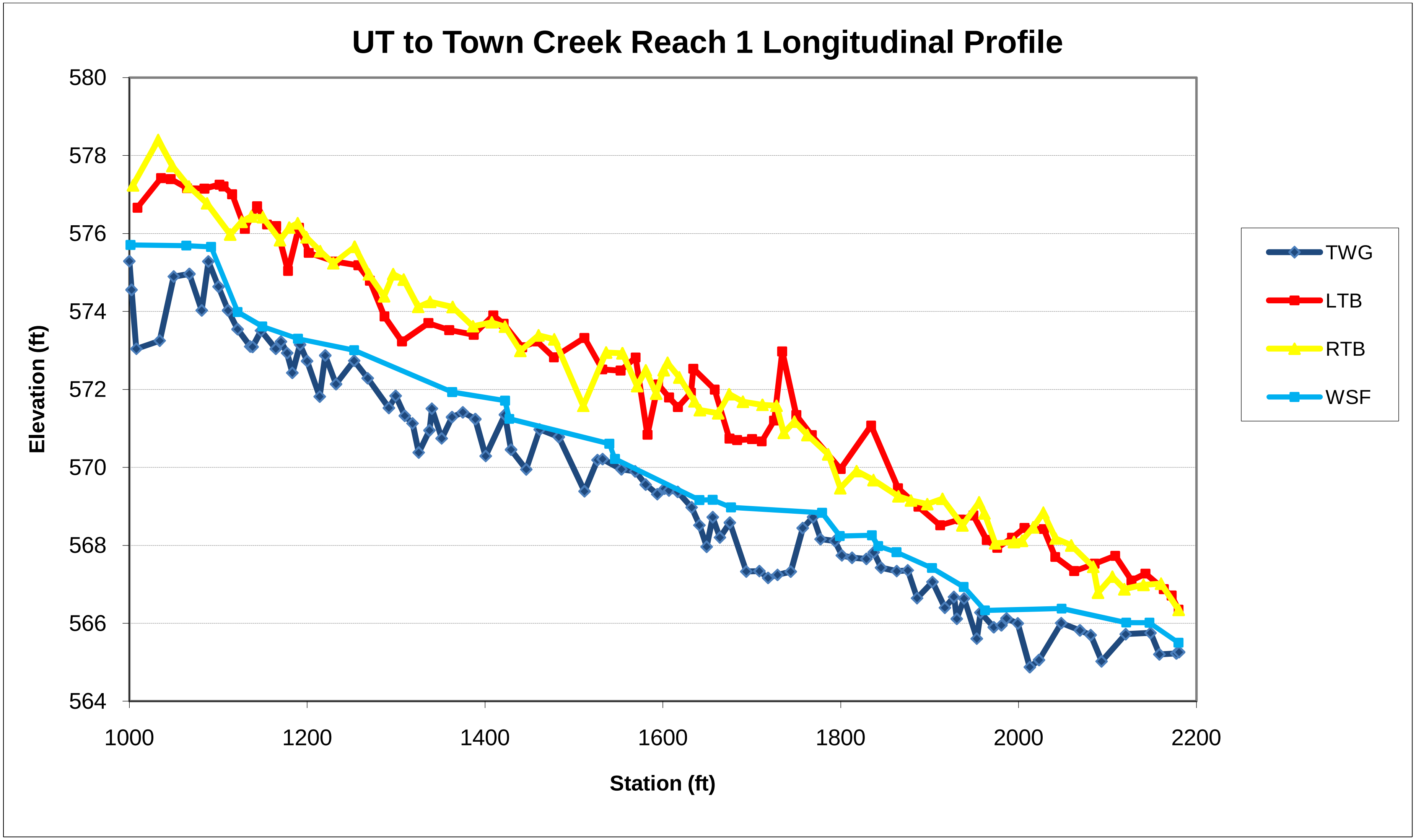
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle		14.9	15.66	0.95	1.76	16.49	1.8	1.8	552.55	553.96

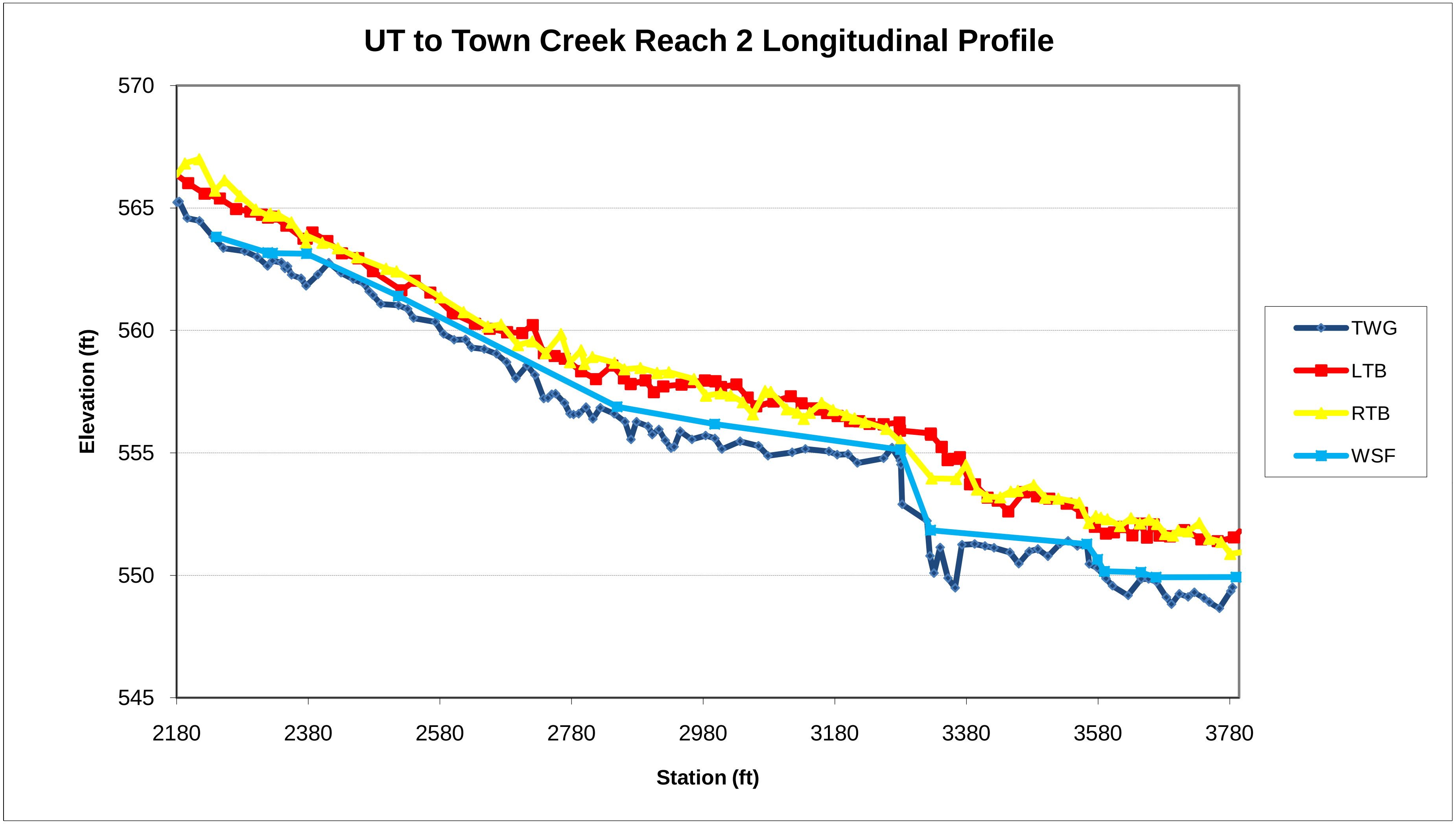


Cross-section Data: UT to Town Creek Reach 3 X18

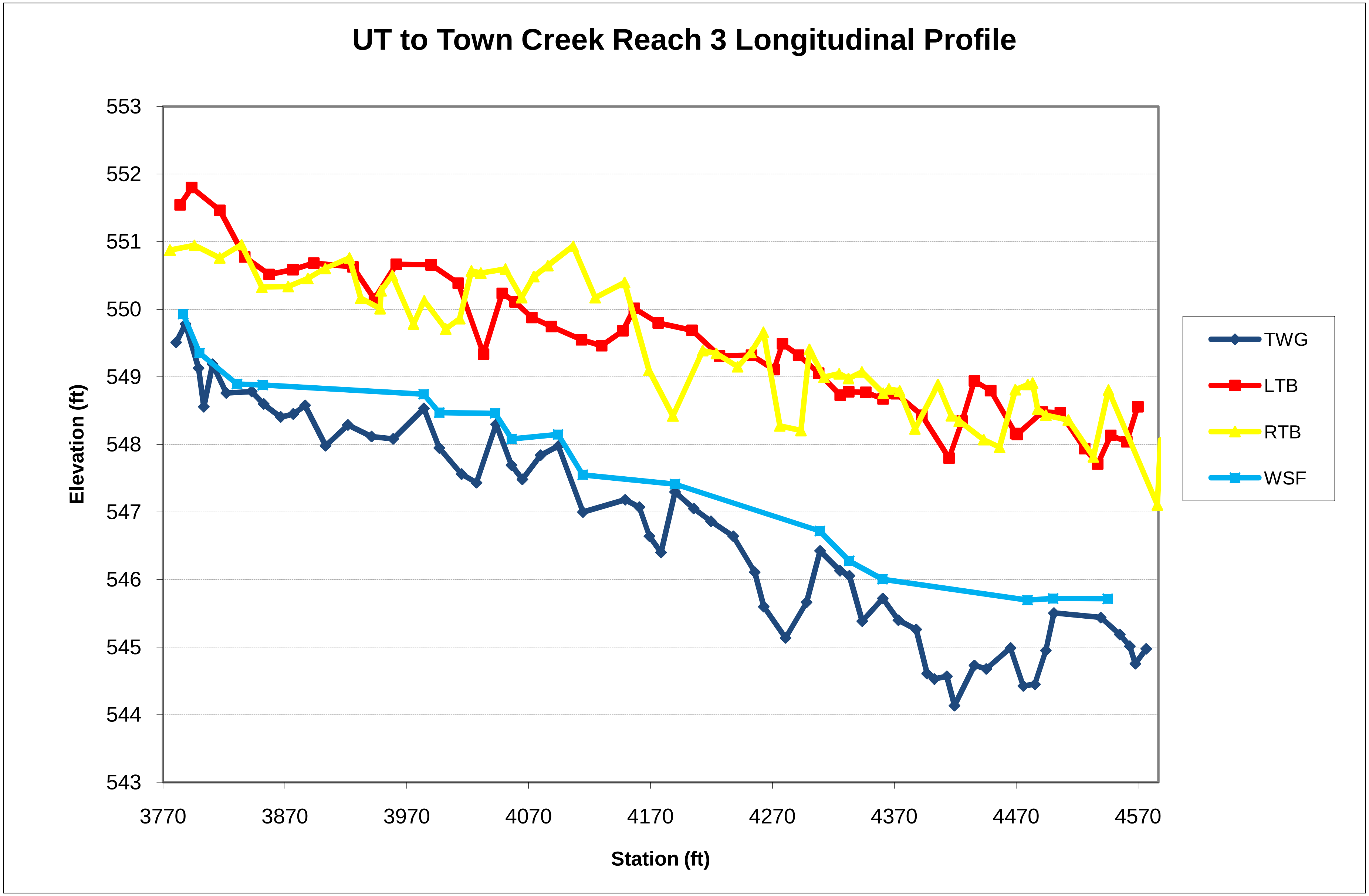
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	18.9	12.74	1.49	2.92	8.55	1	18.08	548.97	548.78

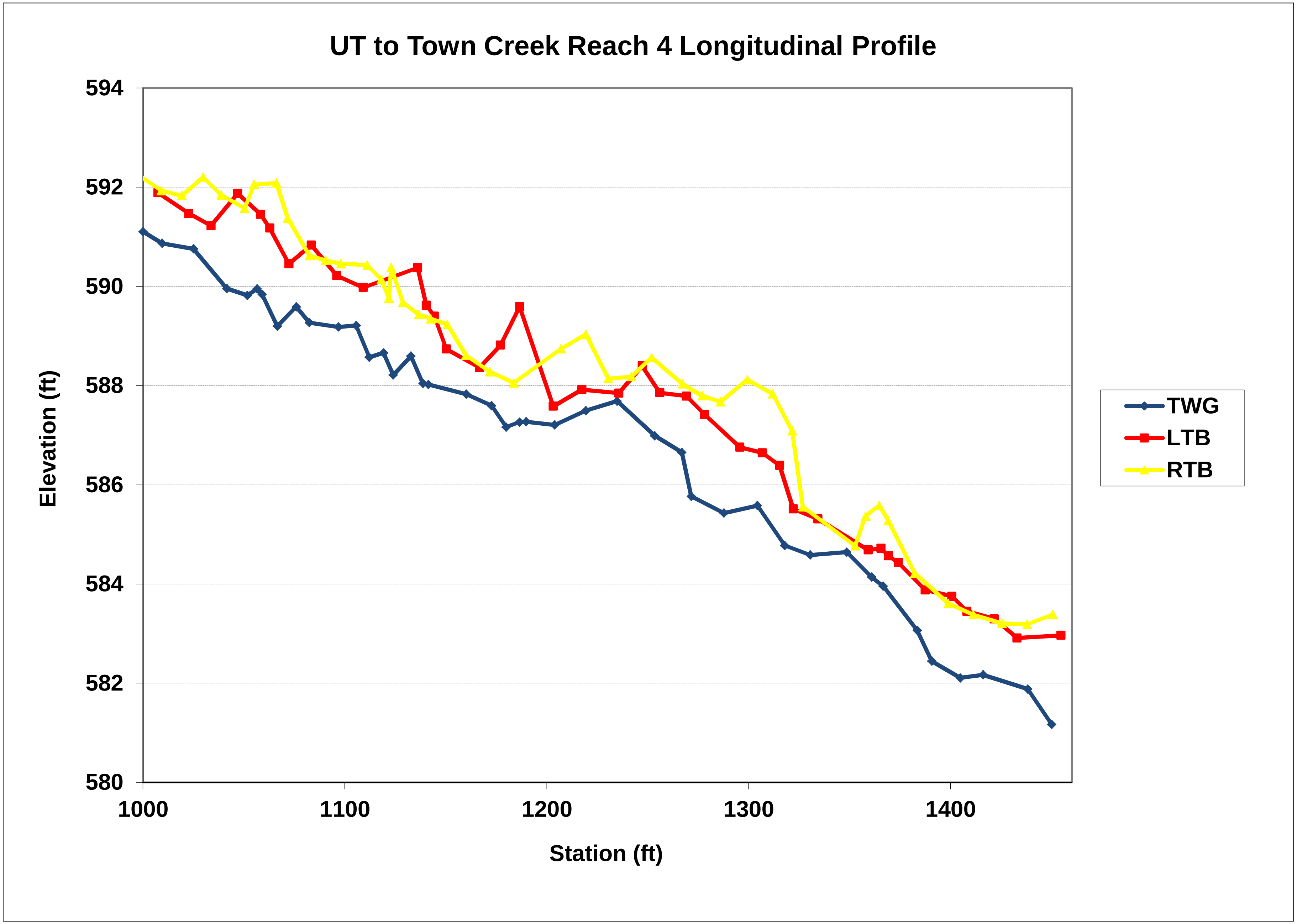



UT to Town Creek Reach 1 Longitudinal Profile
Elevation (ft)
580
578
576
574
572
570
568
566
564
1000
1200
1400
1600
1800
2000
2200
Station (ft)
TWG
LTB
RTB
WSF

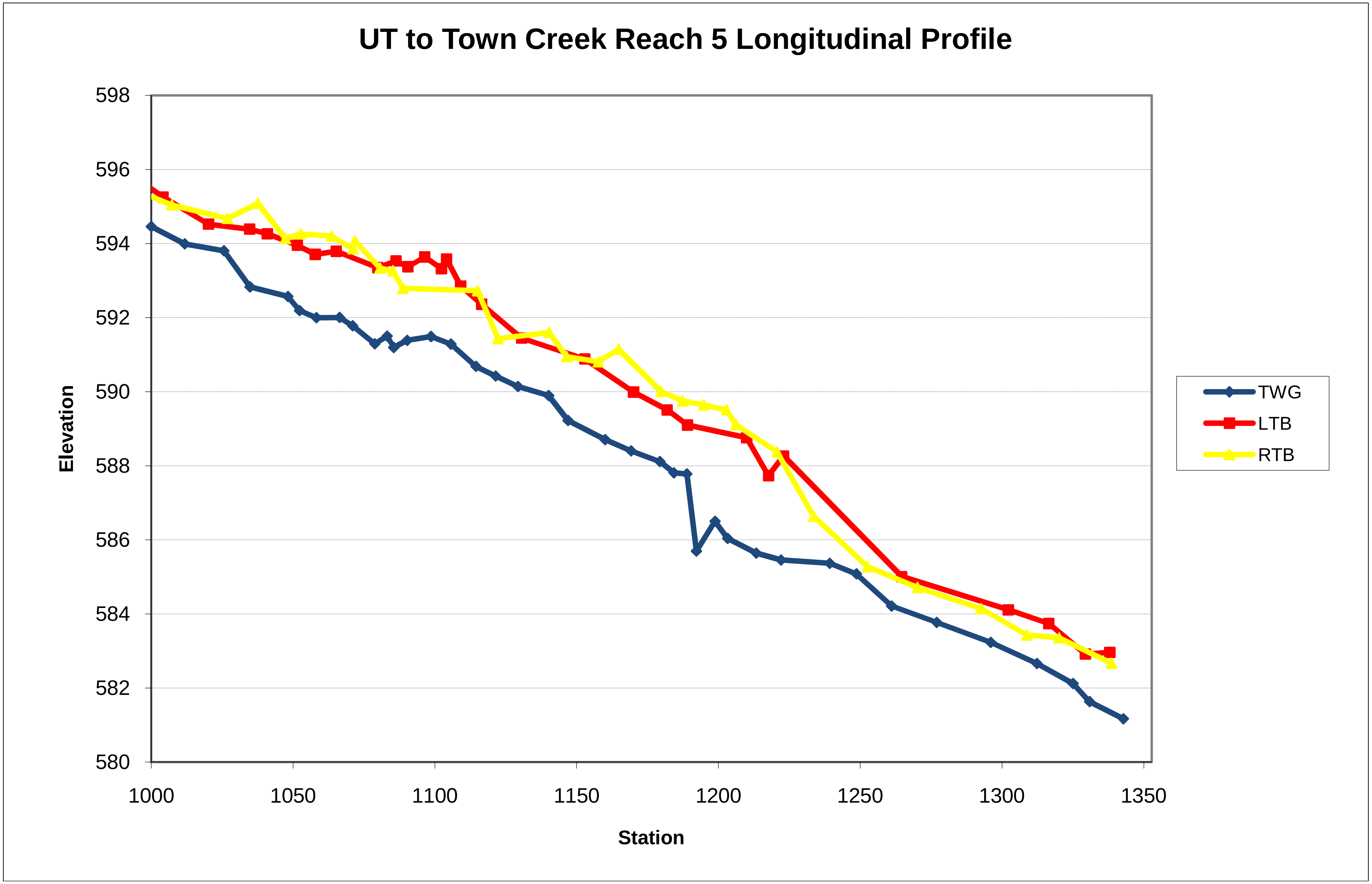


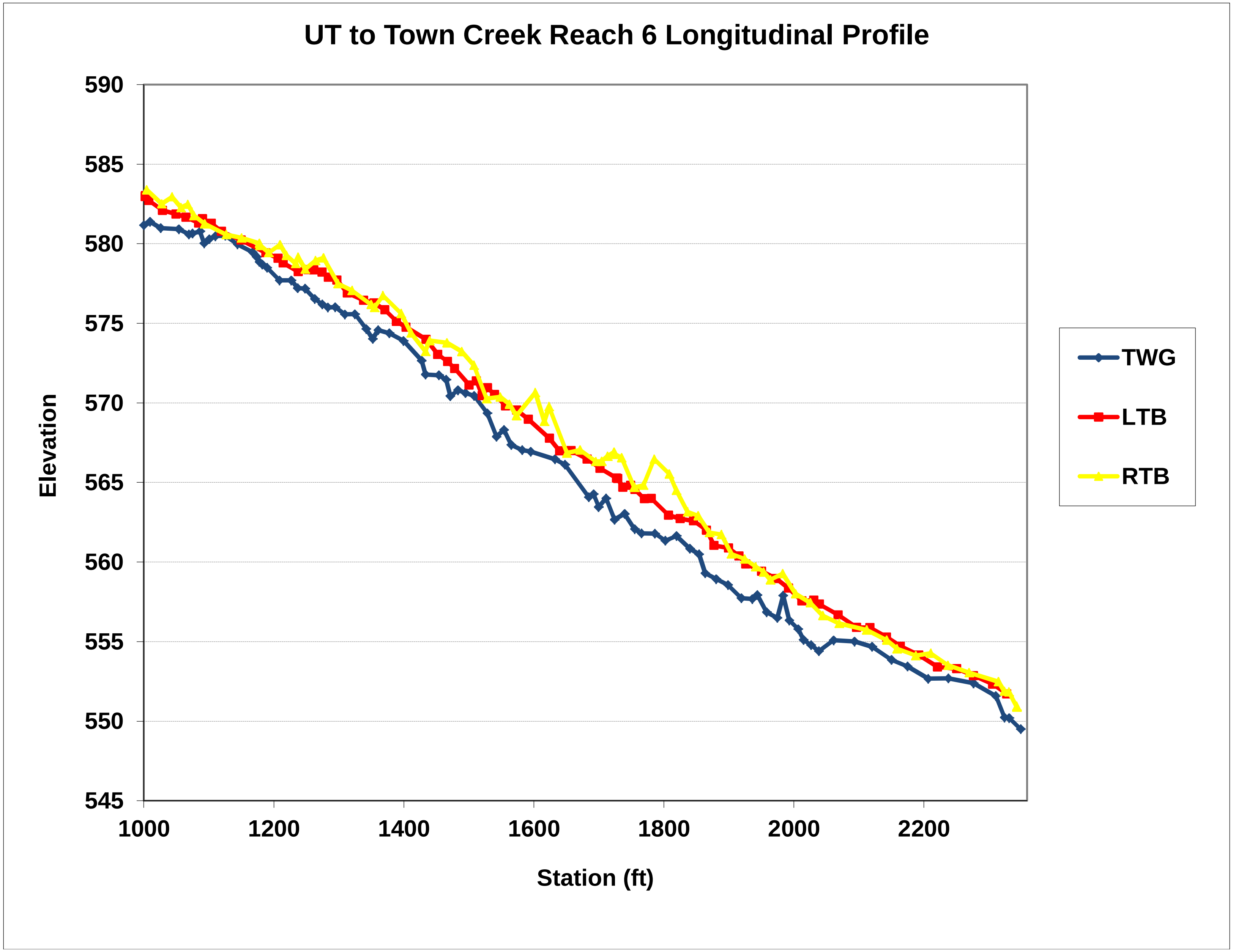
UT to Town Creek Reach 2 Longitudinal Profile
570
565
560
555
550
545
Elevation (ft)
2180
2380
2580
2780
2980
3180
3380
3580
3780
Station (ft)
TWG
LTB
RTB
WSF


UT to Town Creek Reach 3 Longitudinal Profile
553
552
551
550
549
548
547
546
545
544
543
Elevation (ft)
3770
3870
3970
4070
4170
4270
4370
4470
4570
Station (ft)
TWG
LTB
RTB
WSF

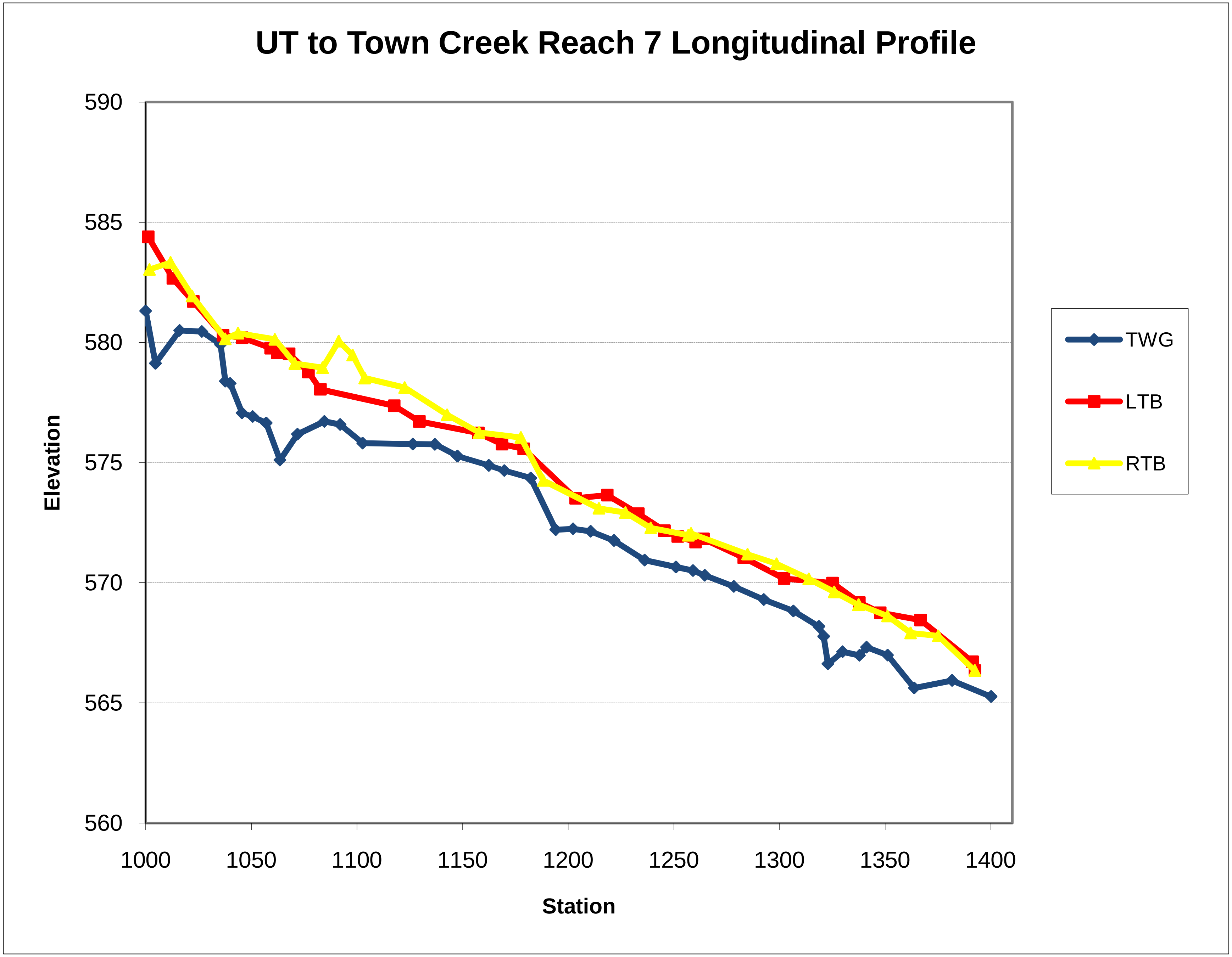


UT to Town Creek Reach 4 Longitudinal Profile
594
592
590
588
586
584
582
580
Elevation (ft)
1000
1100
1200
1300
1400
Station (ft)
TWG
LTB
RTB


UT to Town Creek Reach 5 Longitudinal Profile
598
596
594
592
590
588
586
584
582
580
Elevation
1000
1050
1100
1150
1200
1250
1300
1350
Station
TWG
LTB
RTB



UT to Town Creek Reach 6 Longitudinal Profile
590
585
580
575
570
565
560
555
550
545
Elevation
1000
1200
1400
1600
1800
2000
2200
Station (ft)
TWG
LTB
RTB

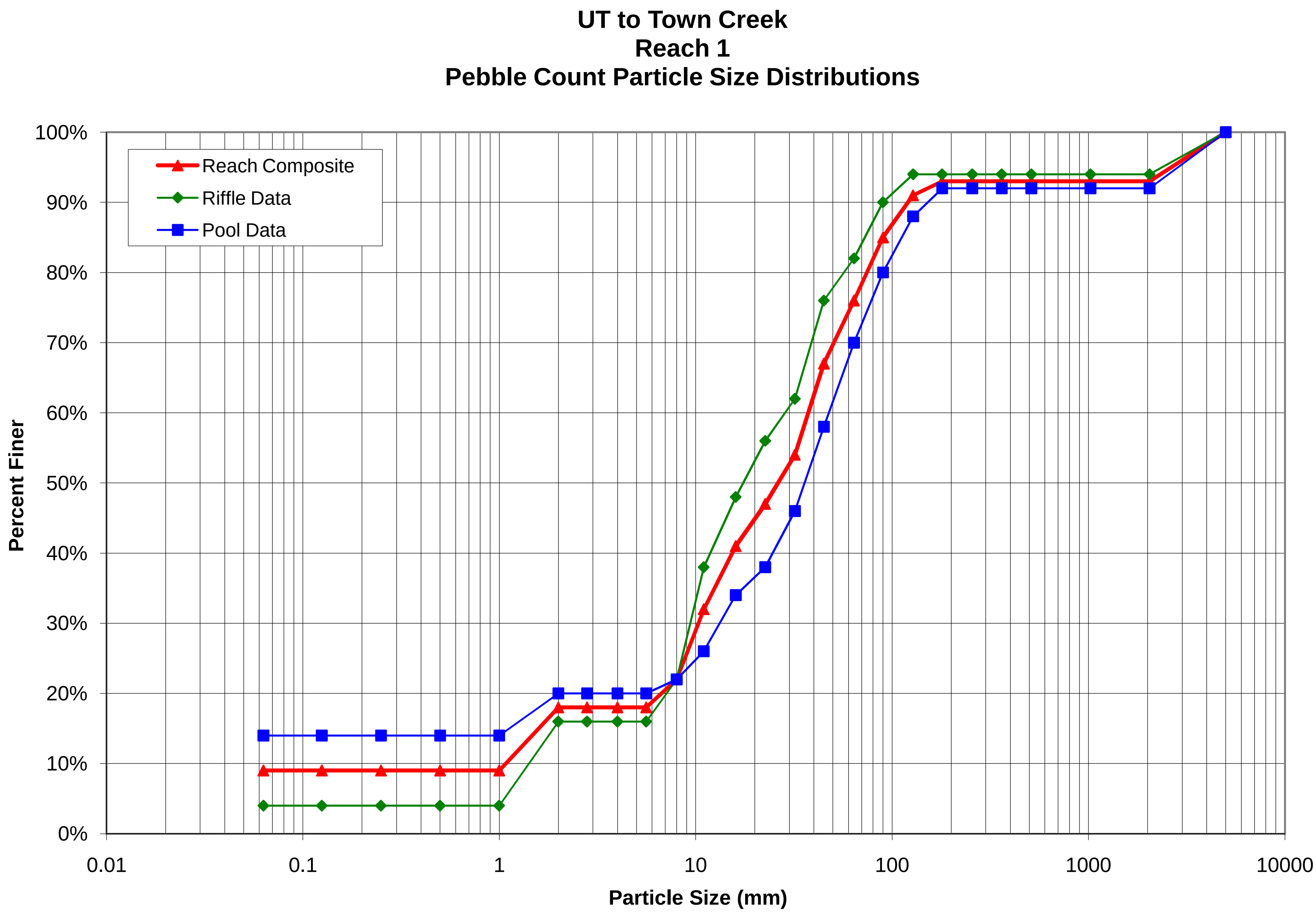

UT to Town Creek Reach 7 Longitudinal Profile
Elevation
590
585
580
575
570
565
560
1000
1050
1100
1150
1200
1250
1300
1350
1400
Station
TWG
LTB
RTB

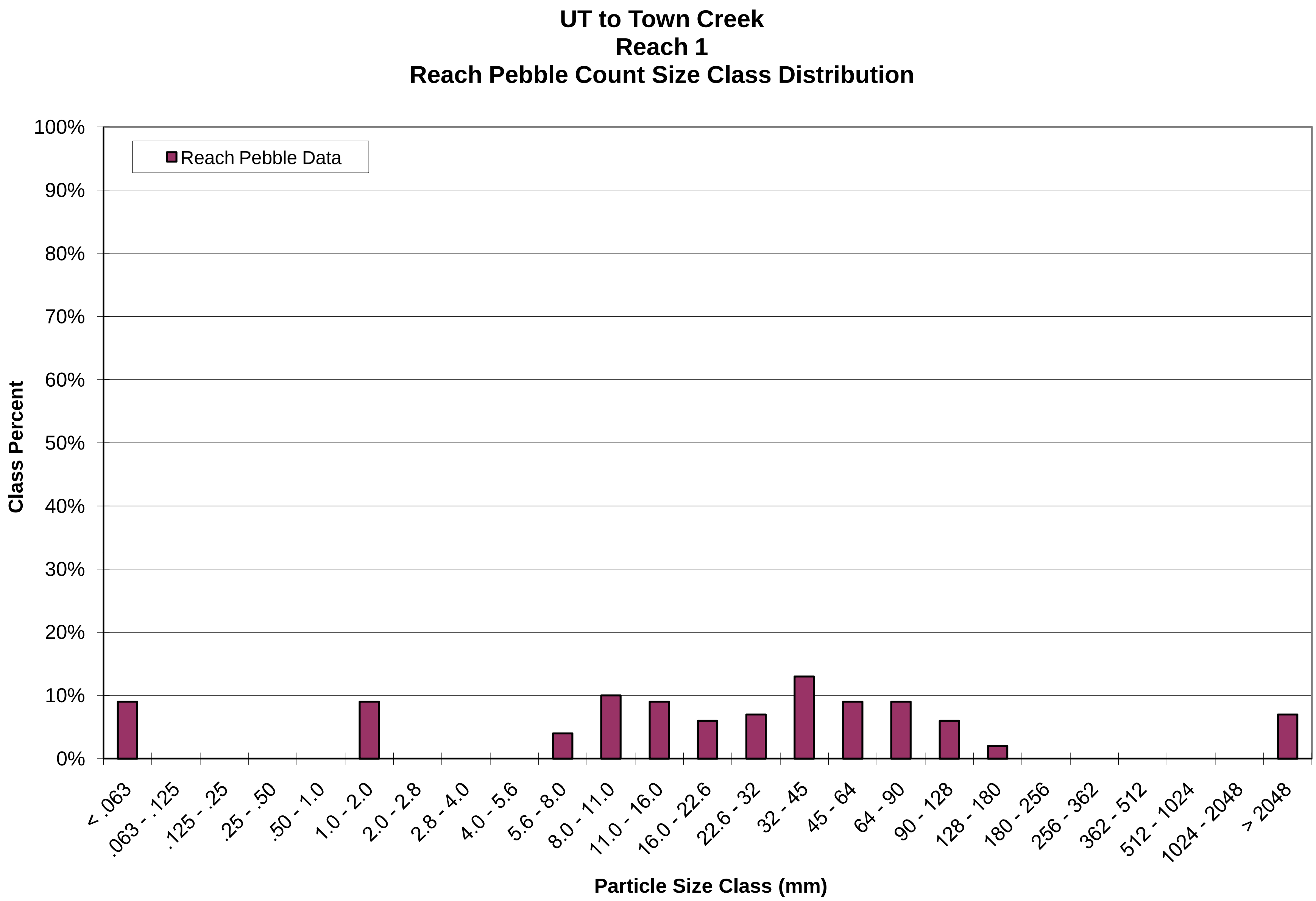
PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 1
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	2	7	9	9%	9%	4%	4%	14%	14%
SAND	Very Fine	.063 - .125					9%		4%		14%
	Fine	.125 - .25					9%		4%		14%
	Medium	.25 - .50					9%		4%		14%
	Coarse	.50 - 1.0					9%		4%		14%
	Very Coarse	1.0 - 2.0	6	3	9	9%	18%	12%	16%	6%	20%
GRAVEL	Very Fine	2.0 - 2.8					18%		16%		20%
	Very Fine	2.8 - 4.0					18%		16%		20%
	Fine	4.0 - 5.6					18%		16%		20%
	Fine	5.6 - 8.0	3	1	4	4%	22%	6%	22%	2%	22%
	Medium	8.0 - 11.0	8	2	10	10%	32%	16%	38%	4%	26%
	Medium	11.0 - 16.0	5	4	9	9%	41%	10%	48%	8%	34%
	Coarse	16.0 - 22.6	4	2	6	6%	47%	8%	56%	4%	38%
	Coarse	22.6 - 32	3	4	7	7%	54%	6%	62%	8%	46%
	Very Coarse	32 - 45	7	6	13	13%	67%	14%	76%	12%	58%
	Very Coarse	45 - 64	3	6	9	9%	76%	6%	82%	12%	70%
COBBLE	Small	64 - 90	4	5	9	9%	85%	8%	90%	10%	80%
	Small	90 - 128	2	4	6	6%	91%	4%	94%	8%	88%
	Large	128 - 180		2	2	2%	93%		94%	4%	92%
	Large	180 - 256					93%		94%		92%
BOULDER	Small	256 - 362					93%		94%		92%
	Small	362 - 512					93%		94%		92%
	Medium	512 - 1024					93%		94%		92%
	Large-Very Large	1024 - 2048					93%		94%		92%
BEDROCK	Bedrock	> 2048	3	4	7	7%	100%	6%	100%	8%	100%
		Total	**50**	**50**	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Largest particles: __________ __________ **mm**
(riffle) **(pool)**


UT to Town Creek
Reach 1
Pebble Count Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

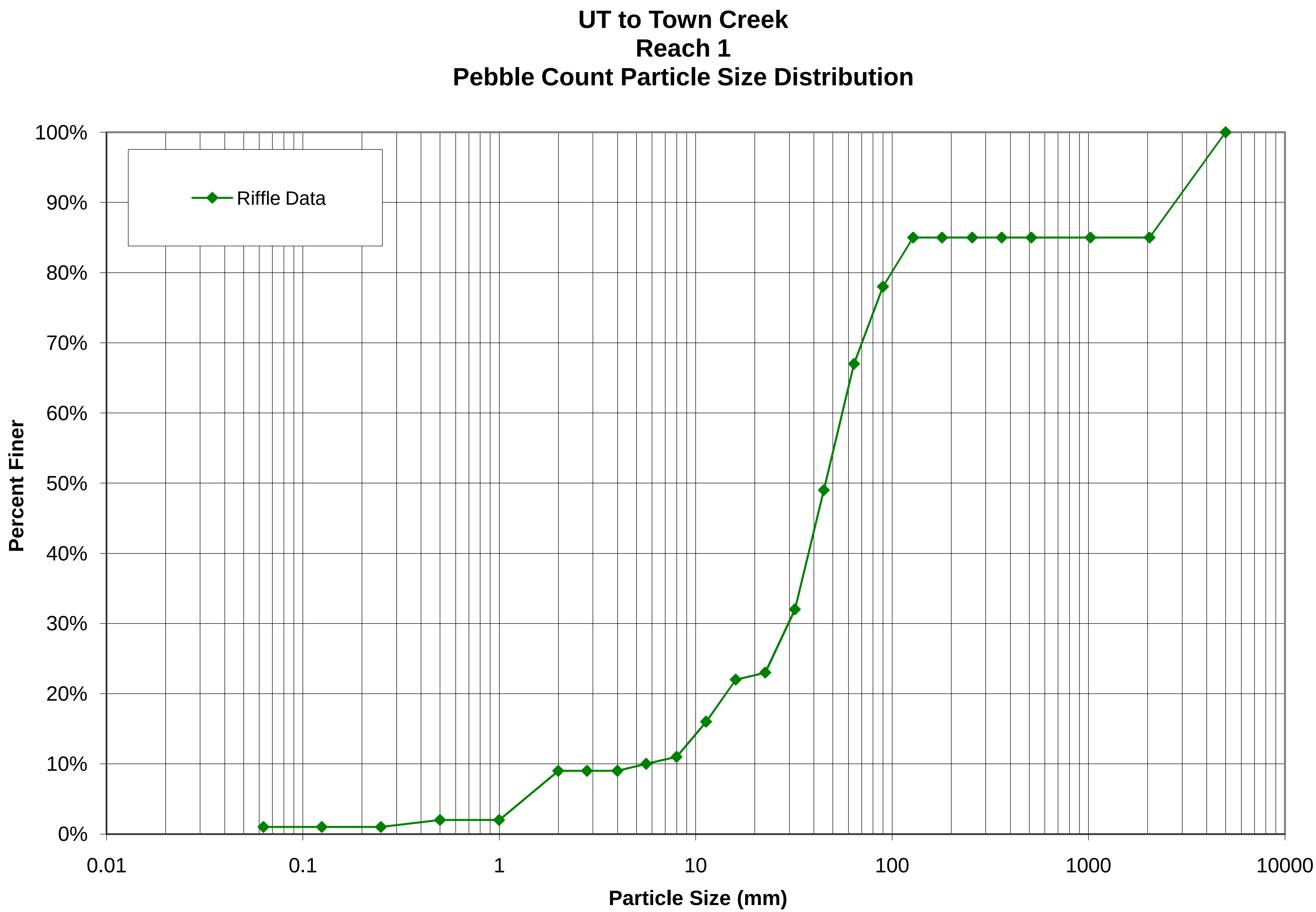

UT to Town Creek
Reach 1
Reach Pebble Count Size Class Distribution
Reach Pebble Data
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size Class (mm)

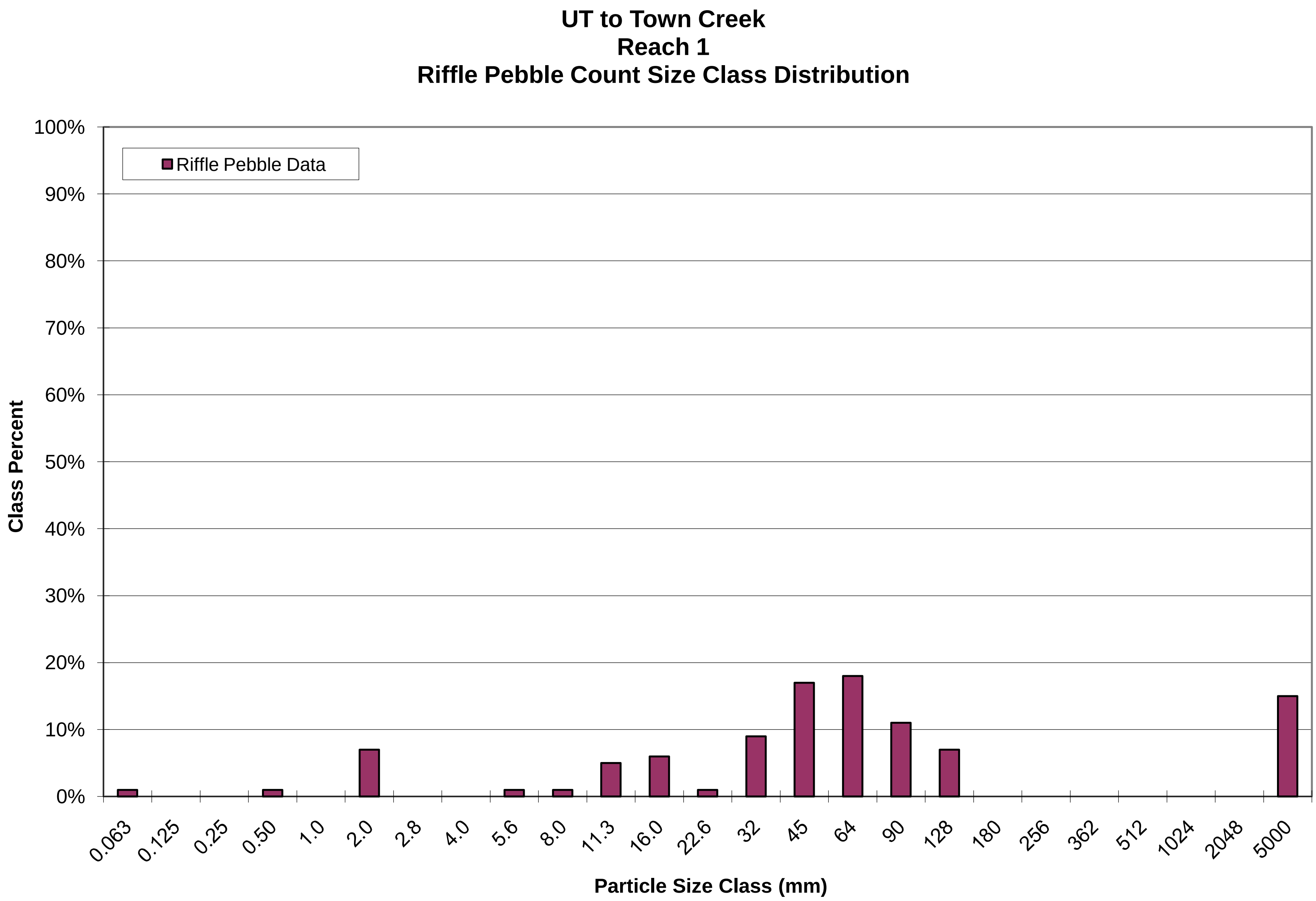
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 1/2 (Confluence Reach 7)
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	1	1%	1%
SAND	Very Fine	.063 - .125			1%
	Fine	.125 - .25			1%
	Medium	.25 - .50	1	1%	2%
	Coarse	.50 - 1.0			2%
	Very Coarse	1.0 - 2.0	7	7%	9%
GRAVEL	Very Fine	2.0 - 2.8			9%
	Very Fine	2.8 - 4.0			9%
	Fine	4.0 - 5.6	1	1%	10%
	Fine	5.6 - 8.0	1	1%	11%
	Medium	8.0 - 11.0	5	5%	16%
	Medium	11.0 - 16.0	6	6%	22%
	Coarse	16.0 - 22.6	1	1%	23%
	Coarse	22.6 - 32	9	9%	32%
	Very Coarse	32 - 45	17	17%	49%
	Very Coarse	45 - 64	18	18%	67%
COBBLE	Small	64 - 90	11	11%	78%
	Small	90 - 128	7	7%	85%
	Large	128 - 180			85%
	Large	180 - 256			85%
BOULDER	Small	256 - 362			85%
	Small	362 - 512			85%
	Medium	512 - 1024			85%
	Large-Very Large	1024 - 2048			85%
BEDROCK	Bedrock	> 2048	15	15%	100%
		Total	**100**	**100%**	

Largest particles: __________
(riffle)


UT to Town Creek
Reach 1
Pebble Count Particle Size Distribution
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


UT to Town Creek
Reach 1
Riffle Pebble Count Size Class Distribution
Riffle Pebble Data
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.063
0.125
0.25
0.50
1.0
2.0
2.8
4.0
5.6
8.0
11.3
16.0
22.6
32
45
64
90
128
180
256
362
512
1024
2048
5000
Particle Size Class (mm)

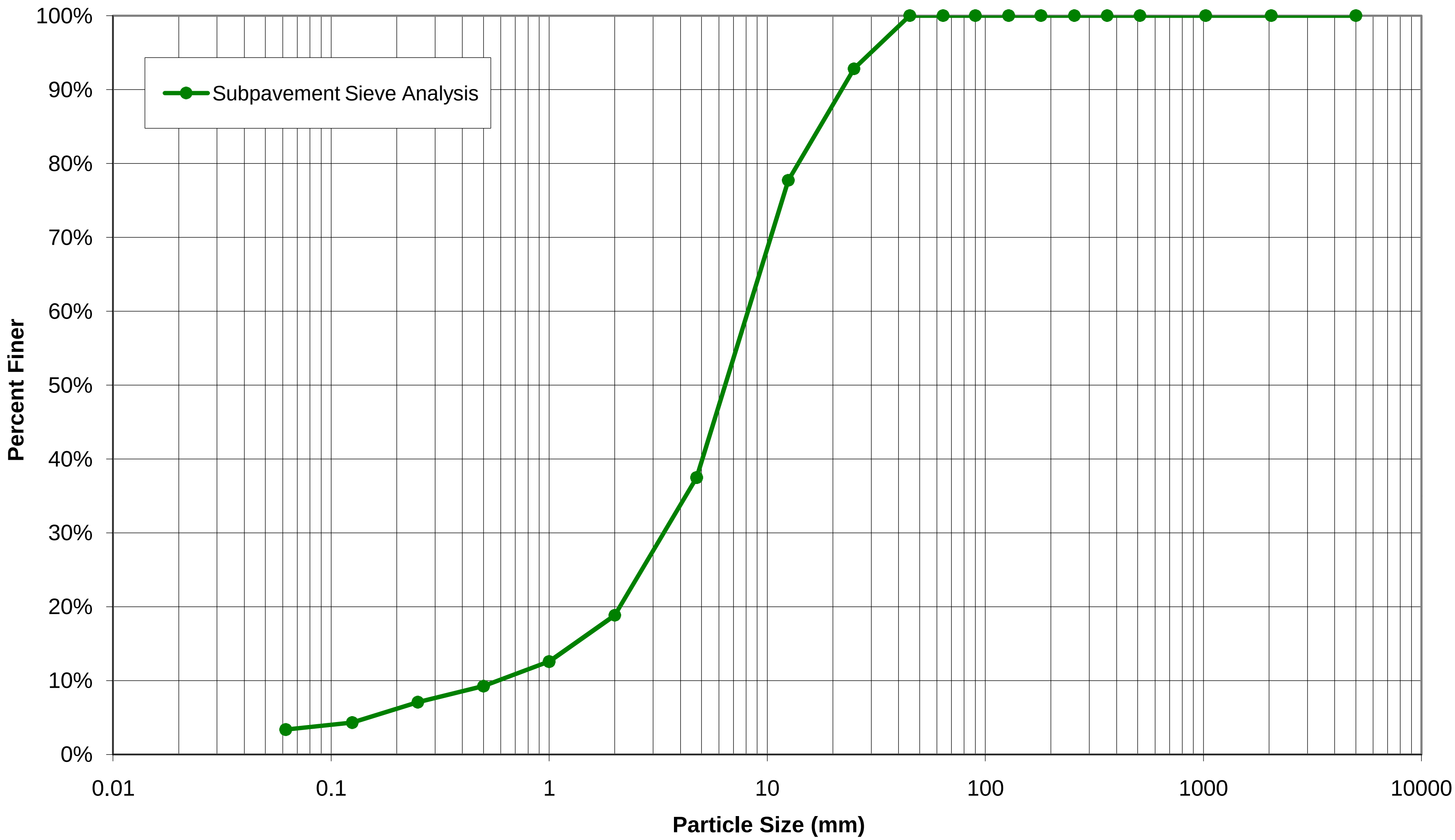
PAVEMENT / SUBPAVEMENT ANALYSIS

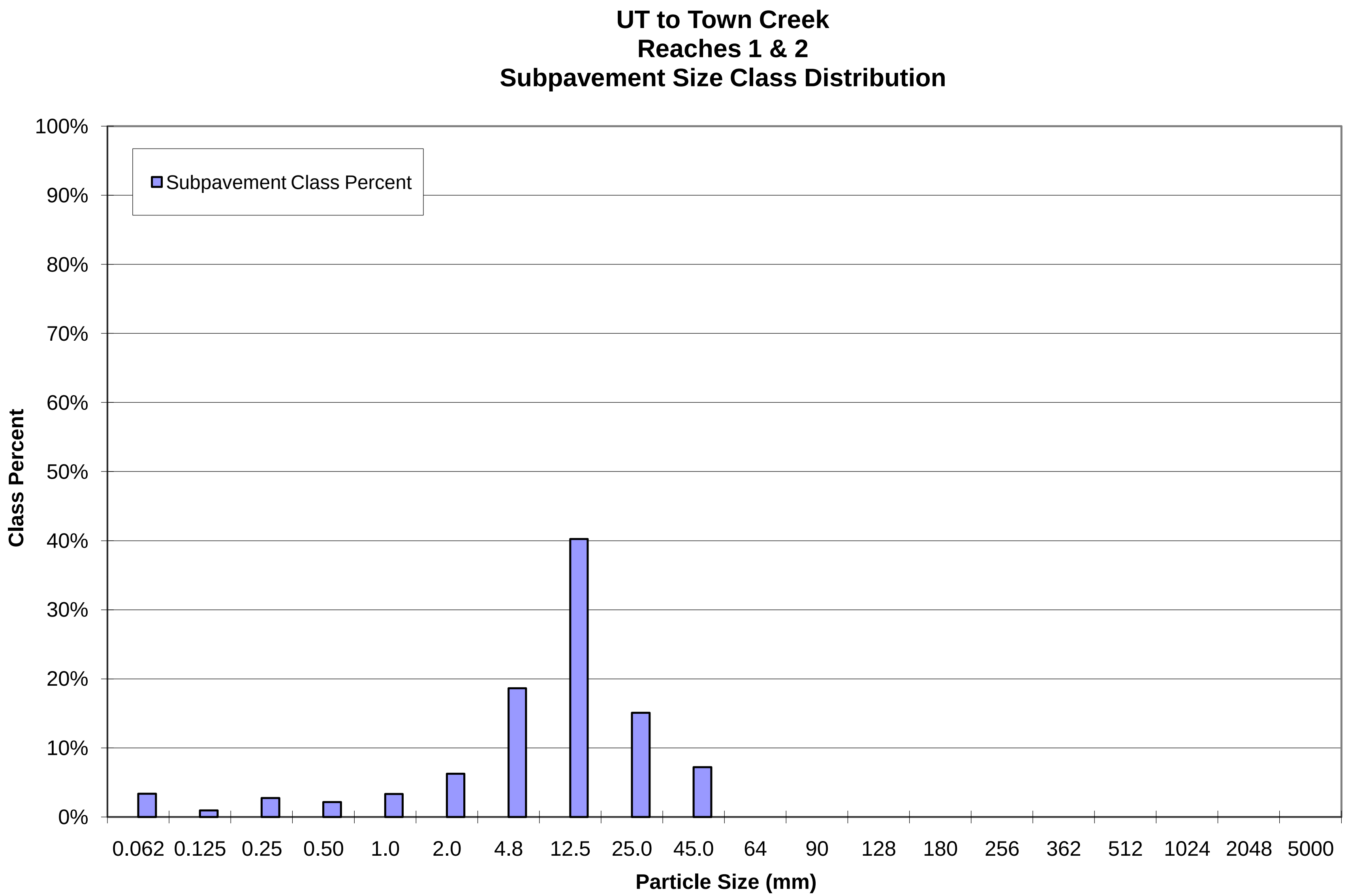
SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 1/2
DATE COLLECTED:	12/8/2010
FIELD COLLECTION BY:	CT
LAB ANALYSIS BY:	CT

LARGEST PAVEMENT: ____ mm LARGEST SUBPAVEMENT: 100.00 mm

			PAVEMENT SIEVE ANALYSIS			SUBPAVEMENT / BAR SIEVE ANALYSIS		
MATERIAL	PARTICLE	SIZE (mm)	RAW	TARE	NET	RAW	TARE	NET
SILT/CLAY	Silt / Clay	< .062			0.0	247.0		247.0
SAND	Very Fine	.062 - .125			0.0	70.5		70.5
	Fine	.125 - .25			0.0	203.5		203.5
	Medium	.25 - .50			0.0	1460.0		160.0
	Coarse	.50 - 1.0			0.0	245.0		245.0
	Very Coarse	1.0 - 2.0			0.0	462.0		462.0
GRAVEL	Very Fine	2.0 - 4.75			0.0	1372.5		1372.5
	Fine - Medium	4.75 - 12.5			0.0	2965.5		2965.5
	Medium- Coarse	12.5 - 25			0.0	1112.5		1112.5
	Coarse	25 - 45			0.0	530.5		530.5
	Very Coarse	45 - 64			0.0			0.0
COBBLE	Small	64 - 90			0.0			0.0
	Small	90-128			0.0			0.0
	Large	128 - 180			0.0			0.0
	Large	180 - 256			0.0			0.0
BOULDER	Small	256 - 362			0.0			0.0
	Small	362 - 512			0.0			0.0
	Medium	512 - 1024			0.0			0.0
	Large - Very Large	1024 - 2048			0.0			0.0
BEDROCK	Bedrock	> 2048			0.0			0.0
		Total			**0.0**			**7369.0**

UT to Town Creek
Reaches 1 & 2
Subpavement Particle Size Distributions




UT to Town Creek
Reaches 1 & 2
Subpavement Size Class Distribution
Subpavement Class Percent
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.062
0.125
0.25
0.50
1.0
2.0
4.8
12.5
25.0
45.0
64
90
128
180
256
362
512
1024
2048
5000
Particle Size (mm)

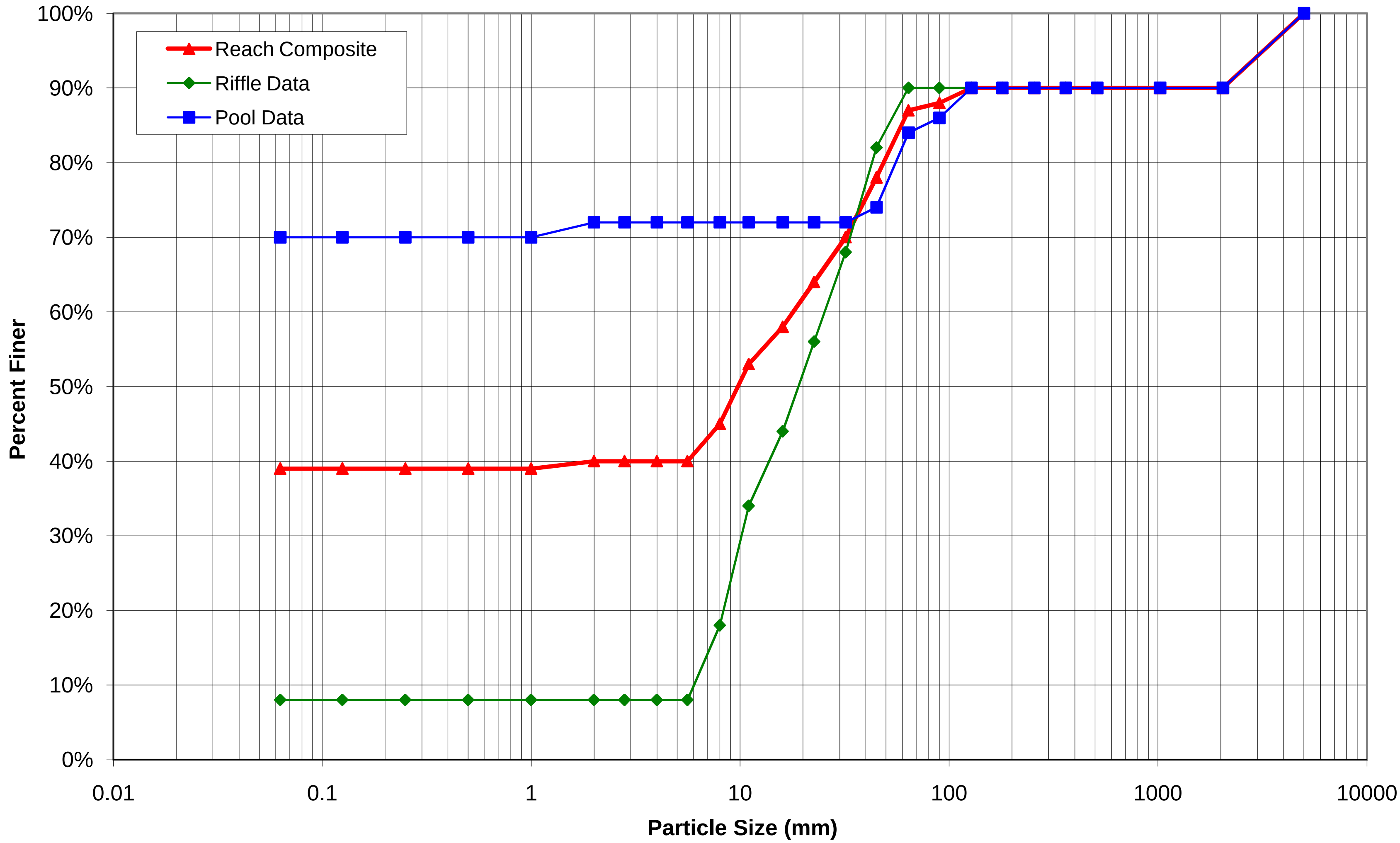
PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

BUCK PROJECT NO.	120857
SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 2
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

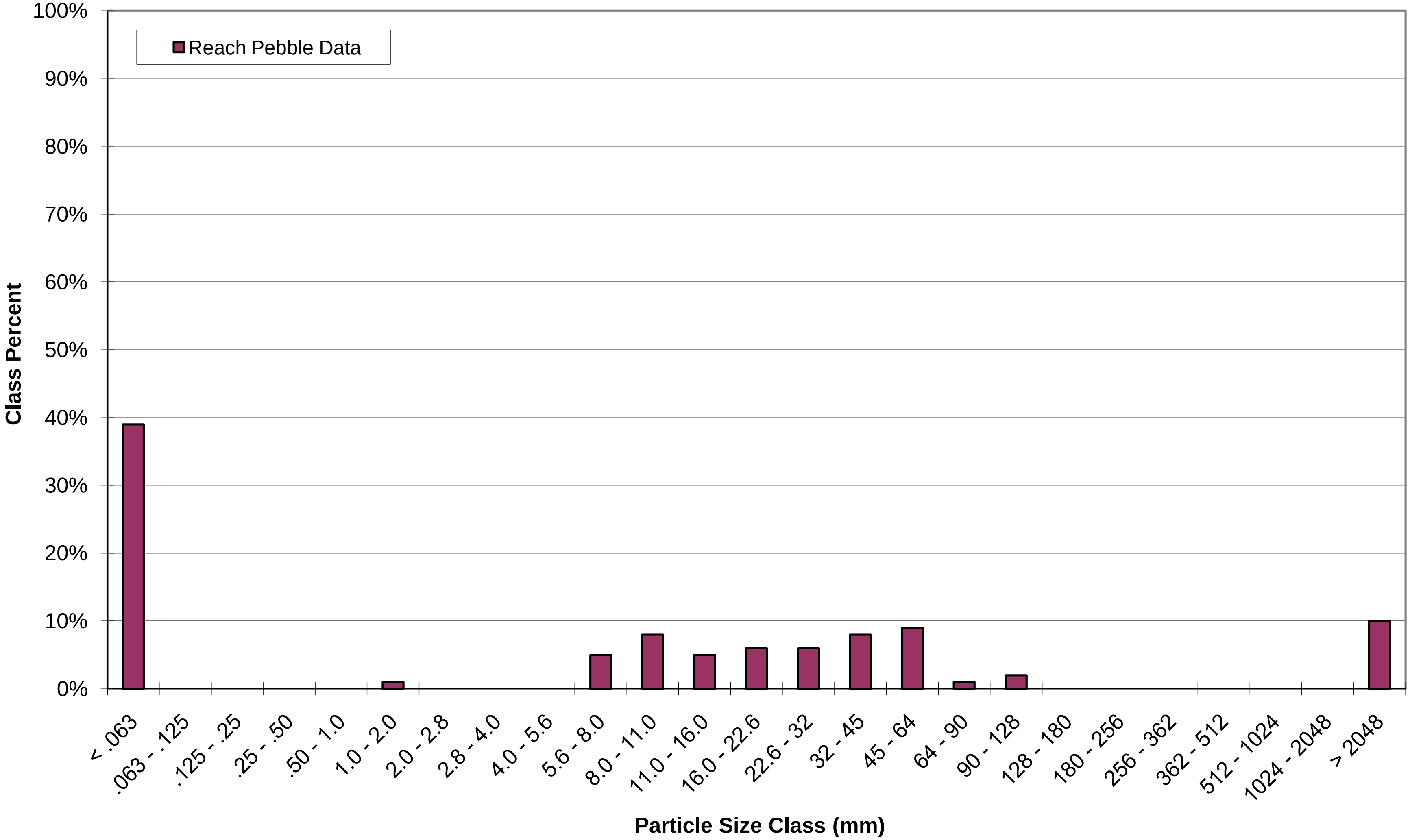
			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	4	35	39	39%	39%	8%	8%	70%	70%
SAND	Very Fine	.063 - .125					39%		8%		70%
	Fine	.125 - .25					39%		8%		70%
	Medium	.25 - .50					39%		8%		70%
	Coarse	.50 - 1.0					39%		8%		70%
	Very Coarse	1.0 - 2.0		1	1	1%	40%		8%	2%	72%
GRAVEL	Very Fine	2.0 - 2.8					40%		8%		72%
	Very Fine	2.8 - 4.0					40%		8%		72%
	Fine	4.0 - 5.6					40%		8%		72%
	Fine	5.6 - 8.0	5		5	5%	45%	10%	18%		72%
	Medium	8.0 - 11.0	8		8	8%	53%	16%	34%		72%
	Medium	11.0 - 16.0	5		5	5%	58%	10%	44%		72%
	Coarse	16.0 - 22.6	6		6	6%	64%	12%	56%		72%
	Coarse	22.6 - 32	6		6	6%	70%	12%	68%		72%
	Very Coarse	32 - 45	7	1	8	8%	78%	14%	82%	2%	74%
	Very Coarse	45 - 64	4	5	9	9%	87%	8%	90%	10%	84%
COBBLE	Small	64 - 90		1	1	1%	88%		90%	2%	86%
	Small	90 - 128		2	2	2%	90%		90%	4%	90%
	Large	128 - 180					90%		90%		90%
	Large	180 - 256					90%		90%		90%
BOULDER	Small	256 - 362					90%		90%		90%
	Small	362 - 512					90%		90%		90%
	Medium	512 - 1024					90%		90%		90%
	Large-Very Large	1024 - 2048					90%		90%		90%
BEDROCK	Bedrock	> 2048	5	5	10	10%	100%	10%	100%	10%	100%
		Total	**50**	**50**	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Largest particles: __________ __________ **mm**
(riffle) (pool)

UT to Town Creek
Reach 2
Pebble Count Particle Size Distributions



UT to Town Creek
Reach 2
Reach Pebble Count Size Class Distribution



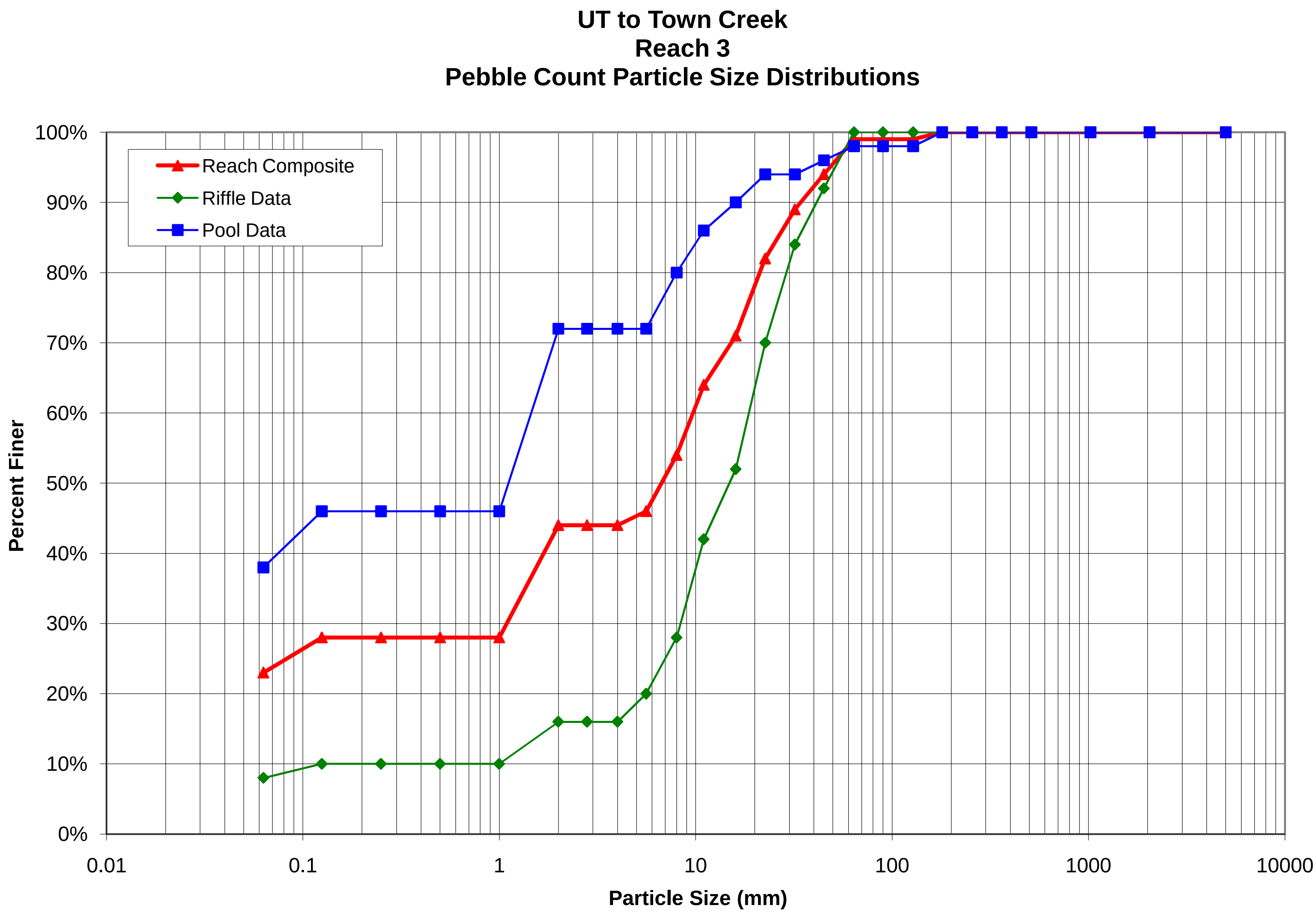
PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

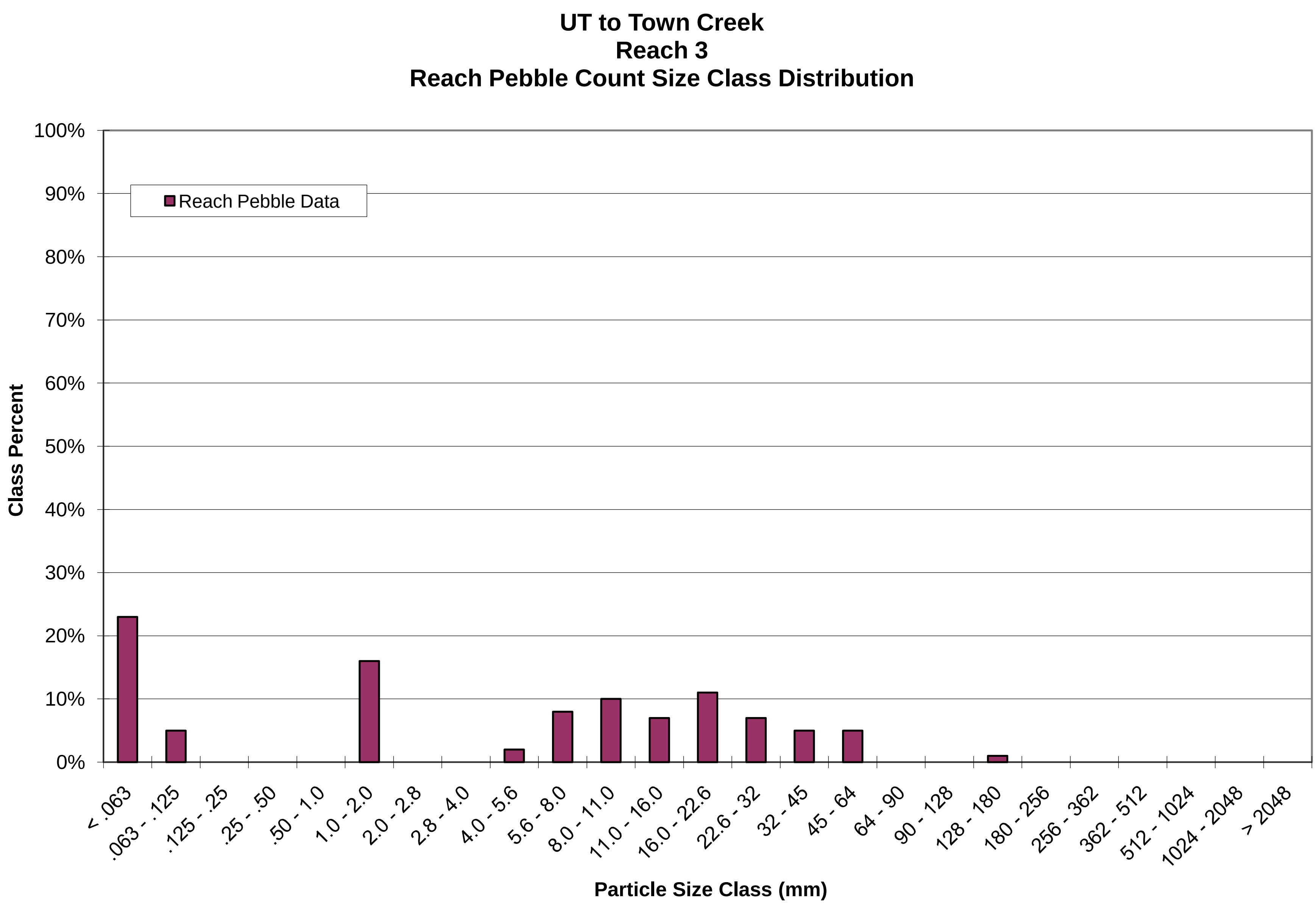
SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 3
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	**PARTICLE**	**SIZE (mm)**	**Riffle**	**Pool**	**Total**	**Class %**	**% Cum**	**Class %**	**% Cum**	**Class %**	**% Cum**
SILT/CLAY	Silt / Clay	< .063	4	19	23	23%	23%	8%	8%	38%	38%
SAND	Very Fine	.063 - .125	1	4	5	5%	28%	2%	10%	8%	46%
	Fine	.125 - .25					28%		10%		46%
	Medium	.25 - .50					28%		10%		46%
	Coarse	.50 - 1.0					28%		10%		46%
	Very Coarse	1.0 - 2.0	3	13	16	16%	44%	6%	16%	26%	72%
GRAVEL	Very Fine	2.0 - 2.8					44%		16%		72%
	Very Fine	2.8 - 4.0					44%		16%		72%
	Fine	4.0 - 5.6	2		2	2%	46%	4%	20%		72%
	Fine	5.6 - 8.0	4	4	8	8%	54%	8%	28%	8%	80%
	Medium	8.0 - 11.0	7	3	10	10%	64%	14%	42%	6%	86%
	Medium	11.0 - 16.0	5	2	7	7%	71%	10%	52%	4%	90%
	Coarse	16.0 - 22.6	9	2	11	11%	82%	18%	70%	4%	94%
	Coarse	22.6 - 32	7		7	7%	89%	14%	84%		94%
	Very Coarse	32 - 45	4	1	5	5%	94%	8%	92%	2%	96%
	Very Coarse	45 - 64	4	1	5	5%	99%	8%	100%	2%	98%
COBBLE	Small	64 - 90					99%		100%		98%
	Small	90 - 128					99%		100%		98%
	Large	128 - 180		1	1	1%	100%		100%	2%	100%
	Large	180 - 256					100%		100%		100%
BOULDER	Small	256 - 362					100%		100%		100%
	Small	362 - 512					100%		100%		100%
	Medium	512 - 1024					100%		100%		100%
	Large-Very Large	1024 - 2048					100%		100%		100%
BEDROCK	Bedrock	> 2048					100%		100%		100%
		Total	**50**	**50**	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Largest particles: __________ __________ **mm**

(riffle) (pool)


UT to Town Creek
Reach 3
Pebble Count Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


UT to Town Creek
Reach 3
Reach Pebble Count Size Class Distribution
Reach Pebble Data
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Class Percent
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size Class (mm)

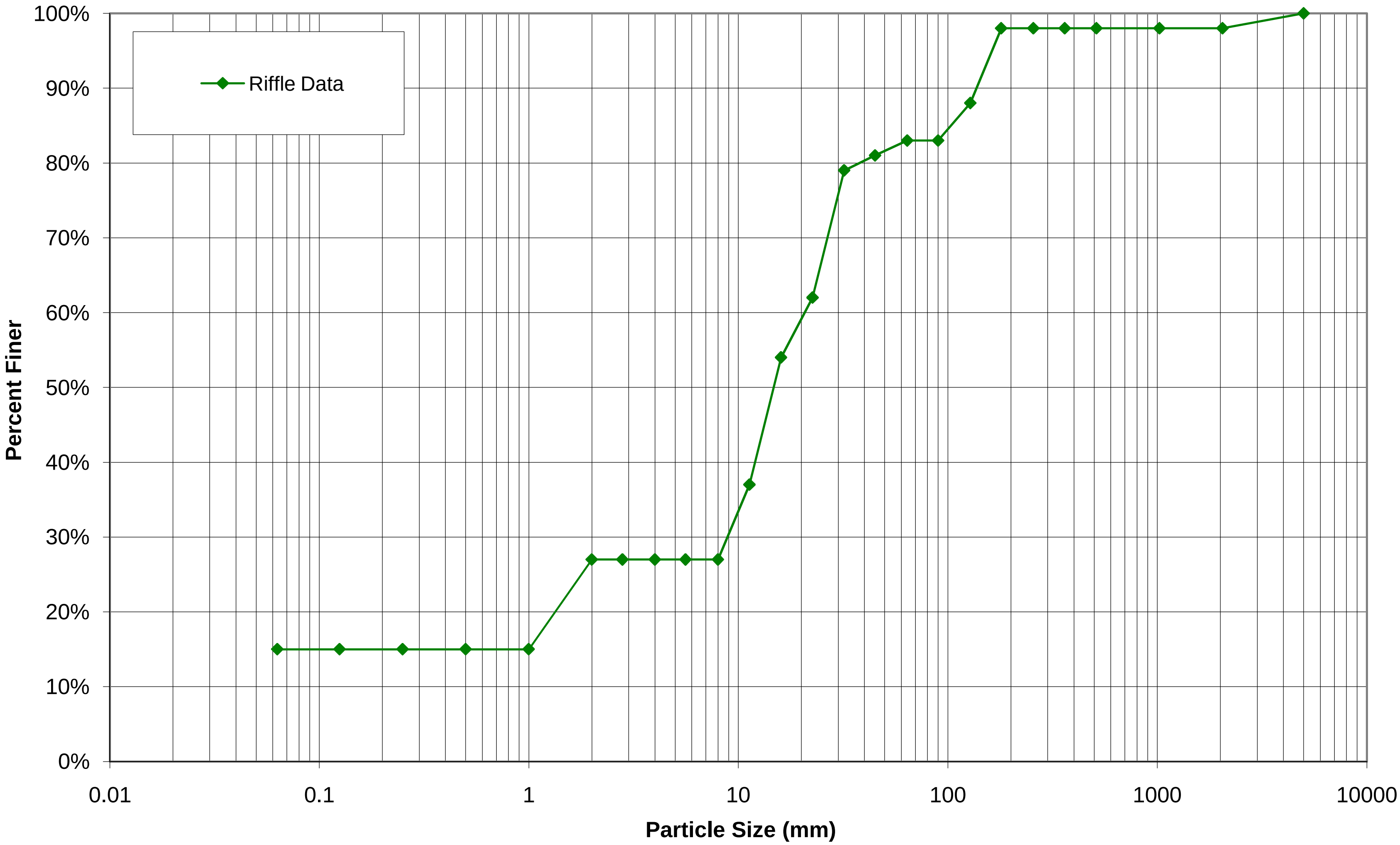
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

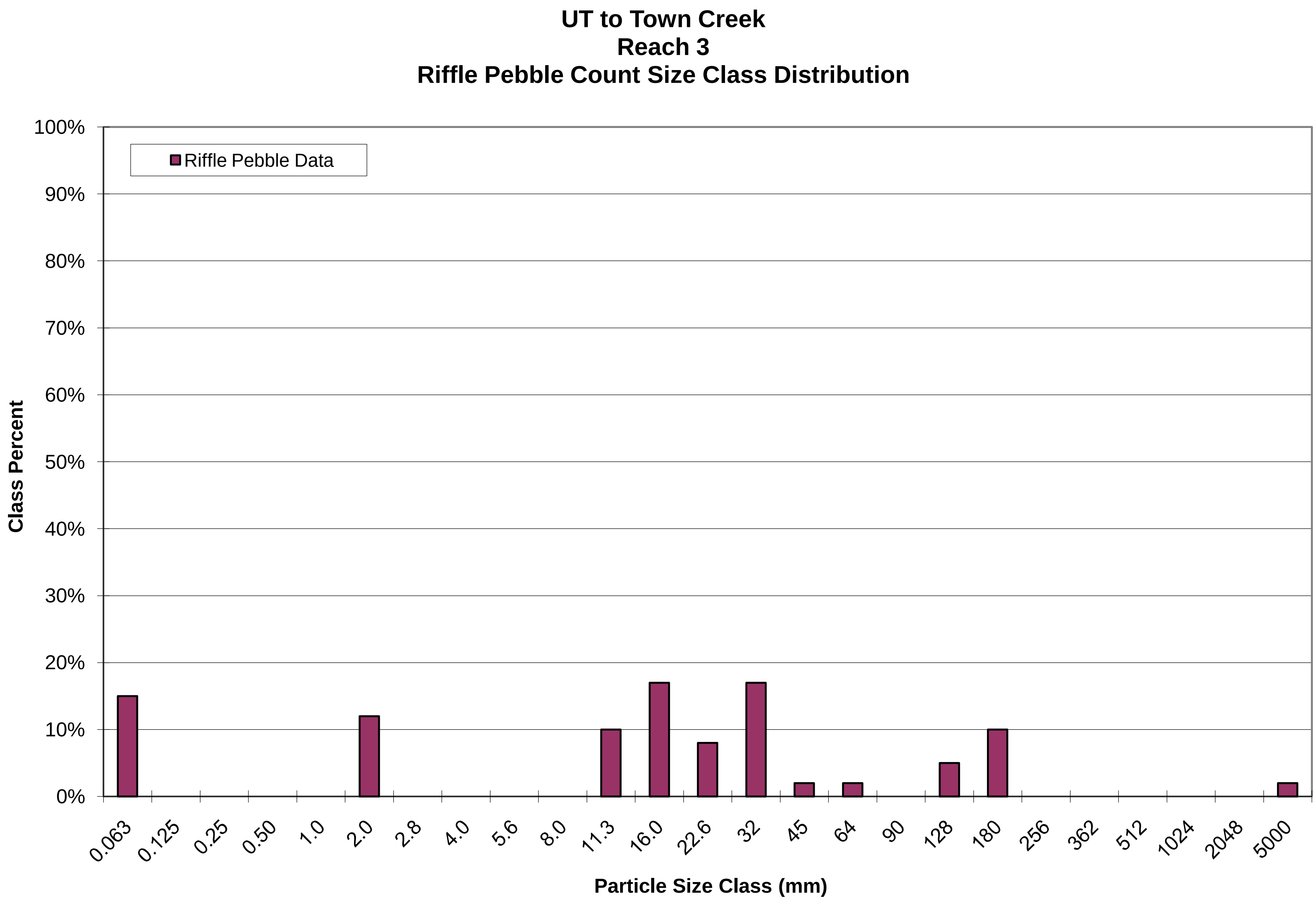
SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 3
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	15	15%	15%
SAND	Very Fine	.063 - .125			15%
	Fine	.125 - .25			15%
	Medium	.25 - .50			15%
	Coarse	.50 - 1.0			15%
	Very Coarse	1.0 - 2.0	12	12%	27%
GRAVEL	Very Fine	2.0 - 2.8			27%
	Very Fine	2.8 - 4.0			27%
	Fine	4.0 - 5.6			27%
	Fine	5.6 - 8.0			27%
	Medium	8.0 - 11.0	10	10%	37%
	Medium	11.0 - 16.0	17	17%	54%
	Coarse	16.0 - 22.6	8	8%	62%
	Coarse	22.6 - 32	17	17%	79%
	Very Coarse	32 - 45	2	2%	81%
	Very Coarse	45 - 64	2	2%	83%
COBBLE	Small	64 - 90			83%
	Small	90 - 128	5	5%	88%
	Large	128 - 180	10	10%	98%
	Large	180 - 256			98%
BOULDER	Small	256 - 362			98%
	Small	362 - 512			98%
	Medium	512 - 1024			98%
	Large-Very Large	1024 - 2048			98%
BEDROCK	Bedrock	> 2048	2	2%	100%
		Total	**100**	**100%**	

Largest particles: __________ **(riffle)**

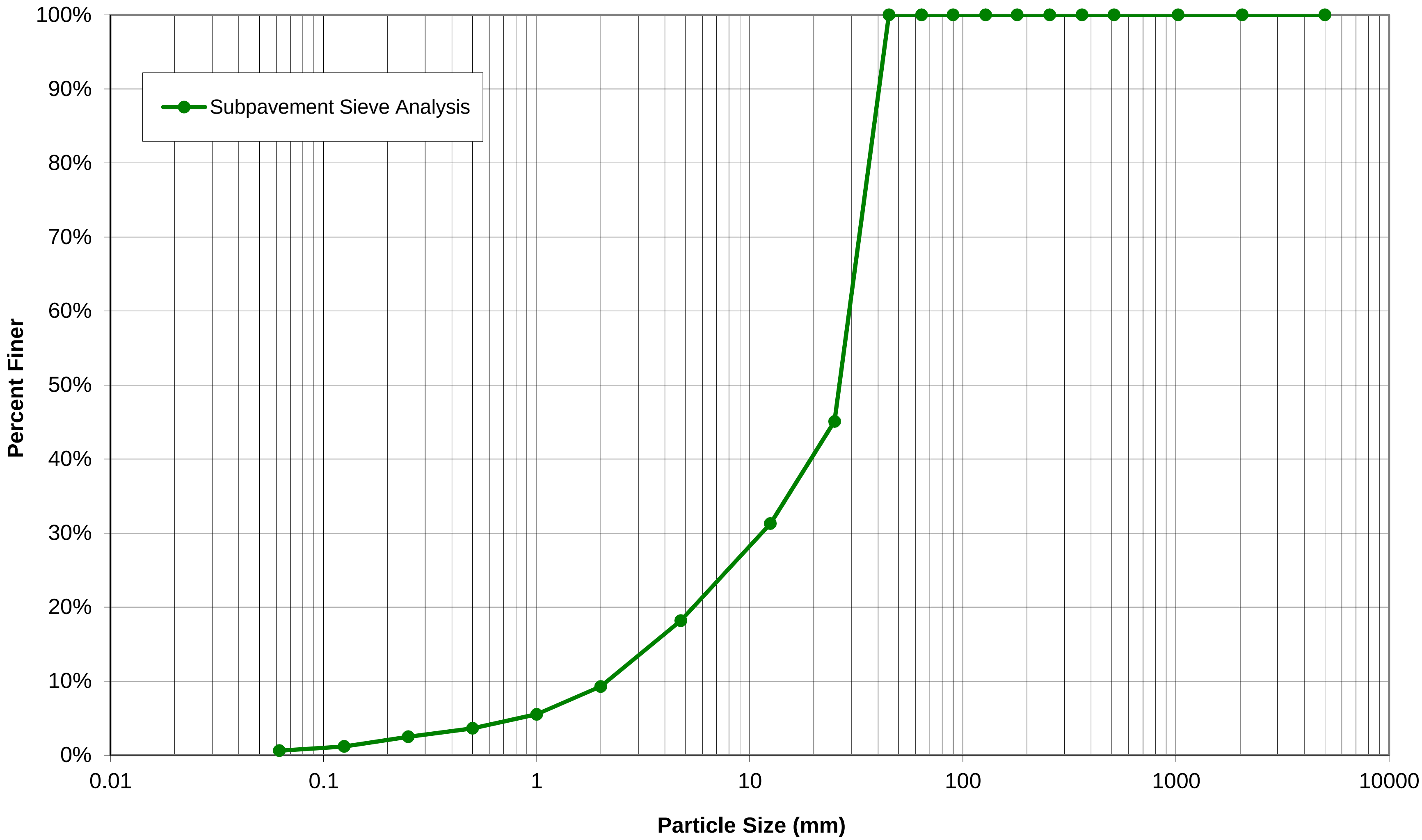
UT to Town Creek
Reach 3
Pebble Count Particle Size Distribution





UT to Town Creek
Reach 3
Riffle Pebble Count Size Class Distribution
Riffle Pebble Data
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.063
0.125
0.25
0.50
1.0
2.0
2.8
4.0
5.6
8.0
11.3
16.0
22.6
32
45
64
90
128
180
256
362
512
1024
2048
5000
Particle Size Class (mm)

UT to Town Creek
Reach 3
Subpavement Particle Size Distributions



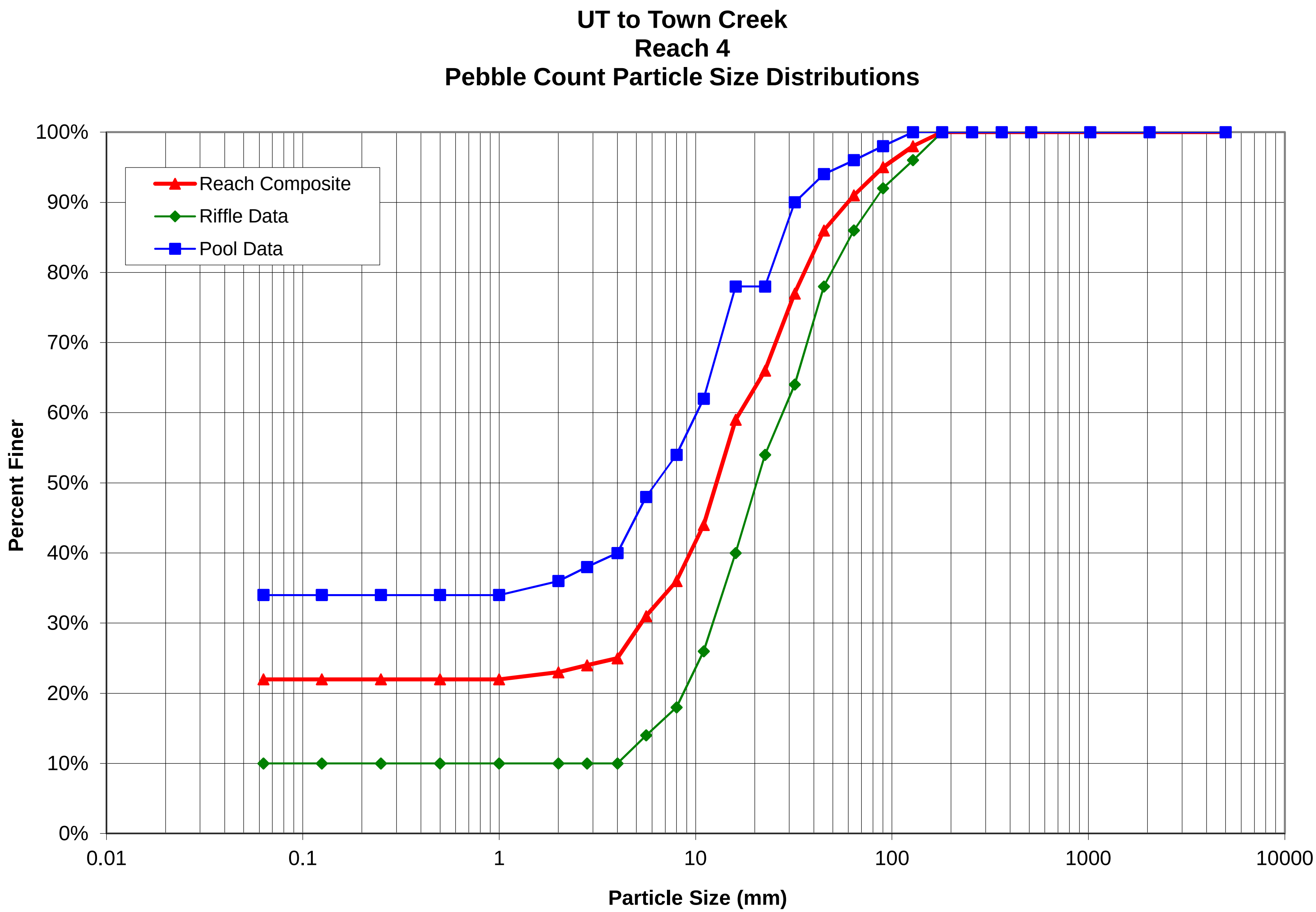
PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 4
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	5	17	22	22%	22%	10%	10%	34%	34%
SAND	Very Fine	.063 - .125					22%		10%		34%
	Fine	.125 - .25					22%		10%		34%
	Medium	.25 - .50					22%		10%		34%
	Coarse	.50 - 1.0					22%		10%		34%
	Very Coarse	1.0 - 2.0		1	1	1%	23%		10%	2%	36%
GRAVEL	Very Fine	2.0 - 2.8		1	1	1%	24%		10%	2%	38%
	Very Fine	2.8 - 4.0		1	1		25%		10%	2%	40%
	Fine	4.0 - 5.6	2	4	6	6%	31%	4%	14%	8%	48%
	Fine	5.6 - 8.0	2	3	5	5%	36%	4%	18%	6%	54%
	Medium	8.0 - 11.0	4	4	8	8%	44%	8%	26%	8%	62%
	Medium	11.0 - 16.0	7	8	15	15%	59%	14%	40%	16%	78%
	Coarse	16.0 - 22.6	7		7	7%	66%	14%	54%		78%
	Coarse	22.6 - 32	5	6	11	11%	77%	10%	64%	12%	90%
	Very Coarse	32 - 45	7	2	9	9%	86%	14%	78%	4%	94%
	Very Coarse	45 - 64	4	1	5	5%	91%	8%	86%	2%	96%
COBBLE	Small	64 - 90	3	1	4	4%	95%	6%	92%	2%	98%
	Small	90 - 128	2	1	3	3%	98%	4%	96%	2%	100%
	Large	128 - 180	2		2	2%	100%	4%	100%		100%
	Large	180 - 256					100%		100%		100%
BOULDER	Small	256 - 362					100%		100%		100%
	Small	362 - 512					100%		100%		100%
	Medium	512 - 1024					100%		100%		100%
	Large-Very Large	1024 - 2048					100%		100%		100%
BEDROCK	Bedrock	> 2048					100%		100%		100%
		Total	**50**	**50**	**100**	**99%**	**100%**	**100%**	**100%**	**100%**	**100%**

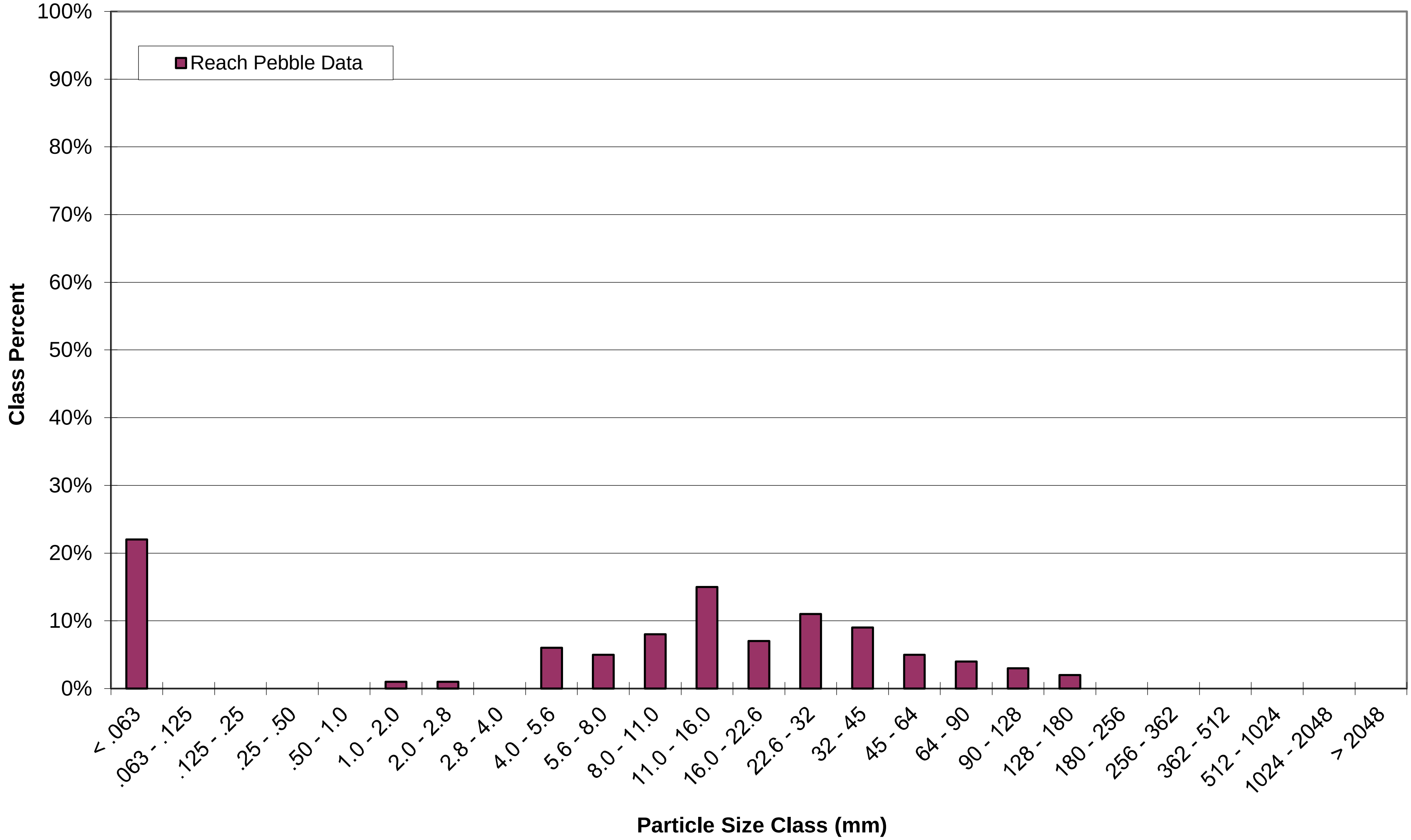
Largest particles: _________ _________ **mm**

(riffle) (pool)



UT to Town Creek
Reach 4
Pebble Count Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
Percent Finer
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

UT to Town Creek
Reach 4
Reach Pebble Count Size Class Distribution



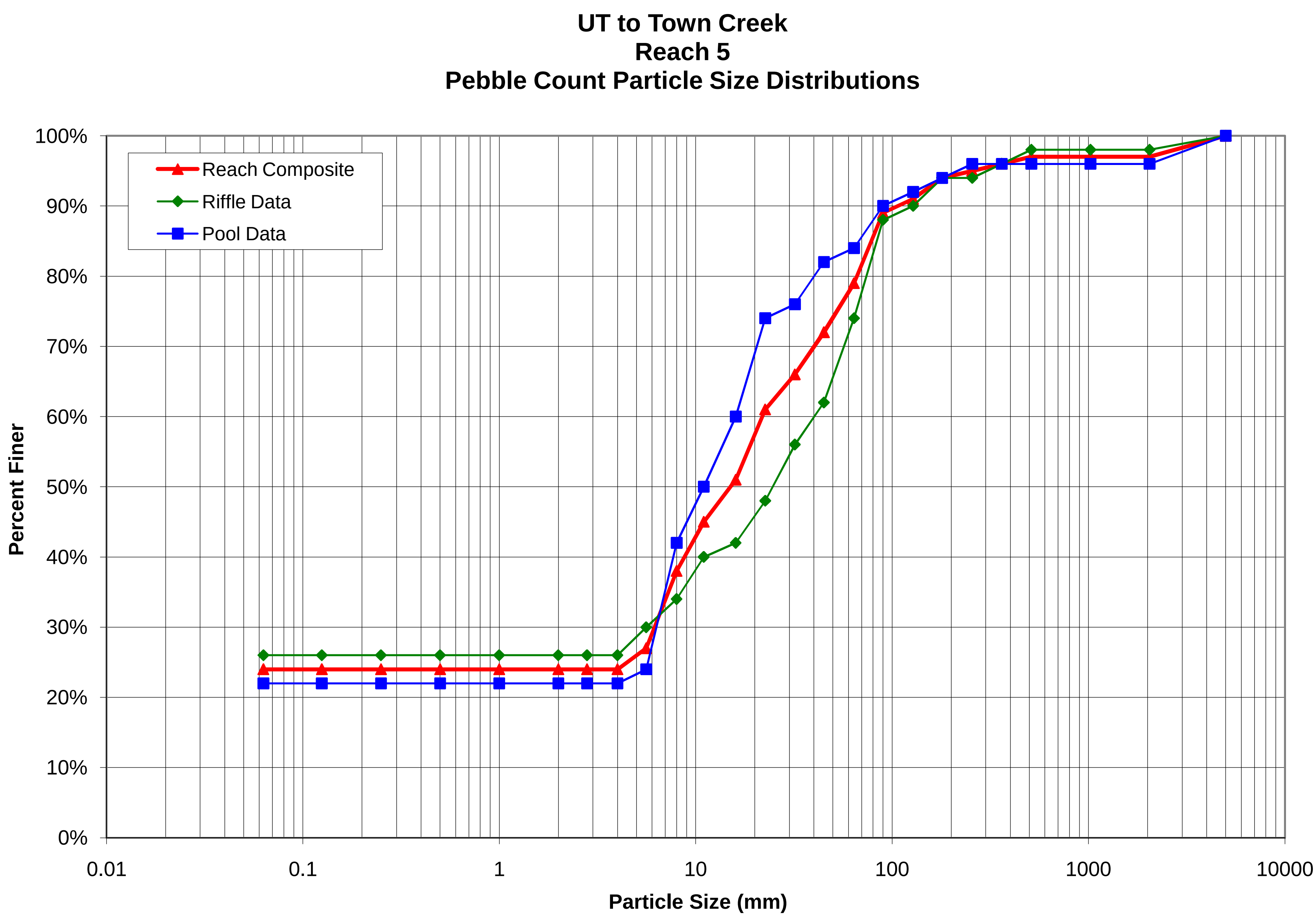
PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 5
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

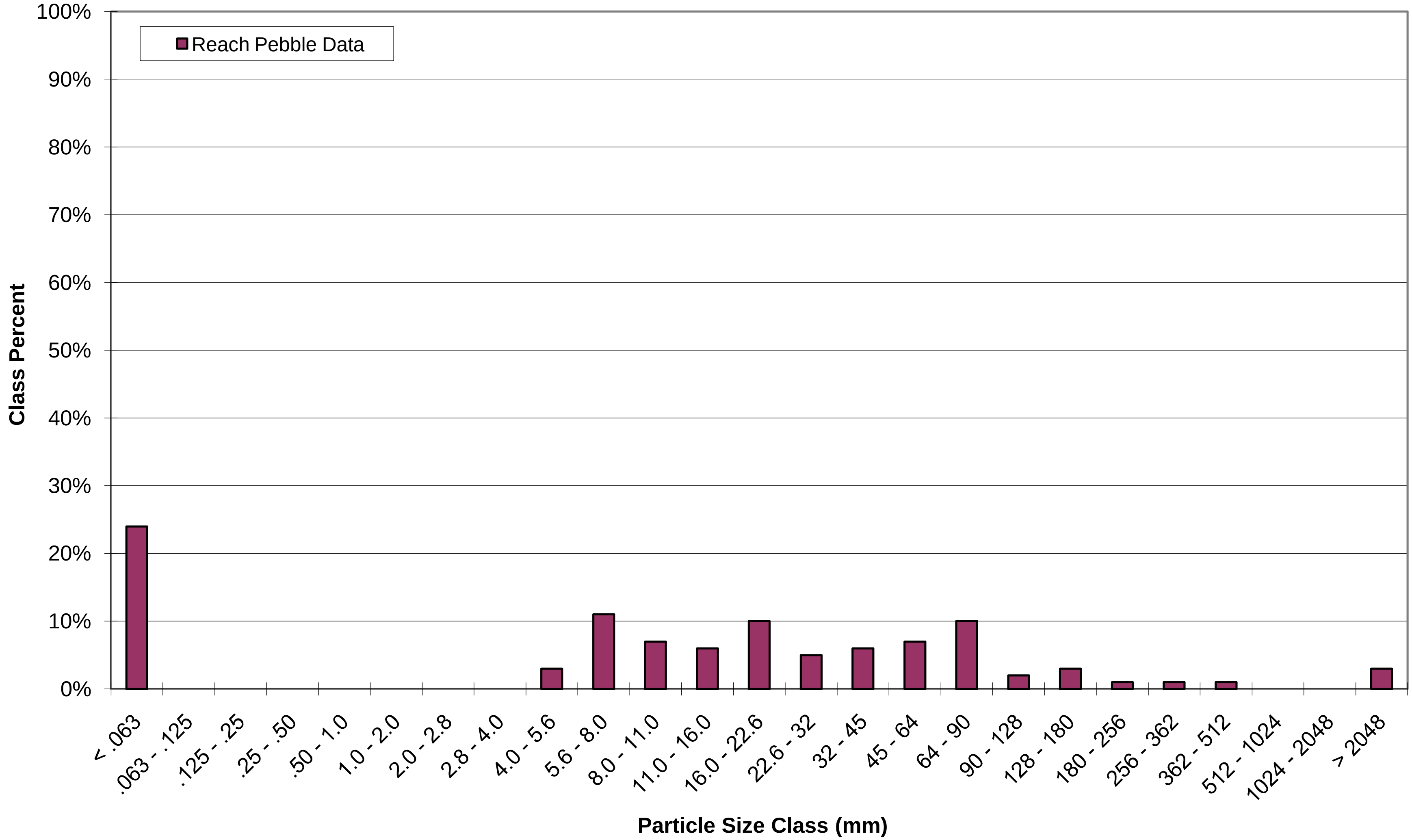
			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	13	11	24	24%	24%	26%	26%	22%	22%
SAND	Very Fine	.063 - .125					24%		26%		22%
	Fine	.125 - .25					24%		26%		22%
	Medium	.25 - .50					24%		26%		22%
	Coarse	.50 - 1.0					24%		26%		22%
	Very Coarse	1.0 - 2.0					24%		26%		22%
GRAVEL	Very Fine	2.0 - 2.8					24%		26%		22%
	Very Fine	2.8 - 4.0					24%		26%		22%
	Fine	4.0 - 5.6	2	1	3	3%	27%	4%	30%	2%	24%
	Fine	5.6 - 8.0	2	9	11	11%	38%	4%	34%	18%	42%
	Medium	8.0 - 11.0	3	4	7	7%	45%	6%	40%	8%	50%
	Medium	11.0 - 16.0	1	5	6	6%	51%	2%	42%	10%	60%
	Coarse	16.0 - 22.6	3	7	10	10%	61%	6%	48%	14%	74%
	Coarse	22.6 - 32	4	1	5	5%	66%	8%	56%	2%	76%
	Very Coarse	32 - 45	3	3	6	6%	72%	6%	62%	6%	82%
	Very Coarse	45 - 64	6	1	7	7%	79%	12%	74%	2%	84%
COBBLE	Small	64 - 90	7	3	10	10%	89%	14%	88%	6%	90%
	Small	90 - 128	1	1	2	2%	91%	2%	90%	2%	92%
	Large	128 - 180	2	1	3	3%	94%	4%	94%	2%	94%
	Large	180 - 256		1	1	1%	95%		94%	2%	96%
BOULDER	Small	256 - 362	1		1	1%	96%	2%	96%		96%
	Small	362 - 512	1		1	1%	97%	2%	98%		96%
	Medium	512 - 1024					97%		98%		96%
	Large-Very Large	1024 - 2048					97%		98%		96%
BEDROCK	Bedrock	> 2048	1	2	3	3%	100%	2%	100%	4%	100%
		Total	50	50	100	100%	100%	100%	100%	100%	100%

Largest particles: _________ _________ **mm**

(riffle) (pool)


UT to Town Creek
Reach 5
Pebble Count Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Finer
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

UT to Town Creek
Reach 5
Reach Pebble Count Size Class Distribution



PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

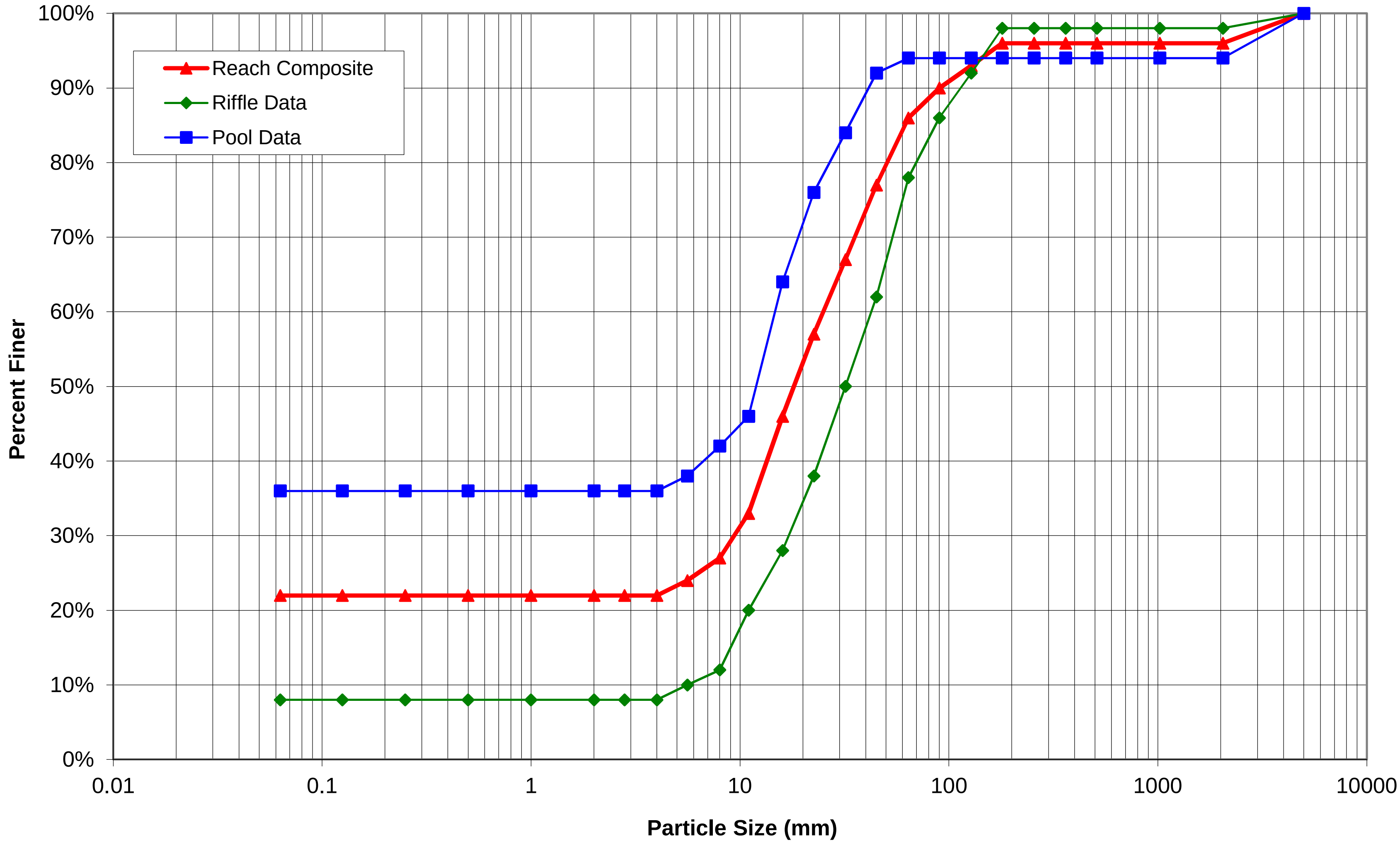
SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 6
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

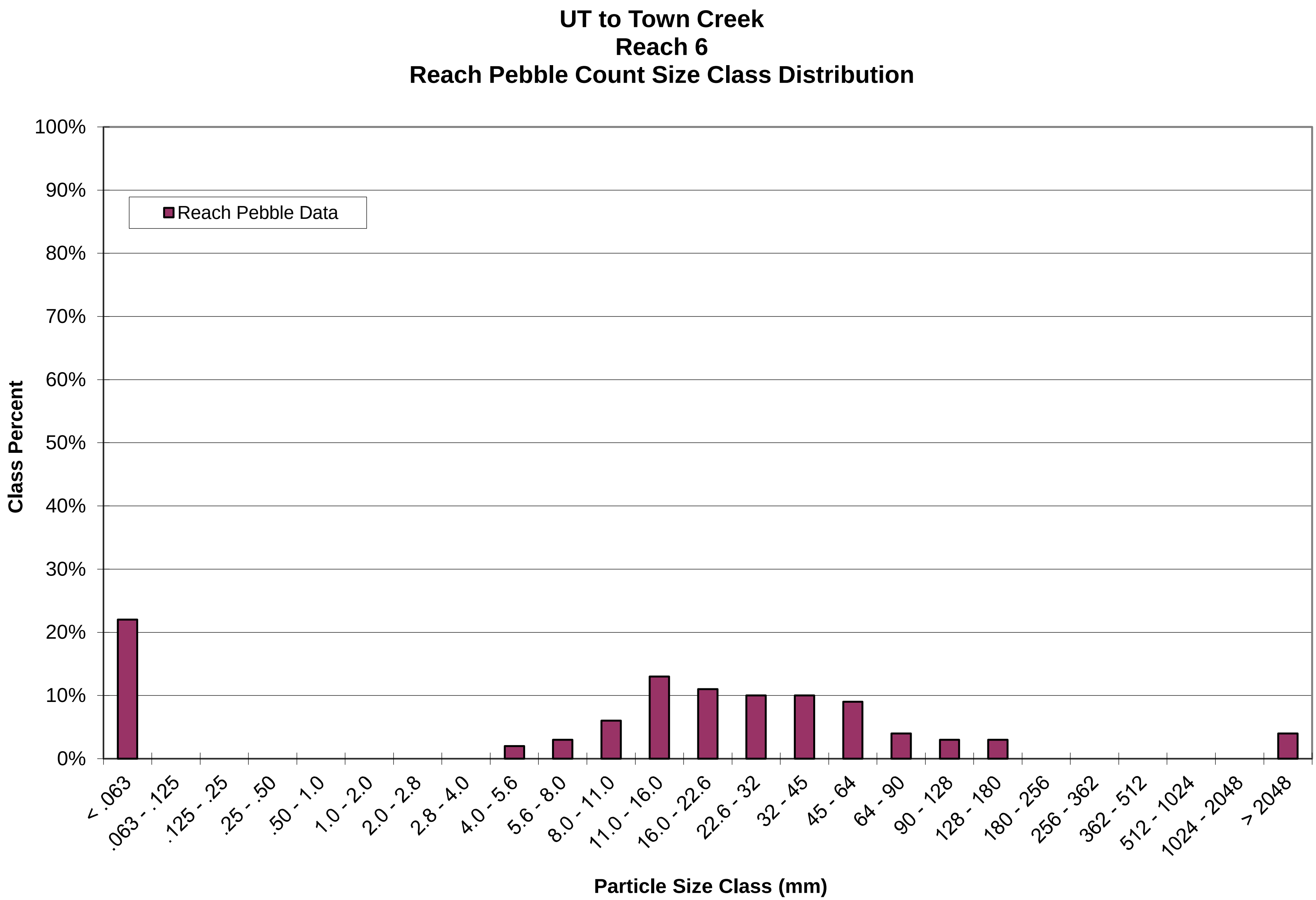
			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	4	18	22	22%	22%	8%	8%	36%	36%
SAND	Very Fine	.063 - .125					22%		8%		36%
	Fine	.125 - .25					22%		8%		36%
	Medium	.25 - .50					22%		8%		36%
	Coarse	.50 - 1.0					22%		8%		36%
	Very Coarse	1.0 - 2.0					22%		8%		36%
GRAVEL	Very Fine	2.0 - 2.8					22%		8%		36%
	Very Fine	2.8 - 4.0					22%		8%		36%
	Fine	4.0 - 5.6	1	1	2	2%	24%	2%	10%	2%	38%
	Fine	5.6 - 8.0	1	2	3	3%	27%	2%	12%	4%	42%
	Medium	8.0 - 11.0	4	2	6	6%	33%	8%	20%	4%	46%
	Medium	11.0 - 16.0	4	9	13	13%	46%	8%	28%	18%	64%
	Coarse	16.0 - 22.6	5	6	11	11%	57%	10%	38%	12%	76%
	Coarse	22.6 - 32	6	4	10	10%	67%	12%	50%	8%	84%
	Very Coarse	32 - 45	6	4	10	10%	77%	12%	62%	8%	92%
	Very Coarse	45 - 64	8	1	9	9%	86%	16%	78%	2%	94%
COBBLE	Small	64 - 90	4		4	4%	90%	8%	86%		94%
	Small	90 - 128	3		3	3%	93%	6%	92%		94%
	Large	128 - 180	3		3	3%	96%	6%	98%		94%
	Large	180 - 256					96%		98%		94%
BOULDER	Small	256 - 362					96%		98%		94%
	Small	362 - 512					96%		98%		94%
	Medium	512 - 1024					96%		98%		94%
	Large-Very Large	1024 - 2048					96%		98%		94%
BEDROCK	Bedrock	> 2048	1	3	4	4%	100%	2%	100%	6%	100%
		Total	**50**	**50**	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Largest particles: __________ __________ **mm**

(riffle) **(pool)**

UT to Town Creek
Reach 6
Pebble Count Particle Size Distributions




UT to Town Creek
Reach 6
Reach Pebble Count Size Class Distribution
Reach Pebble Data
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size Class (mm)

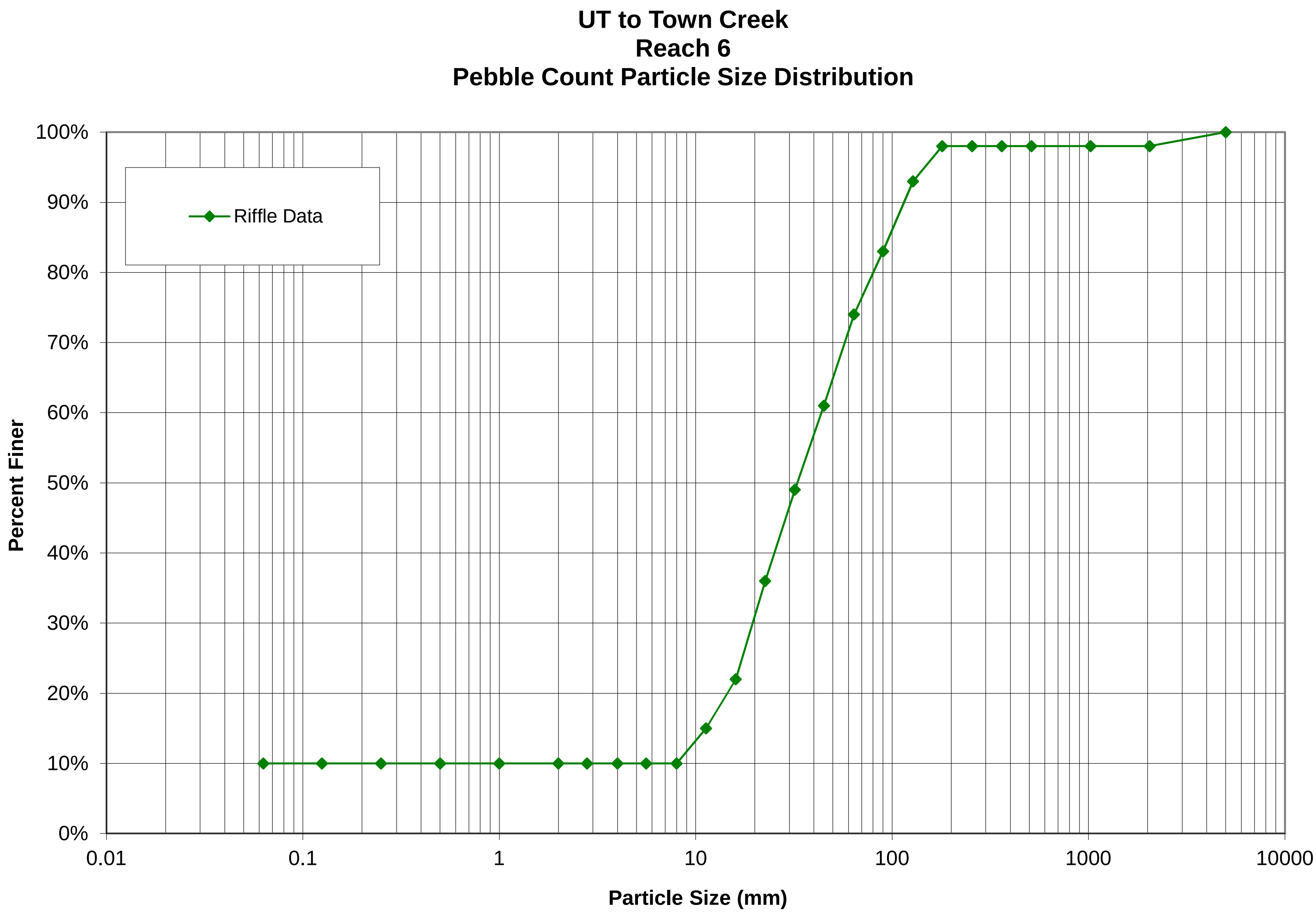
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 6
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

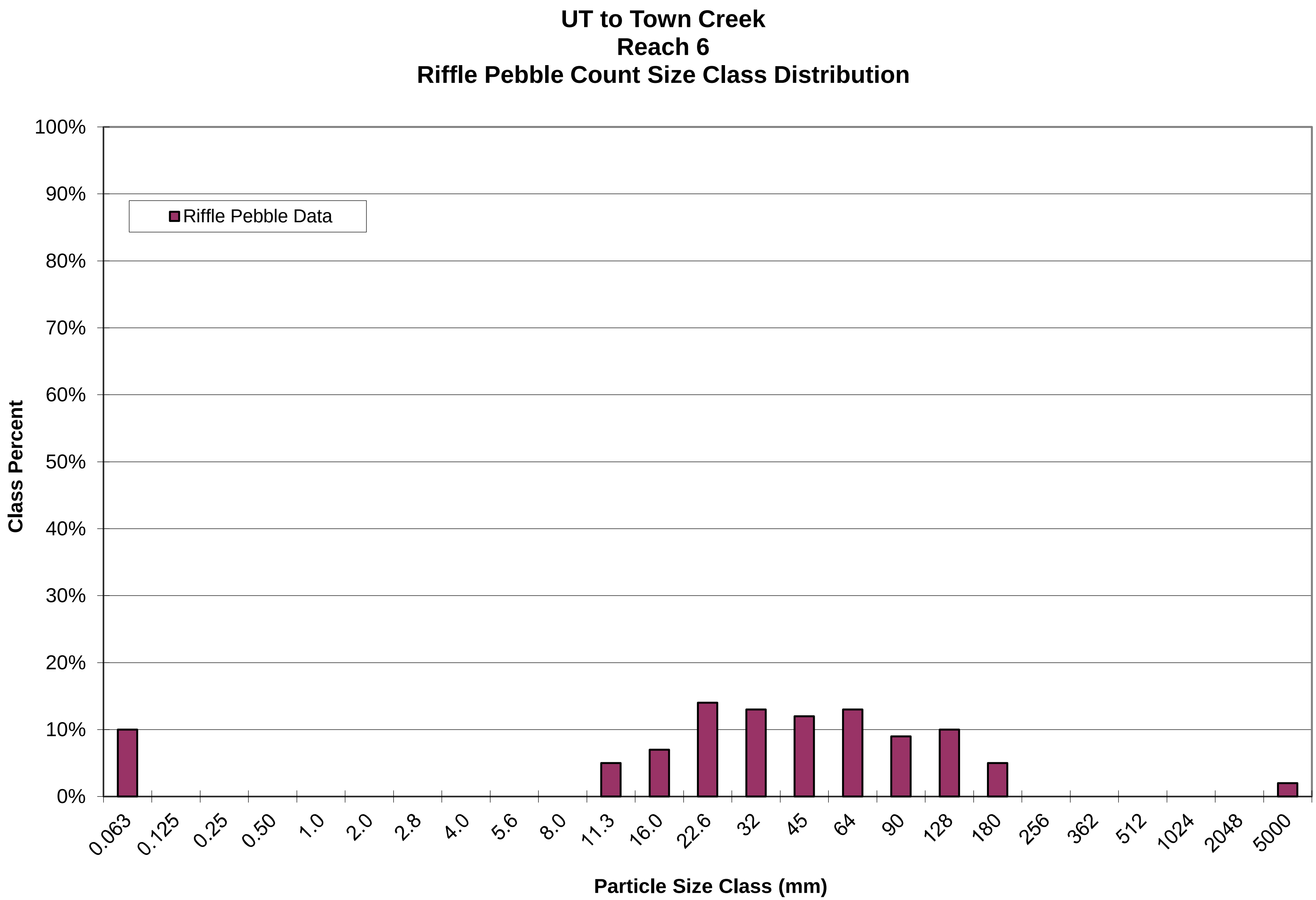
			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	10	10%	10%
SAND	Very Fine	.063 - .125			10%
	Fine	.125 - .25			10%
	Medium	.25 - .50			10%
	Coarse	.50 - 1.0			10%
	Very Coarse	1.0 - 2.0			10%
GRAVEL	Very Fine	2.0 - 2.8			10%
	Very Fine	2.8 - 4.0			10%
	Fine	4.0 - 5.6			10%
	Fine	5.6 - 8.0			10%
	Medium	8.0 - 11.0	5	5%	15%
	Medium	11.0 - 16.0	7	7%	22%
	Coarse	16.0 - 22.6	14	14%	36%
	Coarse	22.6 - 32	13	13%	49%
	Very Coarse	32 - 45	12	12%	61%
	Very Coarse	45 - 64	13	13%	74%
COBBLE	Small	64 - 90	9	9%	83%
	Small	90 - 128	10	10%	93%
	Large	128 - 180	5	5%	98%
	Large	180 - 256			98%
BOULDER	Small	256 - 362			98%
	Small	362 - 512			98%
	Medium	512 - 1024			98%
	Large-Very Large	1024 - 2048			98%
BEDROCK	Bedrock	> 2048	2	2%	100%
		Total	100	100%	

Largest particles: __________

(riffle)



UT to Town Creek
Reach 6
Pebble Count Particle Size Distribution
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

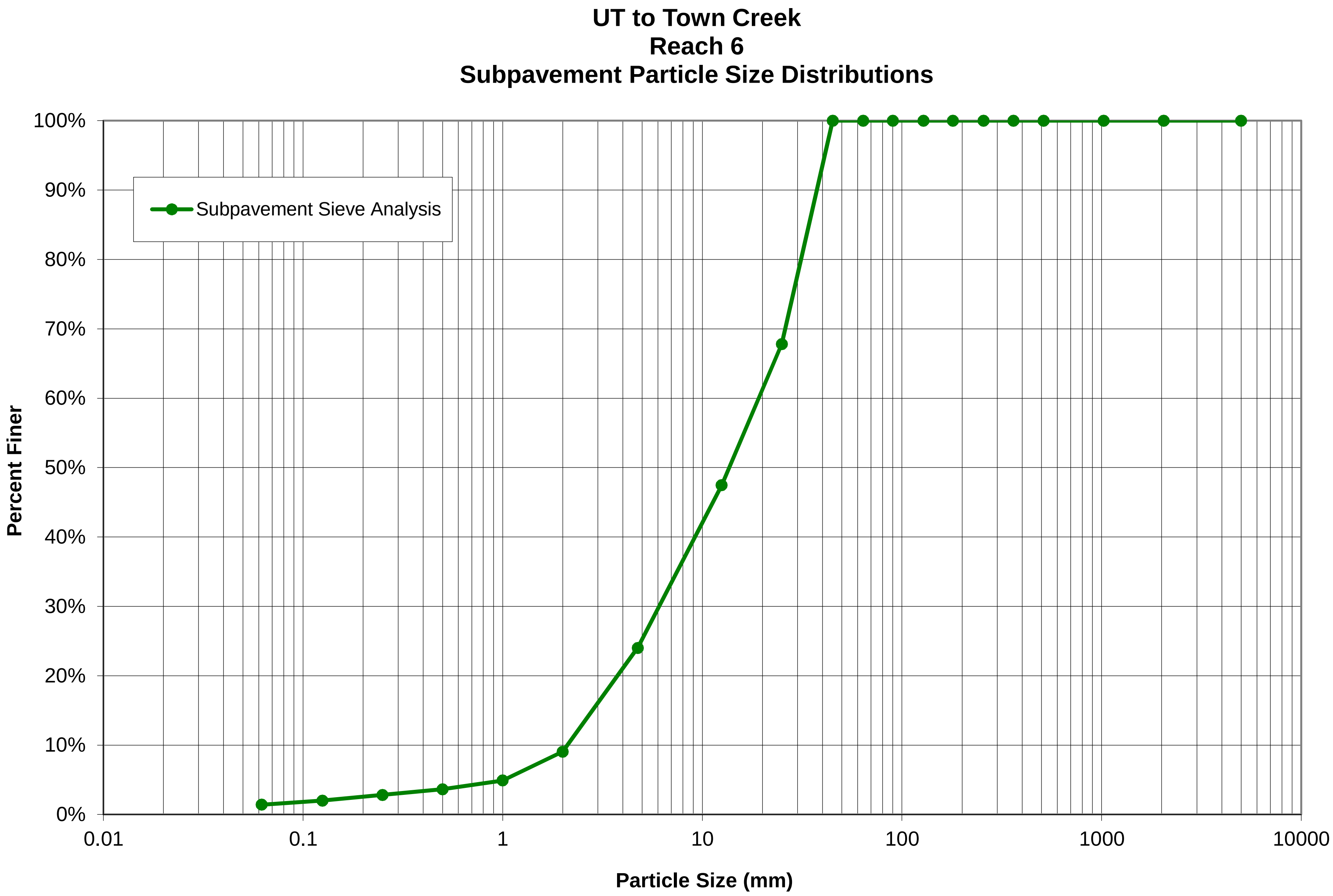

UT to Town Creek
Reach 6
Riffle Pebble Count Size Class Distribution
Riffle Pebble Data
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.063
0.125
0.25
0.50
1.0
2.0
2.8
4.0
5.6
8.0
11.3
16.0
22.6
32
45
64
90
128
180
256
362
512
1024
2048
5000
Particle Size Class (mm)

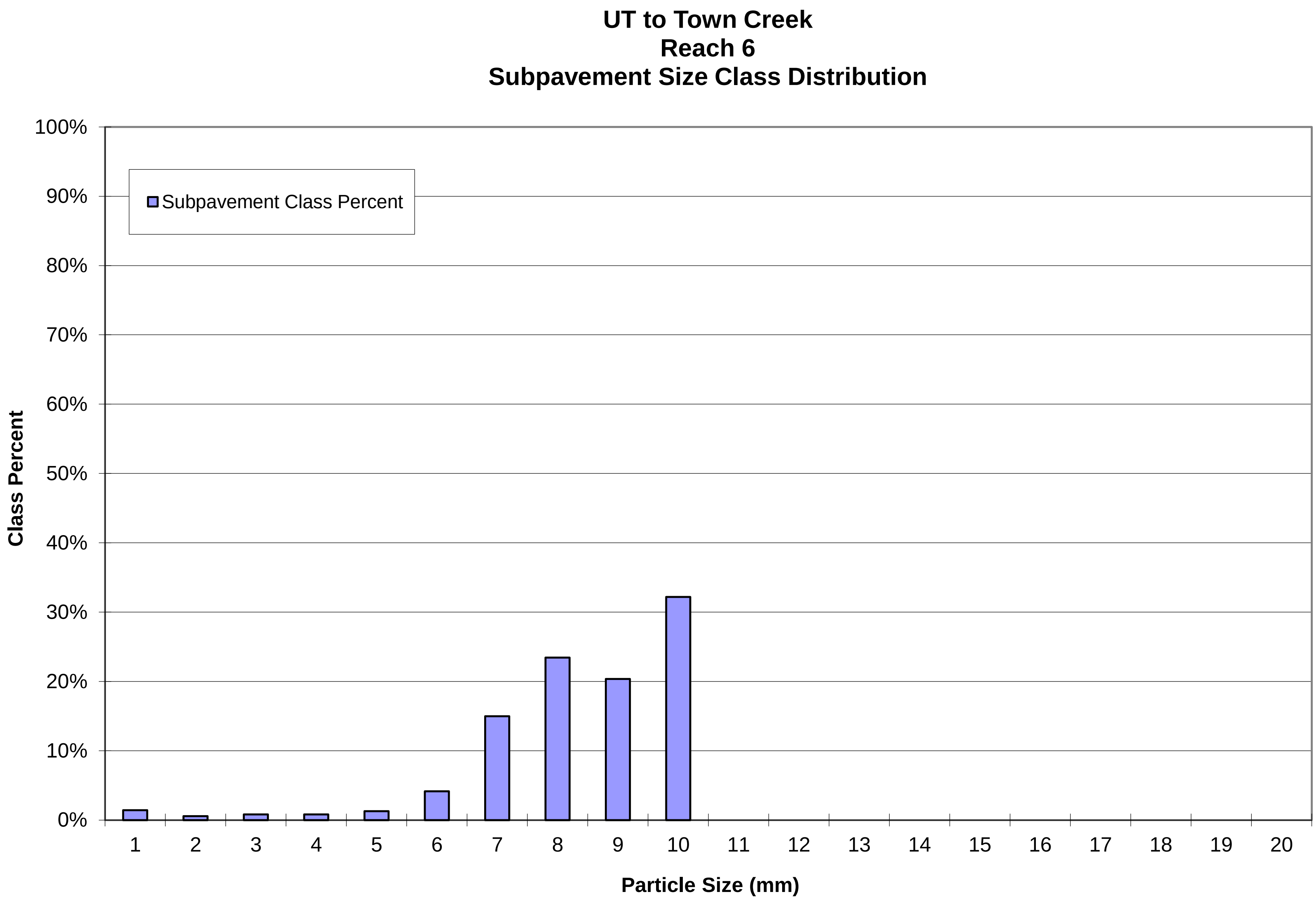
PAVEMENT / SUBPAVEMENT ANALYSIS

SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 6
DATE COLLECTED:	12/8/2010
FIELD COLLECTION BY:	CT
LAB ANALYSIS BY:	CT

LARGEST PAVEMENT: ______ mm   LARGEST SUBPAVEMENT: 90.00 mm

			PAVEMENT SIEVE ANALYSIS			SUBPAVEMENT / BAR SIEVE ANALYSIS		
MATERIAL	PARTICLE	SIZE (mm)	RAW	TARE	NET	RAW	TARE	NET
SILT/CLAY	Silt / Clay	< .062			0.0	102.0		102.0
SAND	Very Fine	.062 - .125			0.0	41.5		41.5
	Fine	.125 - .25			0.0	59.5		59.5
	Medium	.25 - .50			0.0	58.0		58.0
	Coarse	.50 - 1.0			0.0	91.5		91.5
	Very Coarse	1.0 - 2.0			0.0	297.5		297.5
GRAVEL	Very Fine	2.0 - 4.75			0.0	1074.0		1074.0
	Fine - Medium	4.75 - 12.5			0.0	1684.0		1684.0
	Medium- Coarse	12.5 - 25			0.0	1460.5		1460.5
	Coarse	25 - 45			0.0	2311.5		2311.5
	Very Coarse	45 - 64			0.0			0.0
COBBLE	Small	64 - 90			0.0			0.0
	Small	90-128			0.0			0.0
	Large	128 - 180			0.0			0.0
	Large	180 - 256			0.0			0.0
BOULDER	Small	256 - 362			0.0			0.0
	Small	362 - 512			0.0			0.0
	Medium	512 - 1024			0.0			0.0
	Large - Very Large	1024 - 2048			0.0			0.0
BEDROCK	Bedrock	> 2048			0.0			0.0
		Total			**0.0**			**7180.0**


UT to Town Creek
Reach 6
Subpavement Particle Size Distributions
Subpavement Sieve Analysis
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

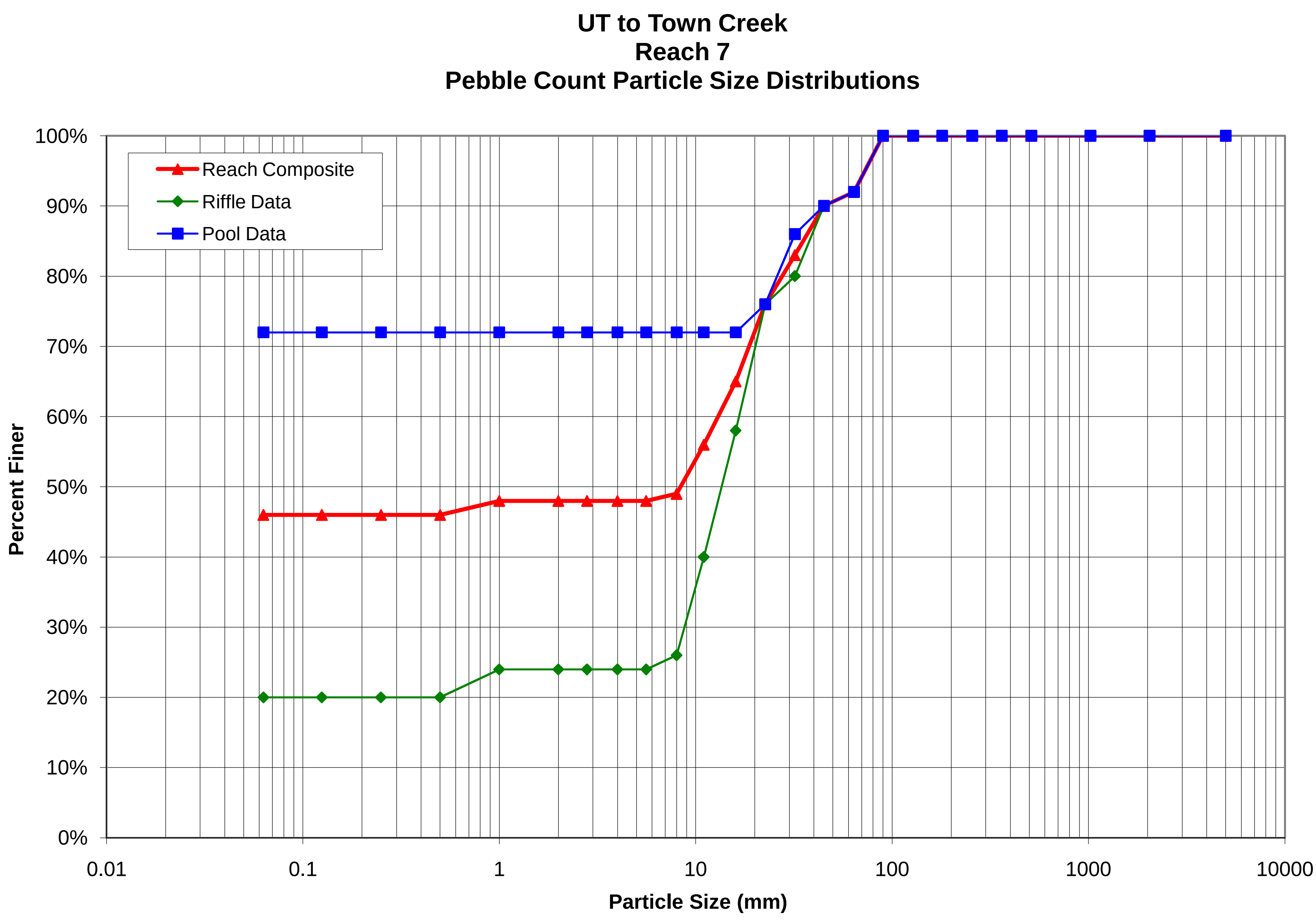

UT to Town Creek
Reach 6
Subpavement Size Class Distribution
Subpavement Class Percent
Class Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Particle Size (mm)

PEBBLE COUNT DATA SHEET: REACH-WIDE COUNT

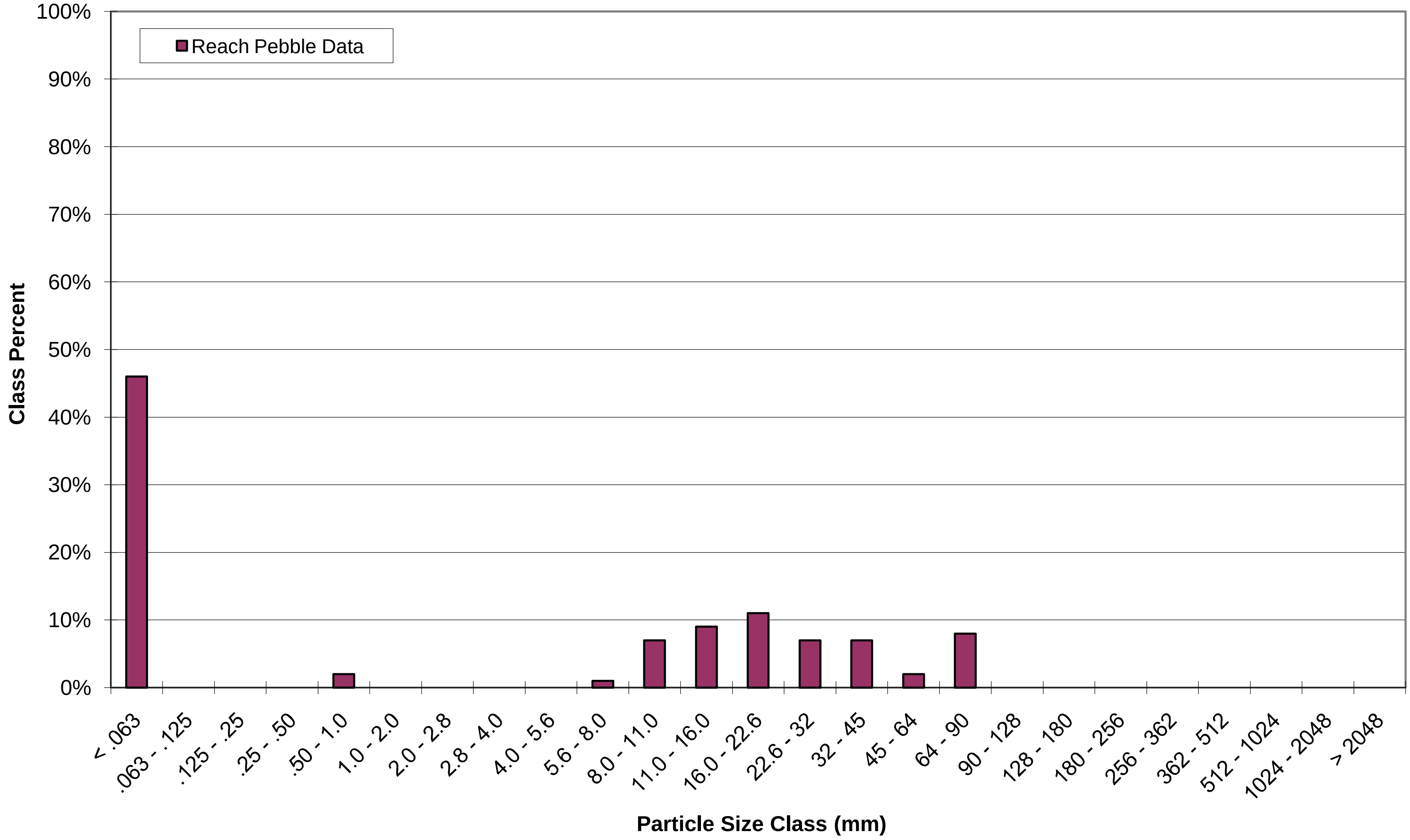
SITE OR PROJECT:	UT to Town Creek
REACH/LOCATION:	Reach 7
DATE COLLECTED:	12/7/2010
FIELD COLLECTION BY:	CT
DATA ENTRY BY:	PL

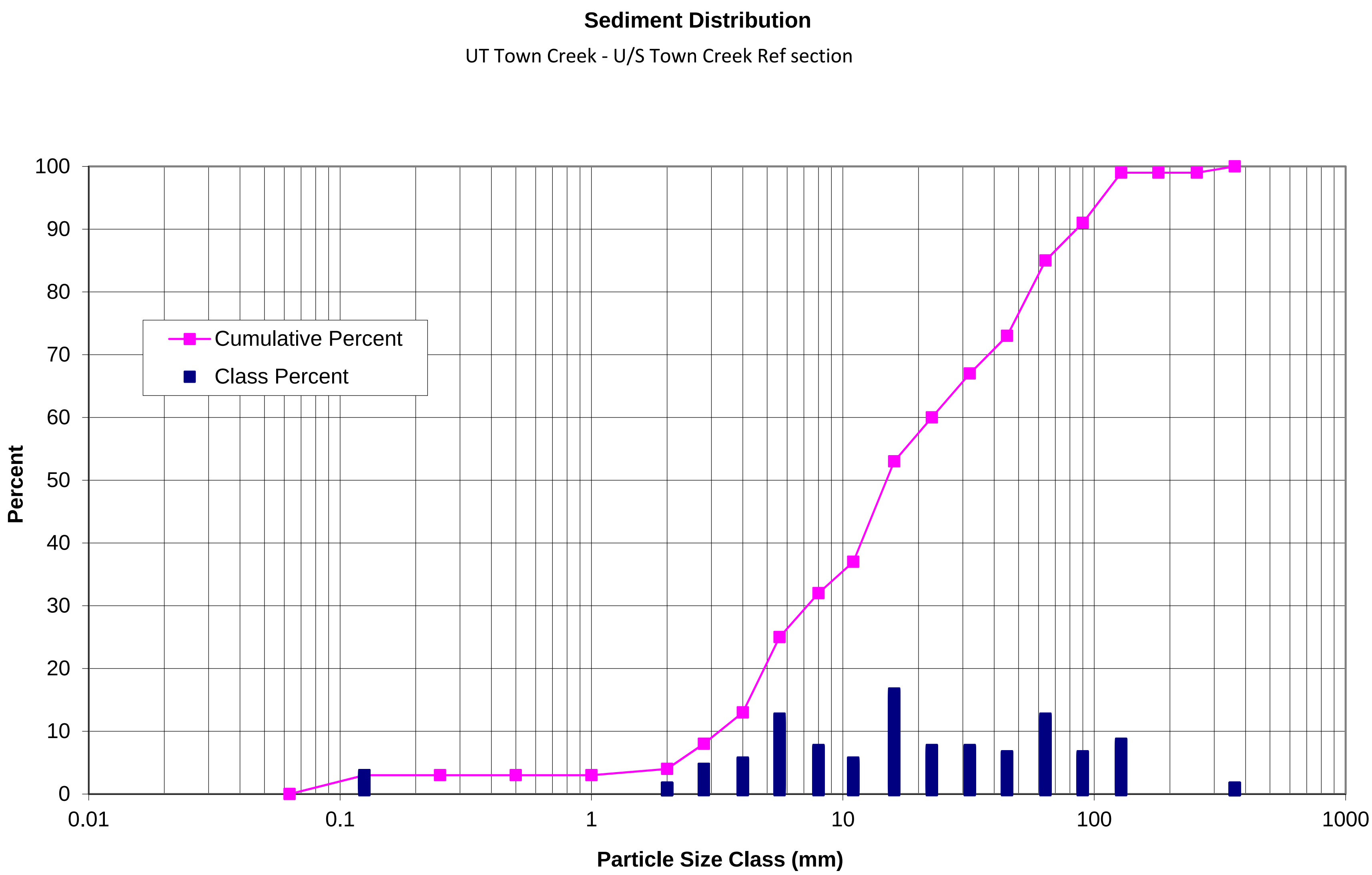
			PARTICLE CLASS WEIGHT (g)			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	10	36	46	46%	46%	20%	20%	72%	72%
SAND	Very Fine	.063 - .125					46%		20%		72%
	Fine	.125 - .25					46%		20%		72%
	Medium	.25 - .50					46%		20%		72%
	Coarse	.50 - 1.0	2		2	2%	48%	4%	24%		72%
	Very Coarse	1.0 - 2.0					48%		24%		72%
GRAVEL	Very Fine	2.0 - 2.8					48%		24%		72%
	Very Fine	2.8 - 4.0					48%		24%		72%
	Fine	4.0 - 5.6					48%		24%		72%
	Fine	5.6 - 8.0	1		1	1%	49%	2%	26%		72%
	Medium	8.0 - 11.0	7		7	7%	56%	14%	40%		72%
	Medium	11.0 - 16.0	9		9	9%	65%	18%	58%		72%
	Coarse	16.0 - 22.6	9	2	11	11%	76%	18%	76%	4%	76%
	Coarse	22.6 - 32	2	5	7	7%	83%	4%	80%	10%	86%
	Very Coarse	32 - 45	5	2	7	7%	90%	10%	90%	4%	90%
	Very Coarse	45 - 64	1	1	2	2%	92%	2%	92%	2%	92%
COBBLE	Small	64 - 90	4	4	8	8%	100%	8%	100%	8%	100%
	Small	90 - 128					100%		100%		100%
	Large	128 - 180					100%		100%		100%
	Large	180 - 256					100%		100%		100%
BOULDER	Small	256 - 362					100%		100%		100%
	Small	362 - 512					100%		100%		100%
	Medium	512 - 1024					100%		100%		100%
	Large-Very Large	1024 - 2048					100%		100%		100%
BEDROCK	Bedrock	> 2048					100%		100%		100%
		Total	**50**	**50**	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Largest particles: __________ __________ **mm**
(riffle) (pool)


UT to Town Creek
Reach 7
Pebble Count Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

UT to Town Creek
Reach 7
Reach Pebble Count Size Class Distribution





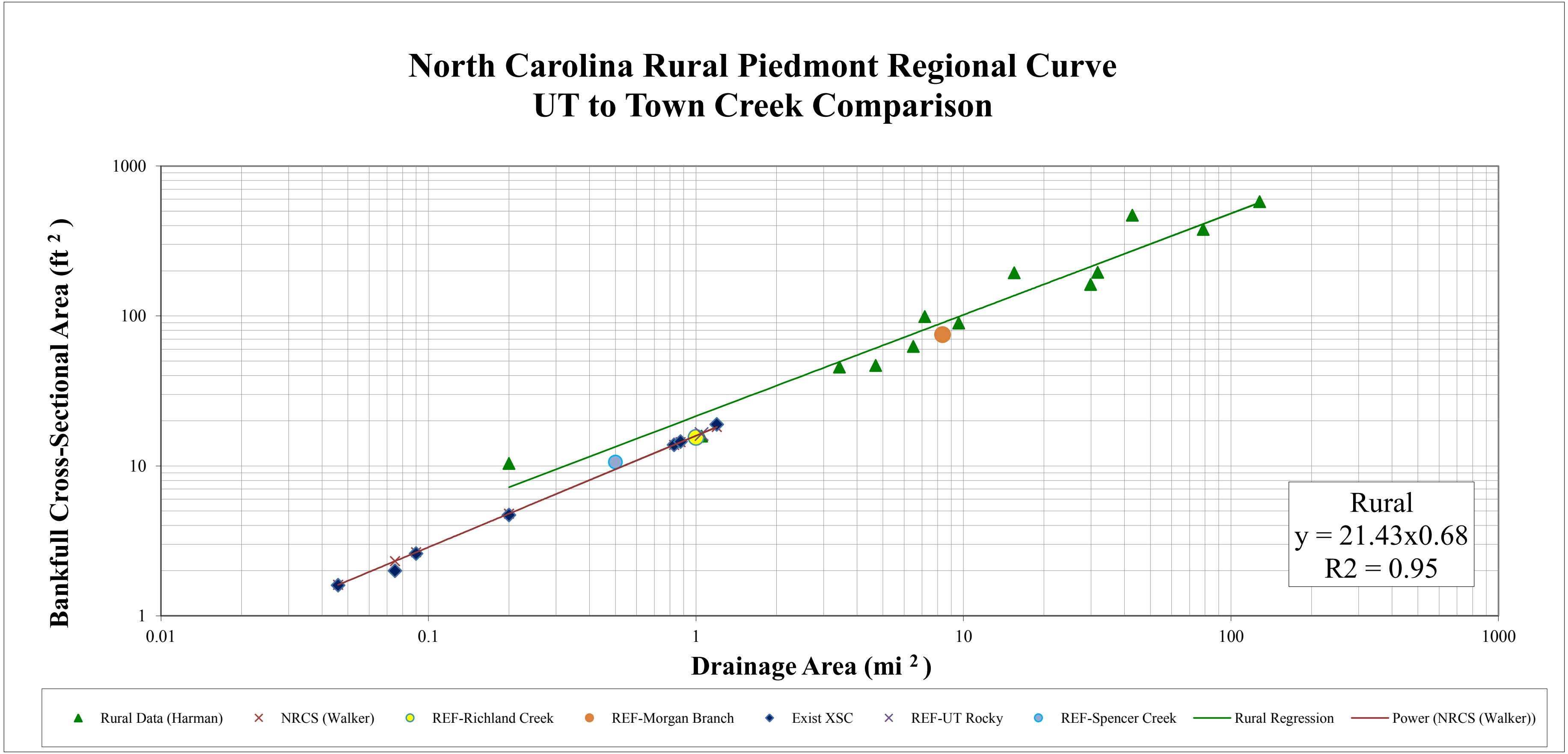
Sediment Distribution
UT Town Creek - U/S Town Creek Ref section
Percent
Particle Size Class (mm)
Cumulative Percent
Class Percent
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000

PEBBLE COUNT DATA SHEET

SITE OR PROJECT:	UT Town Creek
REACH/LOCATION:	U/S Town Creek Ref section
DATE COLLECTED:	7/17/2014
FIELD COLLECTION BY:	KMV, SK
DATA ENTERED BY:	KMV

SEDIMENT ANALYSIS DATA SHEET

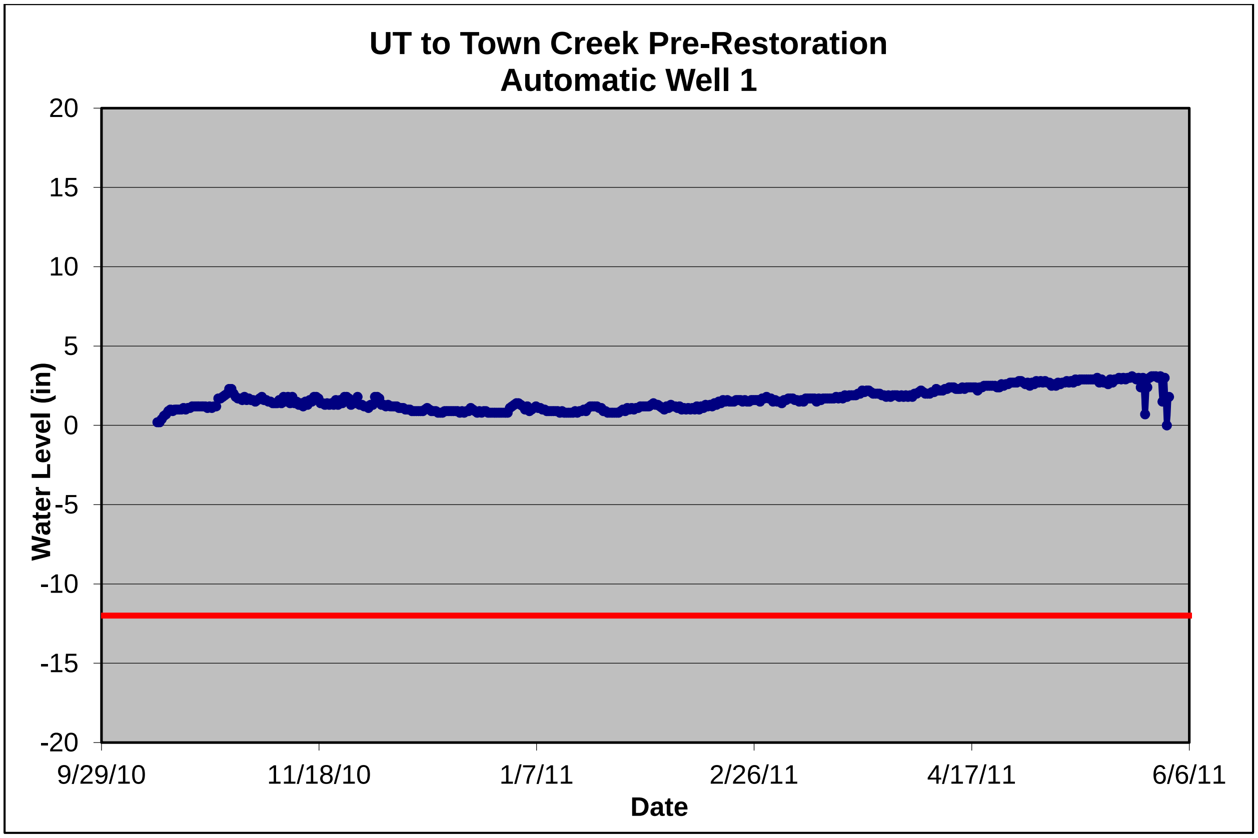
			PARTICLE CLASS			Riffle Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063					0.00
SAND	Very Fine	.063 - .125	3		3	3.00	3.00
	Fine	.125 - .25					3.00
	Medium	.25 - .50					3.00
	Coarse	.50 - 1.0					3.00
	Very Coarse	1.0 - 2.0	1		1	1.00	4.00
GRAVEL	Very Fine	2.0 - 2.8	4		4	4.00	8.00
	Very Fine	2.8 - 4.0	5		5	5.00	13.00
	Fine	4.0 - 5.6	12		12	12.00	25.00
	Fine	5.6 - 8.0	7		7	7.00	32.00
	Medium	8.0 - 11.0	5		5	5.00	37.00
	Medium	11.0 - 16.0	16		16	16.00	53.00
	Coarse	16 - 22.6	7		7	7.00	60.00
	Coarse	22.6 - 32	7		7	7.00	67.00
	Very Coarse	32 - 45	6		6	6.00	73.00
	Very Coarse	45 - 64	12		12	12.00	85.00
COBBLE	Small	64 - 90	6		6	6.00	91.00
	Small	90 - 128	8		8	8.00	99.00
	Large	128 - 180					99.00
	Large	180 - 256					99.00
BOULDER	Small	256 - 362	1		1	1.00	100.00
	Small	362 - 512					100.00
	Medium	512 - 1024					100.00
	Large-Very Large	1024 - 2048					100.00
BEDROCK	Bedrock	> 2048					100.00
			100	0	100		

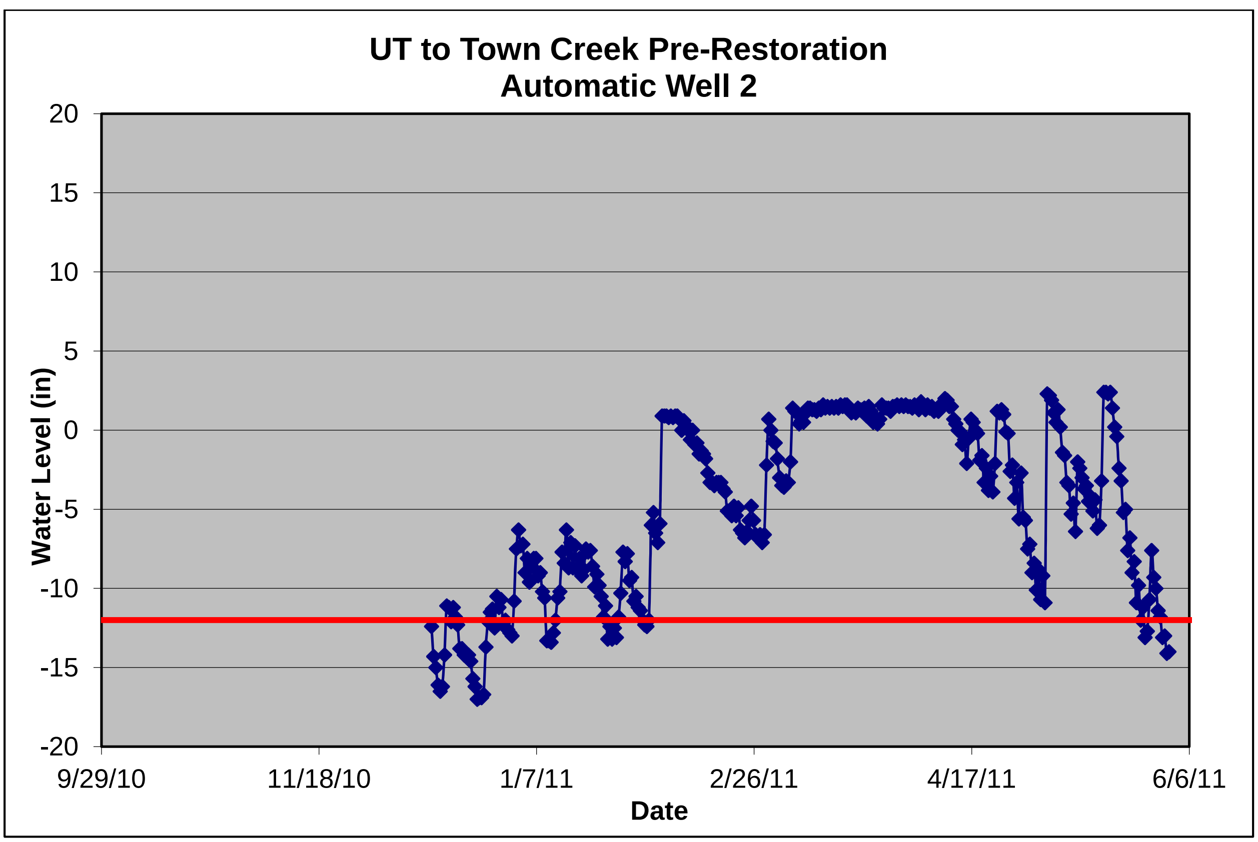


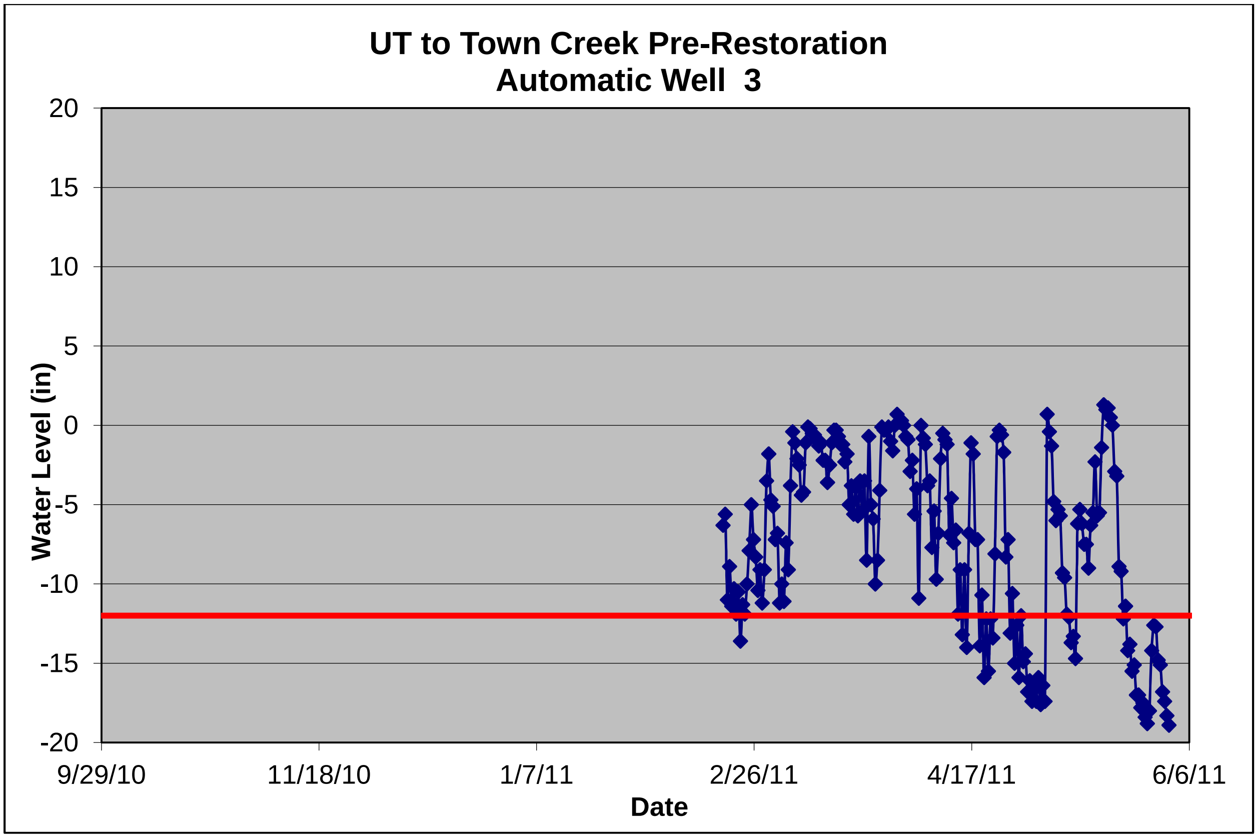
North Carolina Rural Piedmont Regional Curve
UT to Town Creek Comparison
Bankfull Cross-Sectional Area (ft 2)
Drainage Area (mi 2)
1000
100
10
1
0.01
0.1
1
10
100
1000
Rural
y = 21.43x0.68
R2 = 0.95
Rural Data (Harman)
NRCS (Walker)
REF-Richland Creek
REF-Morgan Branch
Exist XSC
REF-UT Rocky
REF-Spencer Creek
Rural Regression
Power (NRCS (Walker))

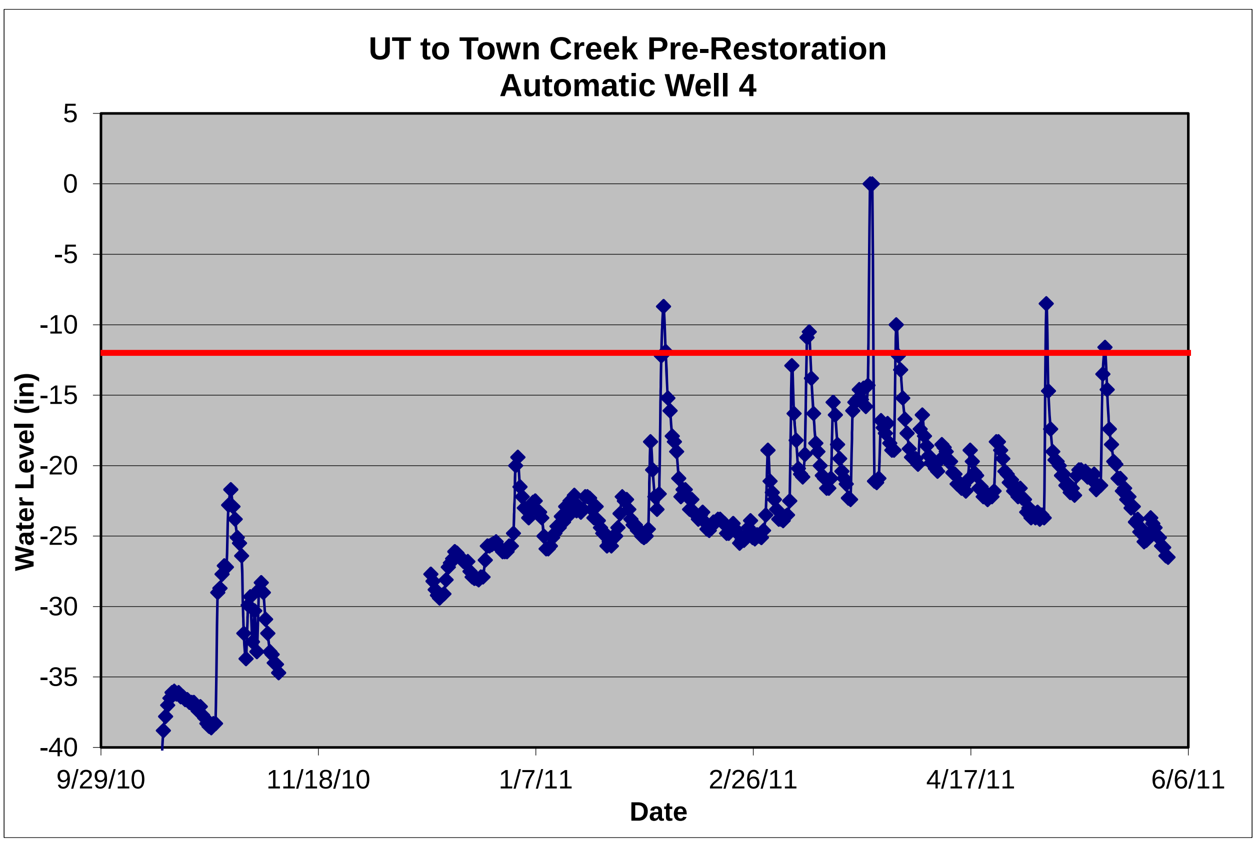
Appendix F

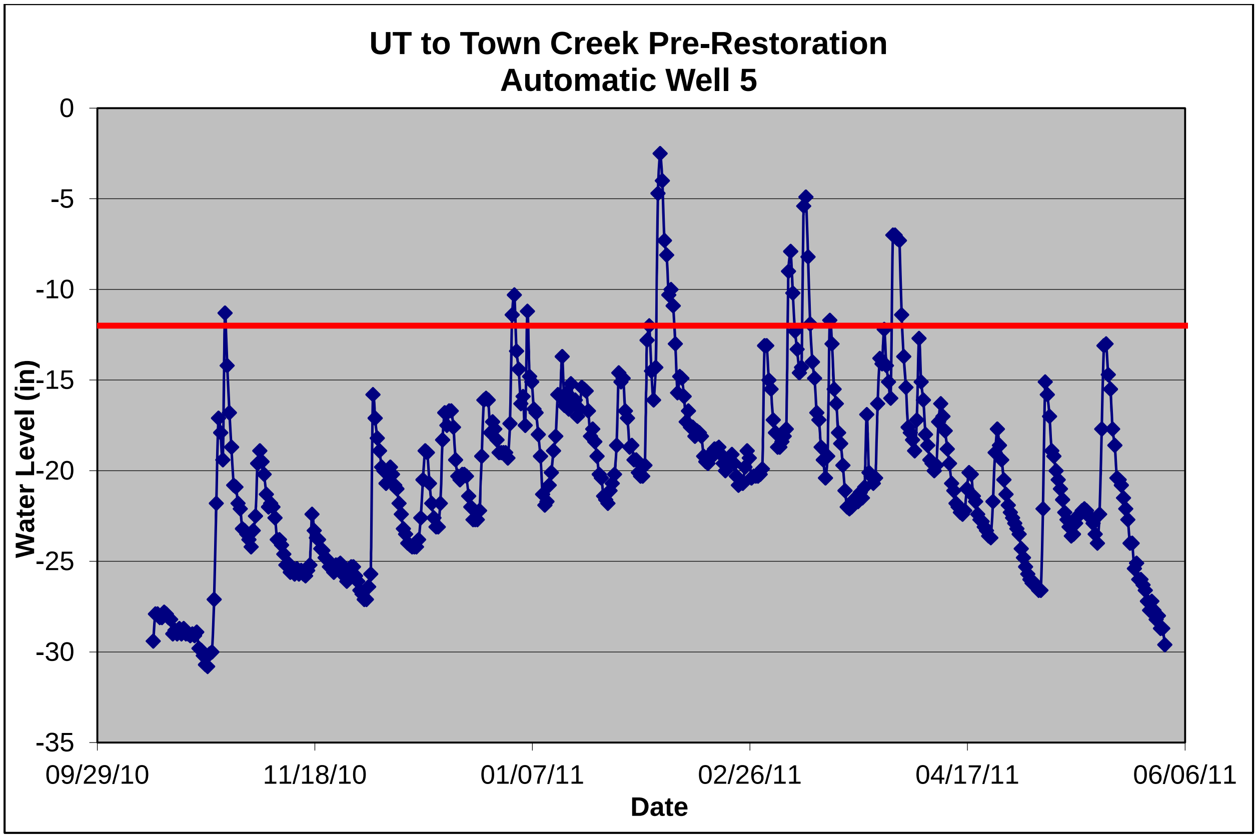
Groundwater Monitoring Well Data & Rainfall Data

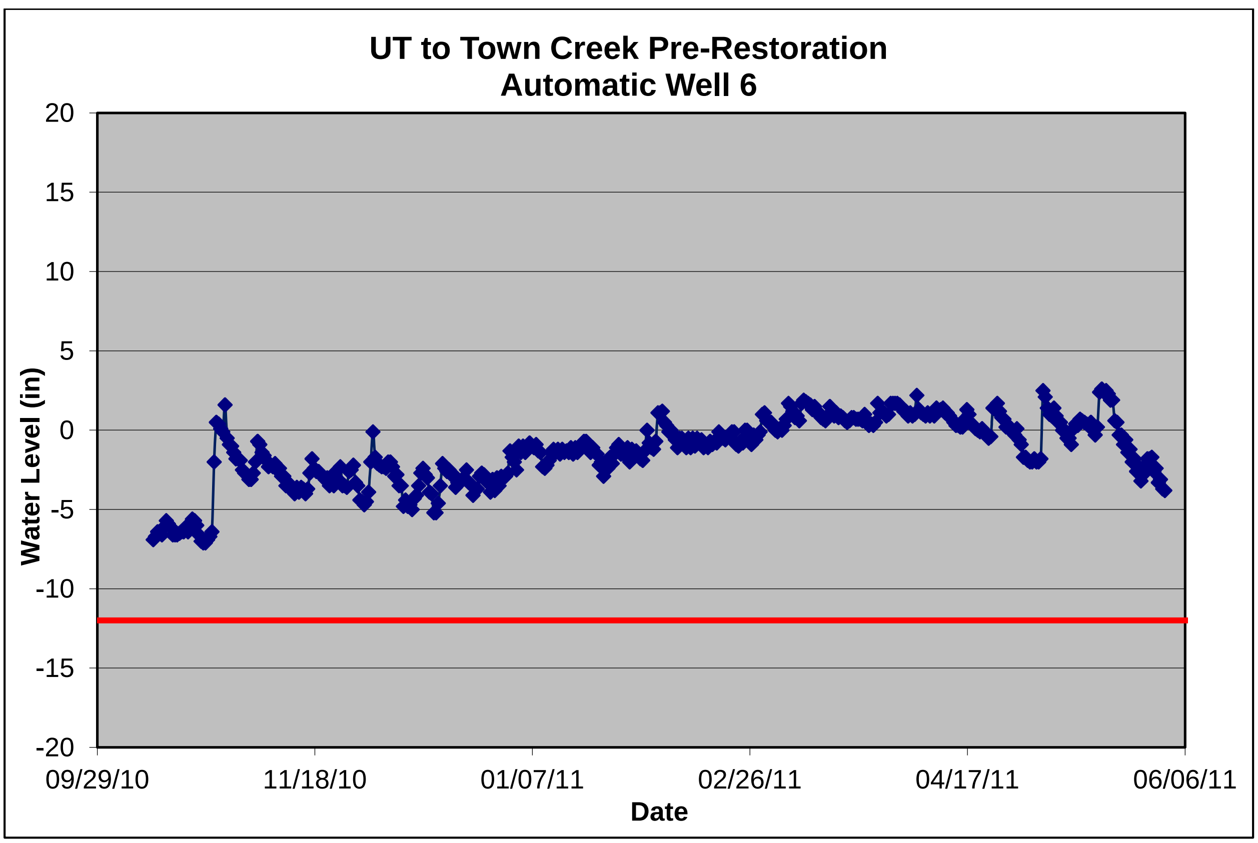

UT to Town Creek Pre-Restoration
Automatic Well 1
Water Level (in)
20
15
10
5
0
-5
-10
-15
-20
9/29/10
11/18/10
1/7/11
2/26/11
4/17/11
6/6/11
Date

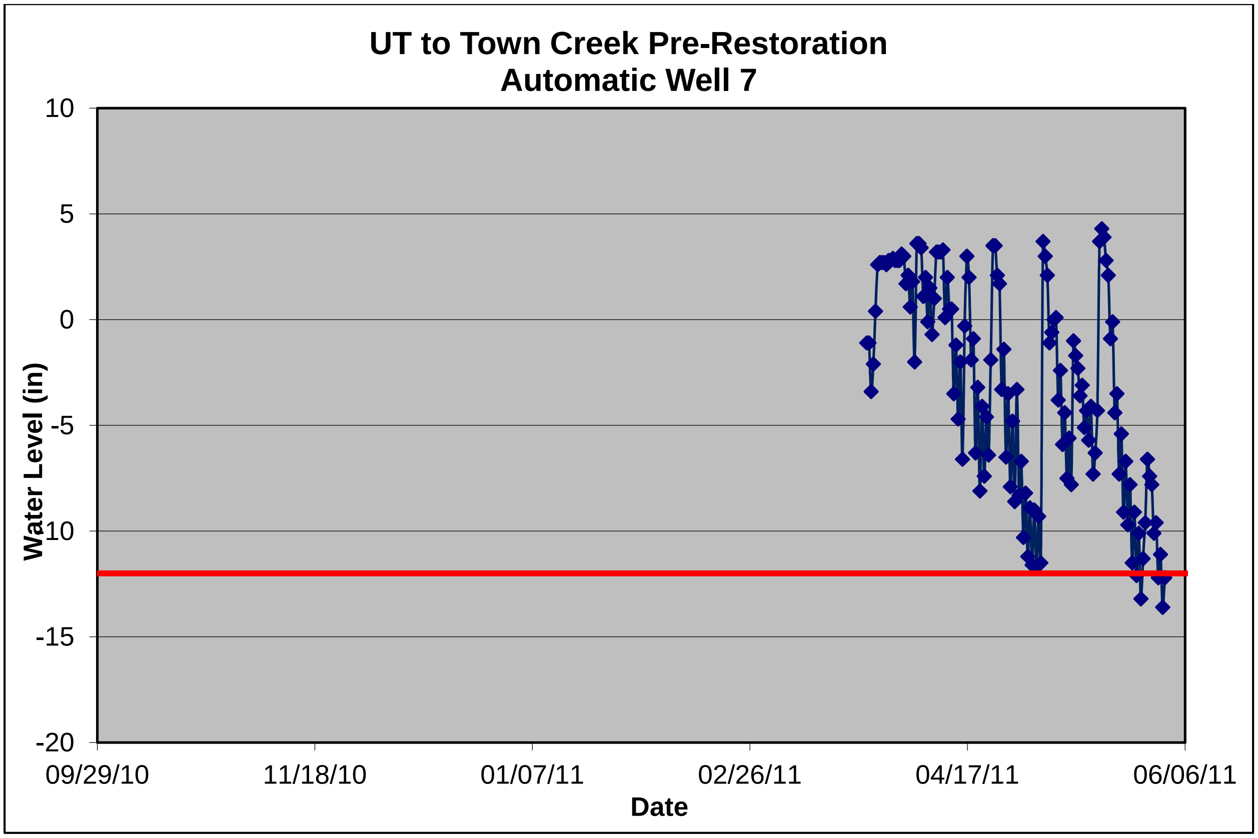

UT to Town Creek Pre-Restoration
Automatic Well 2
Water Level (in)
20
15
10
5
0
-5
-10
-15
-20
9/29/10
11/18/10
1/7/11
2/26/11
4/17/11
6/6/11
Date

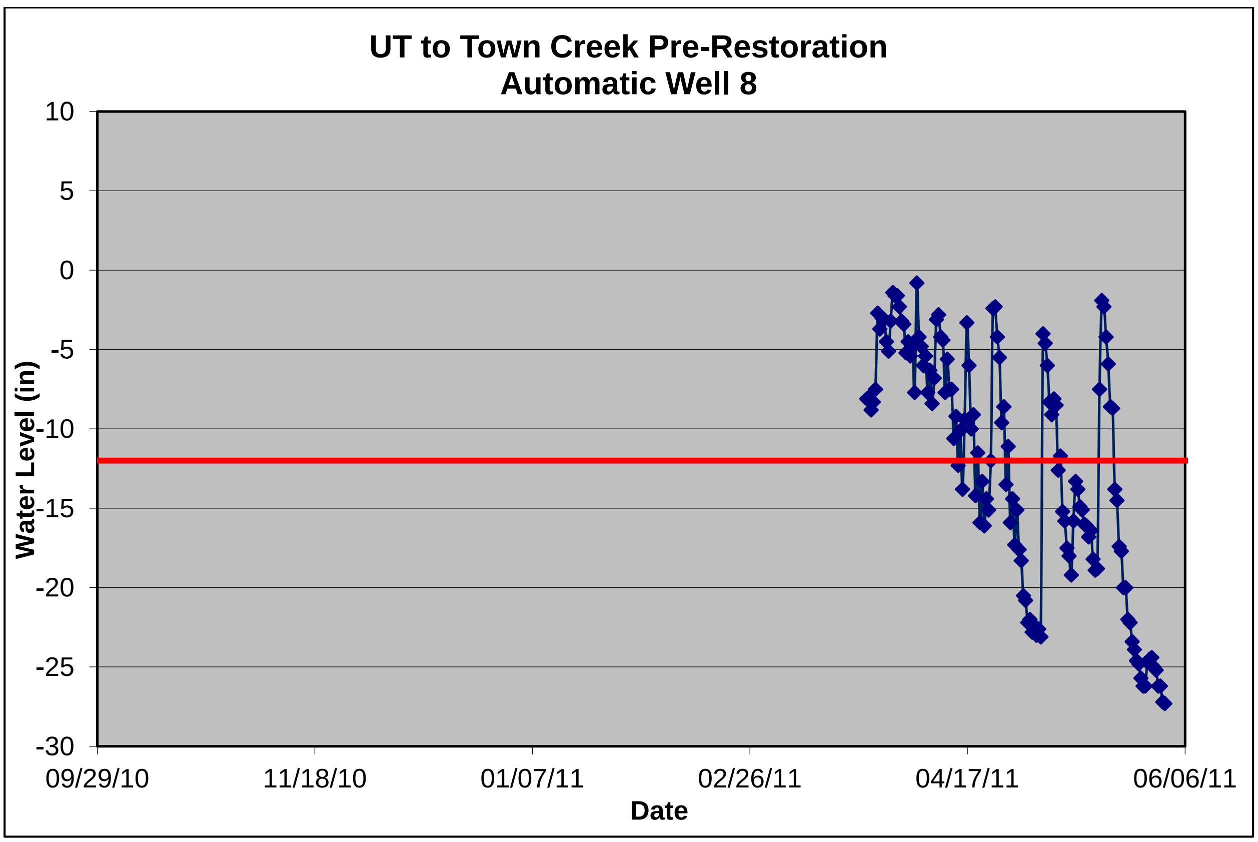

UT to Town Creek Pre-Restoration
Automatic Well 3
Water Level (in)
20
15
10
5
0
-5
-10
-15
-20
9/29/10
11/18/10
1/7/11
2/26/11
4/17/11
6/6/11
Date

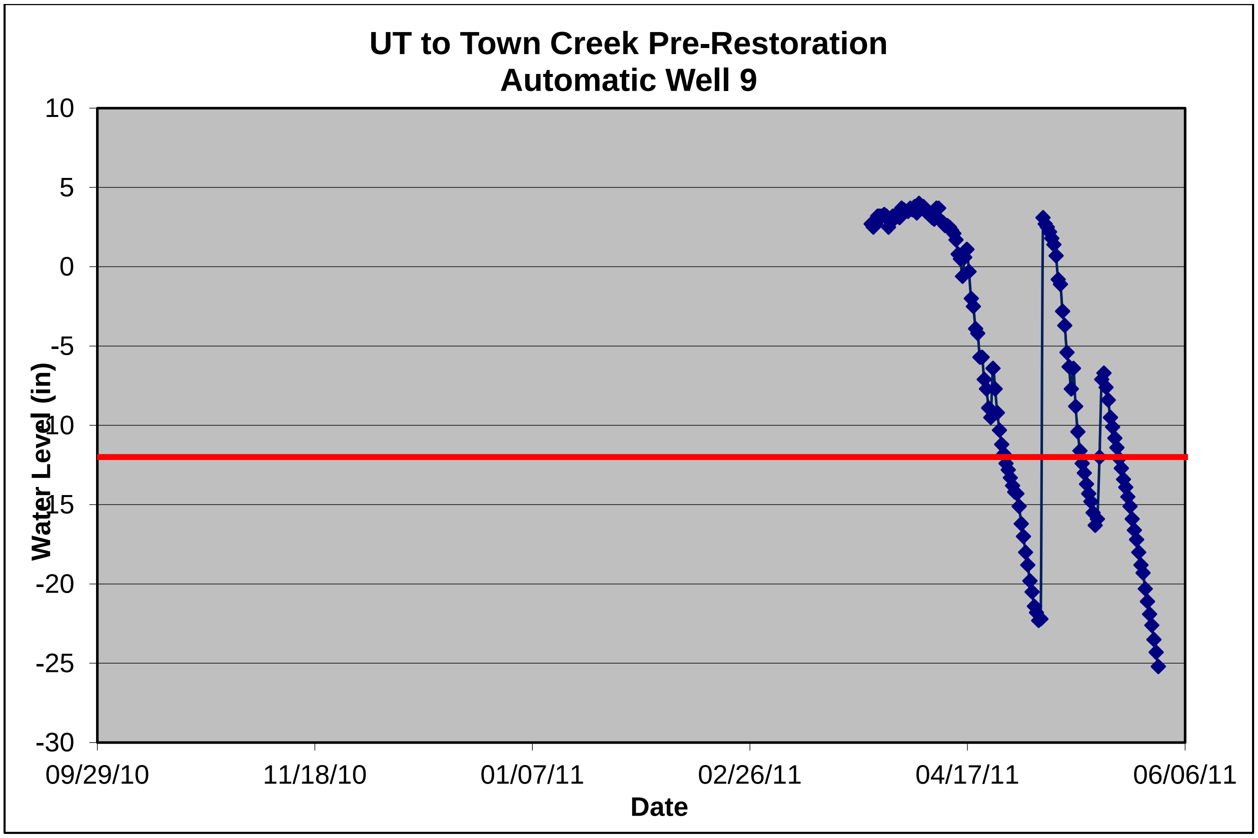

UT to Town Creek Pre-Restoration
Automatic Well 4
Water Level (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
9/29/10
11/18/10
1/7/11
2/26/11
4/17/11
6/6/11
Date


UT to Town Creek Pre-Restoration
Automatic Well 5
Water Level (in)
0
-5
-10
-15
-20
-25
-30
-35
09/29/10
11/18/10
01/07/11
02/26/11
04/17/11
06/06/11
Date

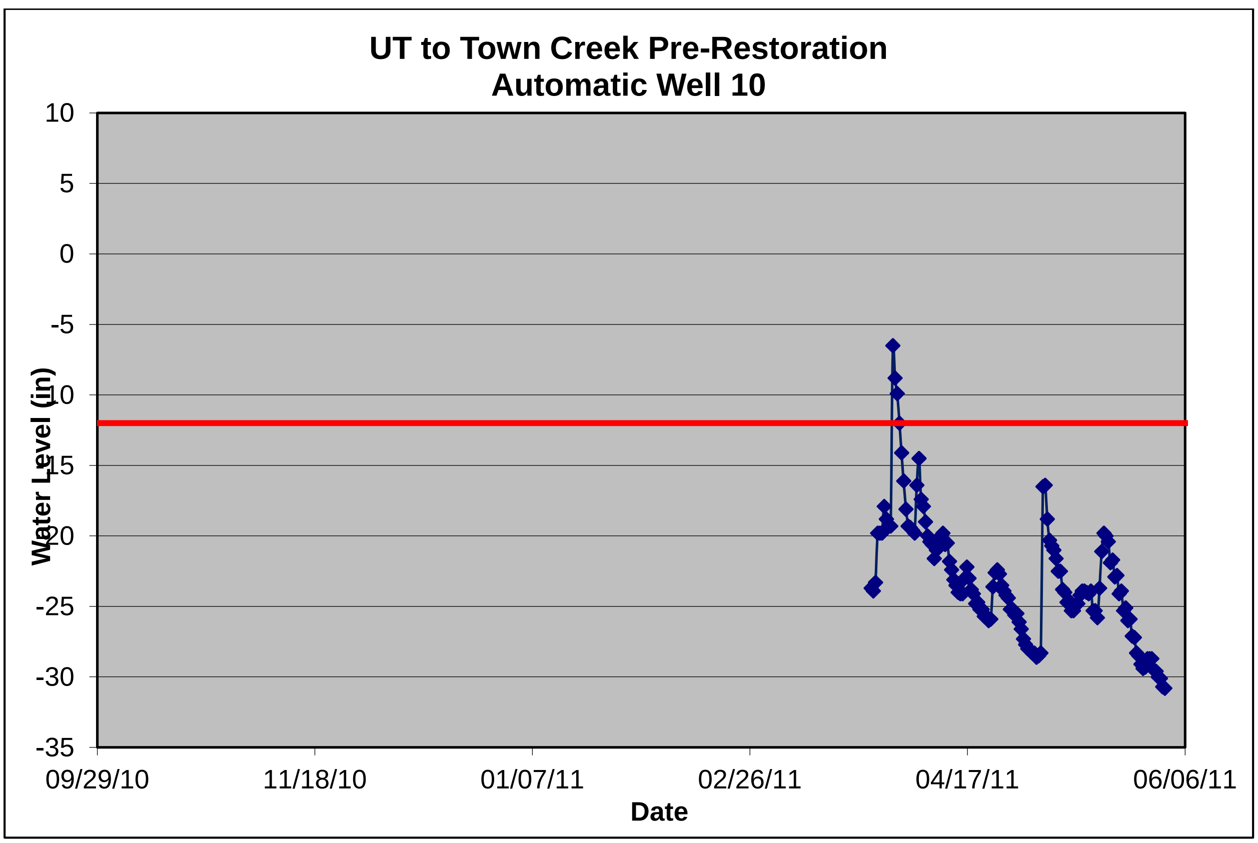

UT to Town Creek Pre-Restoration
Automatic Well 6
Water Level (in)
20
15
10
5
0
-5
-10
-15
-20
09/29/10
11/18/10
01/07/11
02/26/11
04/17/11
06/06/11
Date


UT to Town Creek Pre-Restoration
Automatic Well 7
Water Level (in)
10
5
0
-5
-10
-15
-20
09/29/10
11/18/10
01/07/11
02/26/11
04/17/11
06/06/11
Date

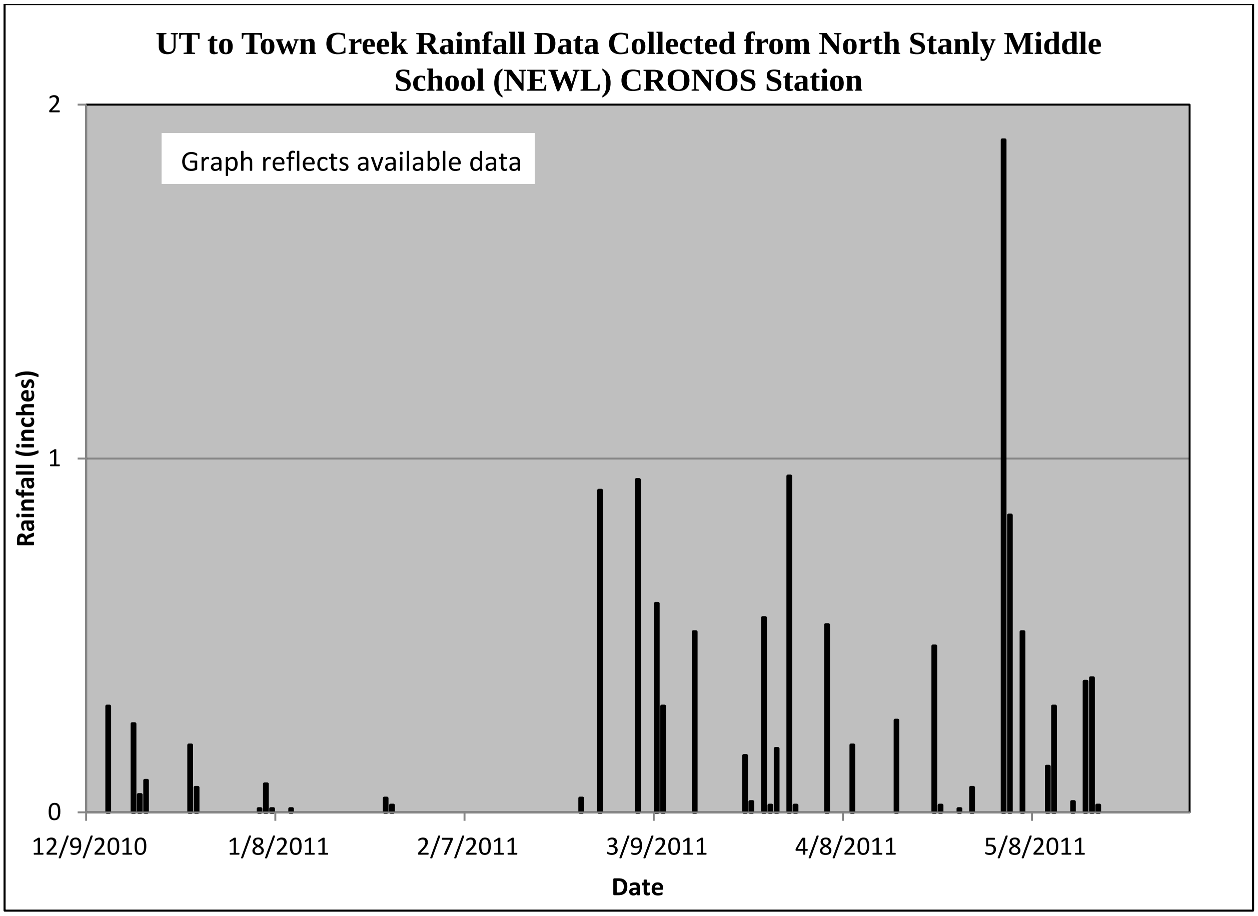

UT to Town Creek Pre-Restoration
Automatic Well 8
Water Level (in)
10
5
0
-5
-10
-15
-20
-25
-30
09/29/10
11/18/10
01/07/11
02/26/11
04/17/11
06/06/11
Date



UT to Town Creek Pre-Restoration
Automatic Well 9
Water Level (in)
10
5
0
-5
-10
-15
-20
-25
-30
09/29/10
11/18/10
01/07/11
02/26/11
04/17/11
06/06/11
Date



UT to Town Creek Pre-Restoration
Automatic Well 10
Water Level (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
09/29/10
11/18/10
01/07/11
02/26/11
04/17/11
06/06/11
Date


UT to Town Creek Rainfall Data Collected from North Stanly Middle School (NEWL) CRONOS Station
Graph reflects available data
Rainfall (inches)
2
1
0
12/9/2010
1/8/2011
2/7/2011
3/9/2011
4/8/2011
5/8/2011
Date

Appendix G

NCIRT Draft Regulatory Guidance for the Calculation of Stream and Buffer Widths Different From Standard Minimum Widths

Mitigation Credit Calculations for Additional Riparian Buffer

NCIRT Closeout Approval Letter

DRAFT – For Public Review and Comment
Regulatory Guidance for the Calculation of Stream and Buffer Mitigation Credit for Buffer Widths Different From Standard Minimum Widths

NC Interagency Review Team (IRT)
Version 4.5[1]
July 20, 2010

1. Background

The joint Federal/State Stream Restoration Guidelines (US Army Corps of Engineers, et. al. 2003) state that stream mitigation projects should have wooded buffers that are 50 feet wide in the coastal plain and piedmont or 30 feet wide in the mountains. Stream mitigation projects require these widths of wooded buffers in order to provide high quality stream mitigation projects. Wooded buffers reduce stream temperature fluctuations, filter sediment and nutrients from adjacent runoff, and provide leaves and woody debris to streams for aquatic food webs. The Guidelines state that "Justification for reduced buffer widths must be provided by the permit applicant and receive approval by the District and DWQ" but will likely result in lower mitigation credits. The guidance also states that wider buffers may be required when special circumstances occur such as the presence of aquatic endangered species. These determinations will be made on a case-by-case basis.

The purpose of this guidance document is to provide a general mechanism to adjust stream and buffer credits when the proposed buffers vary from the standard, minimum widths. In the case of wider buffers, the agencies agree that additional stream credit (as outlined in this document) is appropriate for the 404/401 Permit and Riparian Buffer processes as outlined in this guidance. Conversely, the agencies agree that less stream credit is appropriate for buffers narrower than the standard, minimum widths. The requirements found in this guidance may be modified on a case-by-case basis provided compelling and convincing reasons for the modification are provided to the NC IRT or other appropriate permit review entity. Finally, this guidance only applies to mitigation sites where a channel is constructed or present and the establishment of a riparian buffer is proposed. This guidance does not apply to projects developed in accordance with the "**Information regarding Stream Restoration in the Outer Coastal Plain of North Carolina"** dated November 28, 2005 as prepared by the NC Division of Water Quality and US Army Corps of Engineers, and does not apply to tidal streams subject to permitting by the NC Division of Coastal Management.

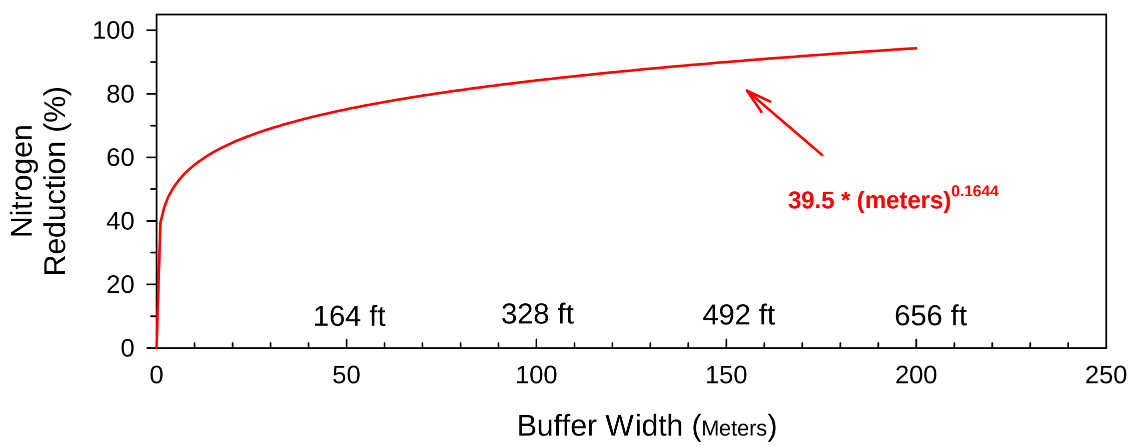
With respect to the Riparian Buffer Protection Rules in the Neuse, Tar-Pamlico and Catawba River basins (15A NCAC 2B .0242 (9)(c)), (15A NCAC 2B .0260 (9)(c)), and (15A NCAC 2B .0244 (9) (c)), respectively), these rules explicitly state that a 50 foot buffer is a minimum width. Therefore, wider buffers may warrant additional buffer credit following the process outlined in Section 3a of this document, but if any portions of the buffers are less than 50 feet wide (with the exceptions allowed in Section 4), then no buffer credit is available.

[1] Note that changes have been made in the draft document based on public comments received from the earlier (December 12, 2009) DWQ public notice. The Corps and Division of Water Quality have reviewed all comments received from that December 2009 public notice and this draft reflects our review of those comments. However we welcome additional comments during this August 2010 Public Comment period.

2. Summary of the scientific literature

A wide variety of scientific publications have addressed the effectiveness of buffers of various widths and vegetation types. Some of the most recent literature summaries have been presented by Wenger (1999) in Georgia, Center for Environmental Policy (2000) in South Carolina, and Environmental Defense (2003) in North Carolina. In general, wider buffers provide more water quality improvements and habitat value. However the relationship is not linear. Rather, the increased benefits of wider buffers tend to increase at a slower rate once the buffer width exceeds 50 feet (NC Division of Water Quality 2007) (see attached Figure 1 as an example). Only nitrogen data are shown on Figure 1, but it should be noted that all pollutants including sediment, phosphorus and bacteria (as well as leaffall) follow this same basic pattern with curves of differing slopes which tend to approach a maximum threshold fairly quickly. Therefore, a buffer of 100 feet in width does not provide twice the water quality benefit as a buffer of 50 feet in width.

Figure 1
Reduction of nitrate nitrogen as a function of riparian buffer width based on Mayer,et al. (2007) (data from various studies)



The most comprehensive review of the literature for a particular chemical constituent was done in 2007 for nitrogen (Mayer, et al. 2007). This work by Environmental Protection Agency researchers examined the results of 89 buffers from 45 published studies. In general, the authors concluded that buffers were effective in removing nitrogen from water flowing through the riparian zone with a small but significant portion of the variance explained by buffer width. Since this review is the most comprehensive review available and provides statistically valid equations that predict buffer effectiveness by width, this guidance will substantially rely on these equations as the basis for this policy. The Environmental Protection Agency is completing a similar review for phosphorus (Paul Mayer, EPA, personal communication, December 12, 2007) but it will probably not be published at the earliest until 2011. Until that time, the results of the nitrogen analysis will be used for this guidance document. In addition, nitrogen is the main pollutant of concern for the Neuse and Tar-Pamlico buffer rules; therefore, use of EPA's nitrogen analysis also makes good regulatory sense. When additional comprehensive reviews similar to that done by Mayer, et al (2007) are completed for other buffer functions, this guidance can be revisited to determine the most accurate process for other constituents such as phosphorus, sediment, organic matter contribution or temperature.

3. Proposed guidance

a. Buffer mitigation credit[2] for DWQ riparian buffer rules

As stated earlier, the Neuse (15A NCAC 2B .0242 (9)(c)), Tar-Pamlico (15A NCAC 2B .0260 (9)(c)), and Catawba (15A NCAC 2B .0244 (9) (c)) buffer rules state that a restored buffer must be a minimum of 50 feet in width. Therefore, buffers less than 50 feet wide in these river basins cannot receive buffer credit according to these rules. For instance, if any portion of the stream buffer is less than 50 feet wide, then there can be no buffer credits for that length of stream. Since the rules provide for additional credit for widths greater than 50 feet, we propose to use the GIS-based methodology (as outlined below) to make decisions concerning additional credits for buffers wider than 50 feet. Again, these wider buffers do provide additional water quality benefits, but the relationship is clearly not linear.

Mayer, et al (2007) provide an equation to determine the increased nitrogen removal that occurs with wider buffers. Their regression model is as follows:

$$y = 39.5x^{0.1644}$$

where y is the percent nitrogen removal and x is buffer width in meters. This model provides a statistically significant relationship at P=0.005. Since all pollutants seem to follow the same general pattern shown in Figure 1 and this model was derived using valid statistical analysis, we propose to use this model to calculate the water quality benefit of buffers for all pollutants until other comprehensive, statistically valid models have been developed and published in the scientific literature.

Since the standard, minimum buffer width is 50 feet for these rules, we propose to set the buffer benefit baseline at 50 feet, and calculate additional buffer benefits above that baseline value. The following equation is proposed to calculate a buffer effectiveness correction factor (BCF) for wider buffers as follows:

$$BCF = \frac{39.5x^{0.1644}}{61.8}$$

Where BCF is the calculated Buffer Effectiveness Correction Factor and X is the buffer width in meters. The predicted nitrogen removal capacity for buffers 50 feet wide (61.8 %) is the denominator of the equation in order to establish the ratio of improved benefits that may be obtained by buffers greater than 50 feet. Table 1 provides examples of this correction factor for different buffer widths. The final percent increase in buffer credits reflects the percent change from the baseline of 50 feet (61.8% nitrogen removal) to the wider buffer. This percent increase in buffer credit can then be multiplied by the length of buffered stream and added to the buffered stream length $[(bufferedlength) + (bufferedlength)(percentincrease)]$ to obtain the final buffer credit. The specific calculations for each project will need to be submitted by the applicant or mitigation provider. Alternately, the Mayer equation

[2] For the purpose of this guidance, buffer widths shall be determined using as-built survey data, measured as the horizontal distance from the bankfull elevation and taken on a line perpendicular to the thalweg.

can be used along with a computer-driven GIS or CADD system to calculate the incremental benefit above 50 feet in width. The agencies will need to approve the use of any GIS or CADD approach to be sure that the calculations are done appropriately.

Table 1
Additional buffer credits for Riparian Buffer Rules from wider buffers

Average Width – feet (meters)	Predicted percent nitrogen removal (from Mayer, et al 2007)	Buffer Effectiveness Correction Factor (BCF)	Percent increase in buffer credit
50 feet (15.2 meters)	61.8%	1.0	+0%
75 feet (22.9 meters)	66.1	1.07	+7%
100 feet (30.5 meters)	69.3	1.12	+12
150 feet (45.7 meters)	74.0	1.20	+20
200 feet (61.0 meters)	77.6	1.26	+26

For instance, if a buffer of 100 feet (30.5 meters) is proposed at a mitigation site, then the correction ratio would be 1.12. In other words, 12% additional buffer credit $[(100\,ft)+(100\,ft)(0.12)=112\,ft]$ would be available for a site with a 100 foot (30.5 meter) buffer rather than a 50 foot (15.2 meter) buffer. This relatively small increase in buffer effectiveness from a doubling of the width reflects the fact that the relationship between buffer width and pollutant removal is not linear and in fact, increases at a much slower rate above 50 feet (15 meters).

b. <u>Stream mitigation credit for 404/401 and isolated stream permitting</u>

In general, there is a minimum width below which only marginal water quality improvements occur. Most of the literature suggests that buffers less than 15 feet wide have little to no water quality benefit. For instance, Wenger (1999) states that "buffers as narrow as 15 feet have proven fairly effective" in the short term although their long term performance is in doubt. Therefore, no stream credit will be given when the buffer width is less than 15 feet.

We propose to use the equation presented by Mayer, et al (2007) as described in the previous section with three modifications. These modifications reflect the differences between the riparian buffer rules and the 404/401 permit program. First, it is possible to get stream credit for buffers less than the minimum, standard 50 feet in the coastal plain and piedmont or 30 feet in the mountains for the 404/401 permit program, but only when average buffer widths are greater than the 15 feet mentioned above. Second, it is clear that any benefit from buffers accounts for only part of the aquatic life benefits of mitigation since physical stream work (such as cross vanes and constructed riffles) also provide direct aquatic life benefits. Third, the calculations need to account for the differences between the minimum, standard 50 foot buffers in the piedmont/coastal plain versus the minimum, standard 30 foot buffer width in the mountains.

To account for these differences, we again propose to use the Mayer, et al (2007) equation with a 30-foot criterion in the denominator for the mountains or a 50-foot criterion in the denominator for the piedmont and coastal plain. Since the data are much less certain for narrower buffer widths (Paul Mayer, personal communication, January 23, 2008), we propose to reduce the stream credits by the amounts shown on Tables 2 and 3. This reduction also reflects the fact that physical stream improvements resulting from stream restoration are as valuable as buffers to ultimate stream quality. No credits will be given for buffers that are less than 15 feet wide regardless of their location. Alternately, the Mayer equation can be used along with a computer-driven GIS or CADD system to calculate the incremental benefit above 50 (30 feet in the mountains) feet in width. The agencies will need to approve the use of any GIS or CADD approach to be sure that the calculations are done appropriately.

In some cases, stream enhancement projects would not be subject to these reductions for instance, when the stream enhancement does not include buffer planting. However please note that protection of the standard buffer widths will need to be provided in order to get full stream credit. In those cases where stream enhancement includes buffer restoration, then this guidance (and its associated reductions or increases) would apply. The following equations and examples then apply.

For stream restoration projects in the mountains, the following formula applies:

$$SCF_m = \frac{39.5x^{0.1644}}{56.8}$$

Where SCF_m is the calculated Stream Effectiveness Correction Factor for the mountains and X is the average buffer width in meters. The predicted nitrogen removal capacity for buffers 30 feet wide (56.8 %) is used as the denominator of the equation in order to establish the ratio of improved benefits that may be obtained by buffers greater than 30 feet. Table 2 provides examples of this correction factor for different buffer widths. The percent increase or decrease in stream credit reflects the recognition that no more than 50% of the additional stream uplift should be attributed to the buffer alone $\left(\frac{SCFm}{2}\right)$. This percent increase or decrease in stream credit is then be multiplied by the length of buffered stream and added to the buffered stream length $[(bufferedlength) + (bufferedlength)(percentincrease)]$ to obtain the final stream credit.

Table 2
Stream mitigation credit adjustments for wider or narrower buffer widths in the mountains [3]

Width – feet (meters)	Predicted percent nitrogen removal (from Mayer, et al 2007)	Stream Buffer Effectiveness Correction Factor (SCF_M)	Percent increase or decrease in stream credit
Less than 15 feet (4.6 meters)		N/a	-100%
15 to 20 feet (4.6 to 6.1 meters)	50.7%	N/a	-50%
21 to 24 feet (6.1 to 7.6 meters)	50.7%	N/a	-37.5%
25 to 29 feet (7.6 to 9.1 meters)	50.7%	N/a	-25%
30 feet (9.1 meters)	56.8	N/a	N/a
31 to 50 feet (9.1 to 15.2 meters)	61.8	1.09	+4.5%
51 to 75 feet (15.2 to 22.9 meters)	66.1	1.16	+8.0%
76 to 100 feet (22.9 to 30.5 meters)	69.3	1.22	+11.0%
101 to 150 feet (30.5 to 45.7 meters)	74.0	1.3	+15.0%
151 to greater than 200 feet (45.7 to 61.0 meters)	77.6	1.37	+18.5%

For stream restoration projects in the piedmont or coastal plain, the following formula applies:

$$SCF_{pcp} = \frac{39.5x^{0.1644}}{61.8}.$$

Where SCFpcp is the calculated Stream Effectiveness Correction Factor for the piedmont and coastal plain and X is the average buffer width in meters. The predicted nitrogen removal capacity for buffers 50 feet wide (61.8 %) is used as the denominator of the equation in order to establish the ratio of improved benefits that may be obtained by buffers greater than 50 feet. Table 3 provides examples of this correction factor for different buffer widths. Again, the percent increase or decrease in stream credit reflects the recognition that no more than 50% of the additional stream uplift should be attributed to the buffer alone. This percent increase in stream credit is then be multiplied by the length of buffered stream and added to the buffered stream length $[(bufferedlength) + (bufferedlength)(percentincrease)]$ to obtain the final stream credit.

[3] This example assumes a stream restoration project.

Table 3
Stream mitigation credit adjustments for wider or narrower buffer widths in the piedmont or coastal plain[4]

Width – feet (meters)	**Predicted percent nitrogen removal (from Mayer, et al 2007)**	**Stream Buffer Effectiveness Correction Factor (SCF_{pcp})**	**Percent increase or decrease in stream credit**
Less than 15 feet (4.6 meters)		N/a	-100%
15 to 25 feet (4.6 to 9.1 meters)	50.7%	N/a	- 50%
15 to 30 feet (7.6 to 9.1 meters)	53.75	N/a	-37.5%
30 to 34 feet (9.1 to 10.4 meters)	56.8	N/a	- 25%
35 to 39 feet (10.7 to 11.9 meters)	58.0	N/a	-18.8%
40 to 44 feet (12.2 to 13.4 meters)	59.3	N/a	-12.5%
45 to 49 feet (13.7 to 15.0 meters)	60.5	N/a	-6.0%
50 feet (15.2 meters)	61.8	N/a	N/a
51 to 75 feet (15.2 to 22.9 meters)	66.1	1.07	+3.5%
76 to 100 feet (22.9 to 30.5 meters)	69.3	1.12	+6.0%
101 to 150 feet (30.5 to 45.7 meters)	74.0	1.20	+10.0%
151 to greater than 200 feet (45.7 to 61.0 meters)	77.6	1.26	+13.0%

4. Urban Situations

It should be noted that in some instances (especially in urban situations and for some public, linear projects), it may be impossible to have buffers wider than 15 feet due to constraints from roads and sewers. In those cases, the permitting agencies may make a case by case determination that it is appropriate to allow some credit for buffers less than 15 feet wide. Also in the case of urban streams, the IRT is beginning the process of revising the joint state-federal stream mitigation guidelines to specifically address urban stream mitigation. Once that guidance is modified, then the case-by-case determination will not be needed for urban streams. Instead the process outlined in those revised guidelines can be followed.

[4] Again, this assumes a stream restoration project

5. Proposed method for calculation of stream credits

In order to simplify the calculations to determine stream credits, the following method is proposed and illustrated in Figures 2 and 3. Buffer width calculations will be made separately for each side of the stream and then totaled for the entire stream reach. The reach will first be broken into 100 foot segments along the thalweg length of the mitigation site starting at the uppermost end of the mitigation reach. The average width of the segment is then calculated for each segment of the stream by averaging the sum of the buffer widths measured at each of the segment boundaries and the mid-point of the segment. The buffer width is measured horizontally from the bankfull elevation to the conservation easement boundary line. The stream channel between the left and right side bankfull elevations are not included in the measurements. The appropriate correction factor (percentage) is then applied to the averages for each segment according to Table 2 (mountains) or Table 3 (piedmont/coastal plain). The credits for all segments are then summed for each side and divided by two. Finally, the results for each side are then added to obtain the total credits for the site.

In the hypothetical example on Figure 2 shows an example where the 50 foot minimum buffer width was provided on both sides of the stream. In this case, additional credit would be provided since buffer widths would always meet or exceed the standard width. The situation shown in Figure 2 would provide 440.0 feet of stream credit for the 400 feet of stream mitigation since the average buffer width regularly exceeds the minimum, standard width. With Figure 3, the 400 foot long restoration project (measured along the thalweg) yields 153.5 feet of credit on one side of the stream (mainly due to a long segment with very narrow widths) and 178 feet of credit on the other side for an adjusted total of 331.5 feet of stream credit from the 400 foot of restoration length. Also note that any remaining part of the mitigation site that is less than 100 feet in length can have its credits determined using the remaining length and its associated average width.

6. Proposed method for calculation of stream or buffer credits

The agencies propose one of three possible methods for determining the amount of stream or buffer credit. We welcome comments on which of these three methods would be the most appropriate method to use to determine crediting. One additional issue is the interval at which measurements are to be made. The agencies suggest that a 10 foot increment be used as a minimum although smaller intervals may be used at the applicant's discretion.

Method one: The riparian buffer rules require a buffer of at least 50 feet in width. Therefore, if the buffer is less than 50 feet wide, no buffer credit can be given for the site. The rules do not provide a precise means to calculate additional buffer credit for buffers wider than 50 feet. Since there is a minimum width of 50 feet, the situation is somewhat more complex but DWQ proposes to follow the same general approach outlined above for stream credit.

Figure 4 shows a site where buffers are always greater than 50 feet. In this case, the area with buffers wider than 50 feet could receive additional credit at the ratios outlined in Table 3. Figure 5 shows a site where buffers are sometimes less than 50 feet wide, sometimes are 50 feet wide and sometimes are greater than 50 feet wide. In this case, various zones of credit are established reflecting the 50 foot minimum width which would then be adjusted using Table 2. Note that many of the areas of this hypothetical project would get no buffer credit since many areas of the project do not meet the minimum 50 foot buffer width.

Method two: A straight line would be drawn down the center of the valley through the entire site. The buffer width would then be measured at 50 foot increments from the channel perpendicular to the line through the center of the valley (Figure 6). Buffer widths would be measured separately for each side of the stream and then totaled as with the method one. The advantage of this approach is that it avoids the problem of having artificially large buffer widths on very sinuous systems. The disadvantage of this approach is that DWQ's buffer rules specify that the measurement is to be done perpendicular to the stream (15 A NCAC 2B .0260 (9) (c) for the Tar-Pamlico rules). Therefore if this method is used for stream credit, then method one would have to be used for buffer calculations unless the buffer rules are changed during the current rule making process to make the methods consistent.

Method three: The third possible method would be to measure the shortest distance from the channel to the buffer at 50 foot increments (Figure 7). The advantage of this approach is its simplicity. The disadvantage of this approach is (again) that DWQ's buffer rules specify that the measurement is to be done perpendicular to the stream (15 A NCAC 2B .0260 (9) (c) for the Tar-Pamlico rules). Therefore if this method is used for stream credit, then method one would have to be used for buffer calculations unless the buffer rules are changed during the current rule making process to make the methods consistent.

Again the agencies request comments on which one of these methods is the best method to use in making these calculations as well as which incremental measurement is best to use.

7. Minor variations from established buffer widths

If the total length of streams with buffers less than the minimum, standard width comprise less than or equal to 5% of the stream length on any one side of the stream, then no credit will be deducted for these narrower buffers. The purpose of this provision is to allow the regulatory agencies and mitigation providers to focus on projects which have widths which are substantially different from the standard widths.

8. Proposed implementation schedule

Existing federal and stream mitigation guidelines from 2003 (US Army Corps of Engineers, et. al. 2003) state that proposed buffer widths varying from the minimum, standard widths (30 feet in mountains and 50 feet elsewhere in the state) need case-by-case approval. The agencies believe that this policy is **not** retroactive since it only applies to projects designed after the effective date of that guidance. Projects designed before April 2003 will be reviewed and their crediting determined on a case by case basis. Therefore all stream and buffer mitigation sites designed after the effective date of the joint state-federal stream mitigation guidelines (April 2003) must follow this new guidance unless they have had an explicit written approval for credits by the Corps and DWQ for a particular site. In order to determine this date, the agencies believe that the dated restoration plan can usually be used. The agencies expect that mitigation providers (with the above exception) may have to modify their credit ledgers accordingly once this guidance has received proper public notice and comment and is then finalized.

In addition, submittals of projects should show all calculations done to meet this guidance as shown in the examples within this document. For project-specific mitigation, the agencies will use whatever buffer width and mitigation crediting was proposed in the approved mitigation plan or permit application.

9. Citations

Center for Environmental Policy. 2000. Final Report of the Statewide Task Force on Riparian Forest Buffers. Institute of Public Affairs, University of South Carolina. Columbia, SC.

Environmental Defense. 2003. Riparian Buffers – Common Sense Protection of North Carolina's Waters. Raleigh, NC.

Mayer, P. M., S.K. Reynolds, M.D. McCutchen and T. J. Canfield. 2007. Meta-Analysis of Nitrogen Removal in Riparian Buffers. J. Environmental Quality 36:1172-1180. Published on-line.

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N.C. Division of Water Quality. 2007. Draft – Stream Mitigation for FERC-related 401 Certifications – Internal DWQ Guidance. Raleigh, NC. On DWQ's website at http://h2o.enr.state.nc.us/ncwetlands/documents/Streammitigationpolicyver1.2-3.doc.

US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission and NC Division of Water Quality. 2003. Stream Mitigation Guidelines. Wilmington, NC.

Wenger, S. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia. Athens, GA.

Figure 2 Riparian buffer width always greater than or equal to 50 feet, piedmont / coastal plain site.

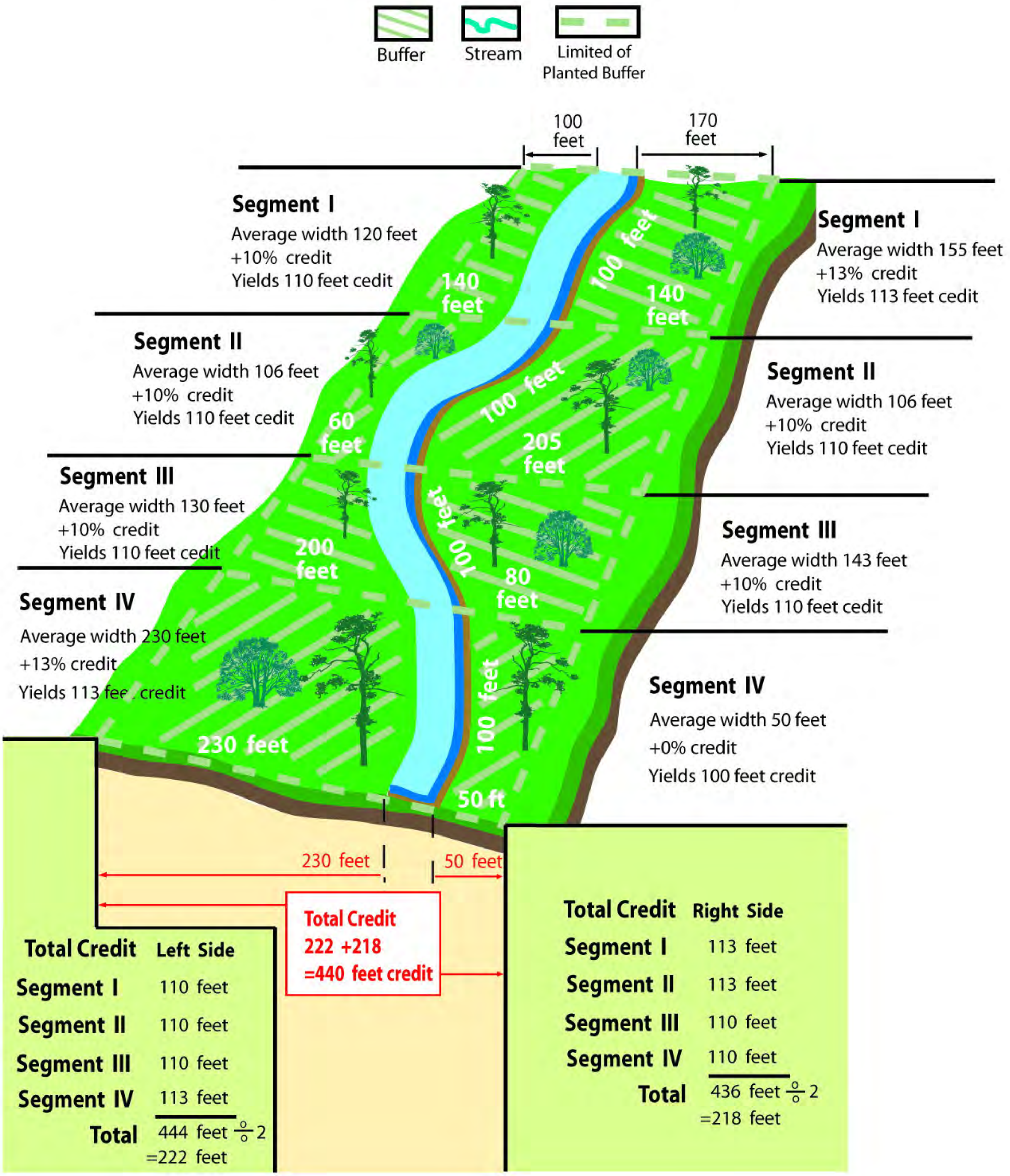


Figure 3 Total Riparian Buffer width 100 feet with meandering stream width, piedmont / coastal plain site.

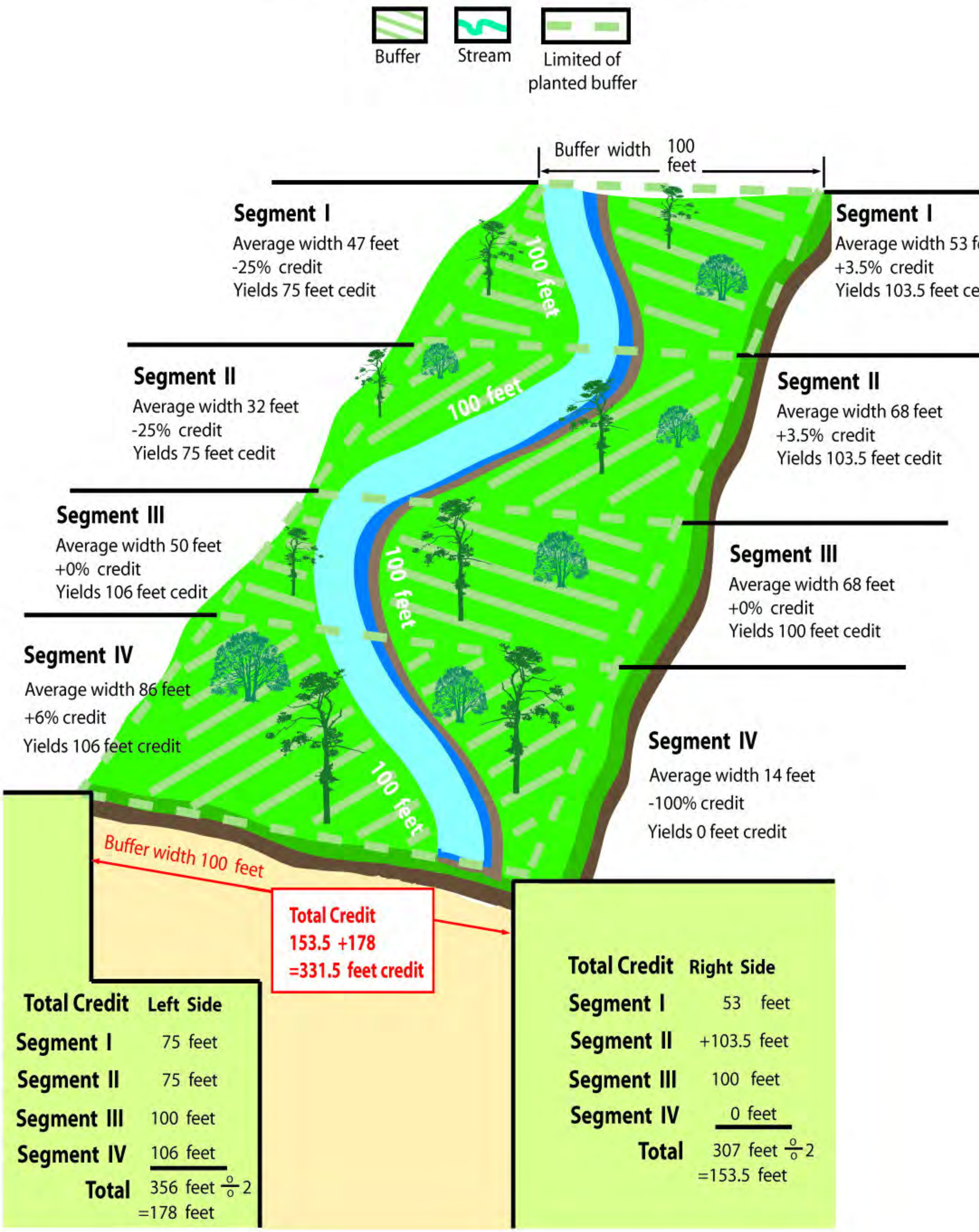


Figure 4   Riparian buffer width always at least 50 feet wide.

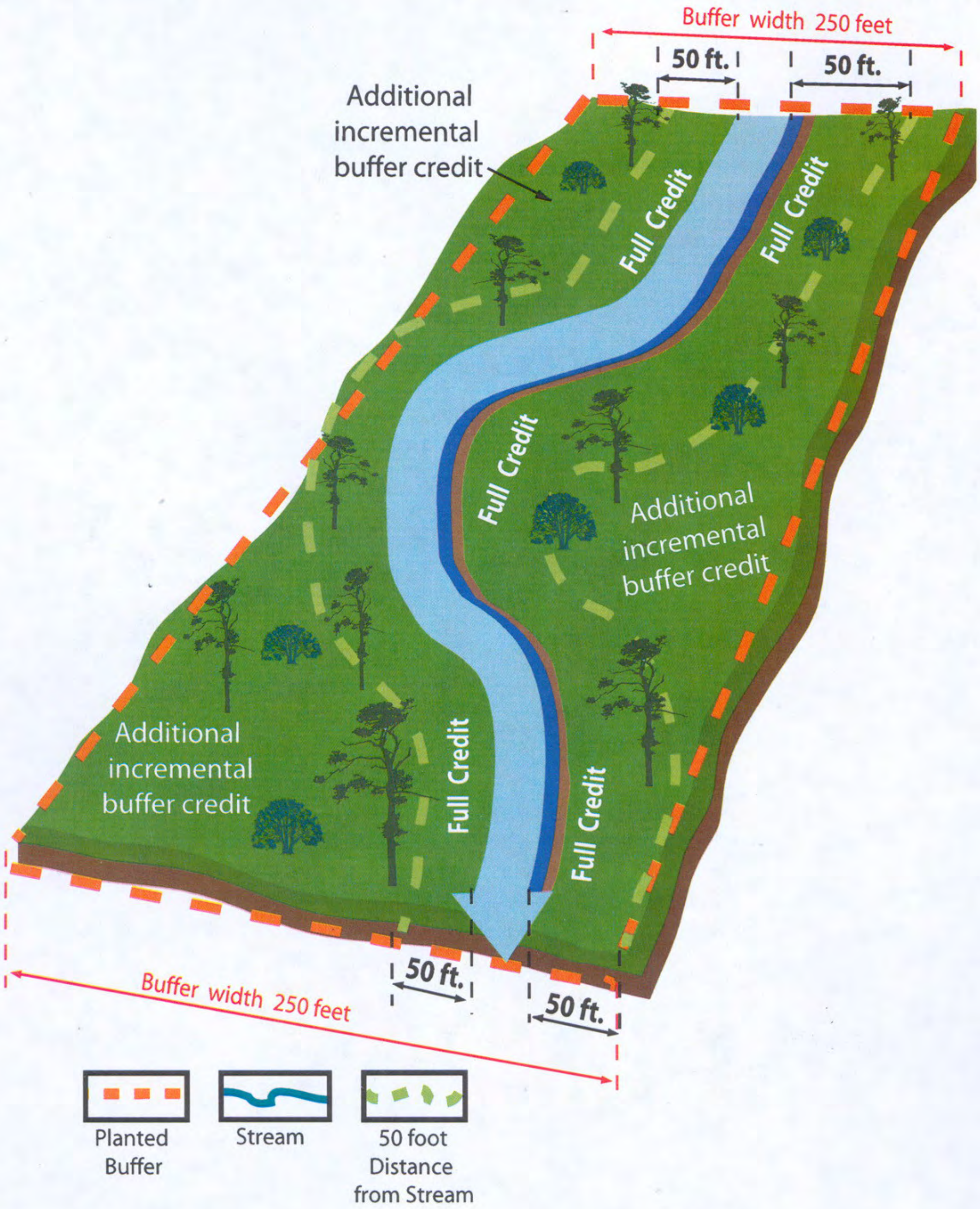


Figure 5 Buffer of varing width.

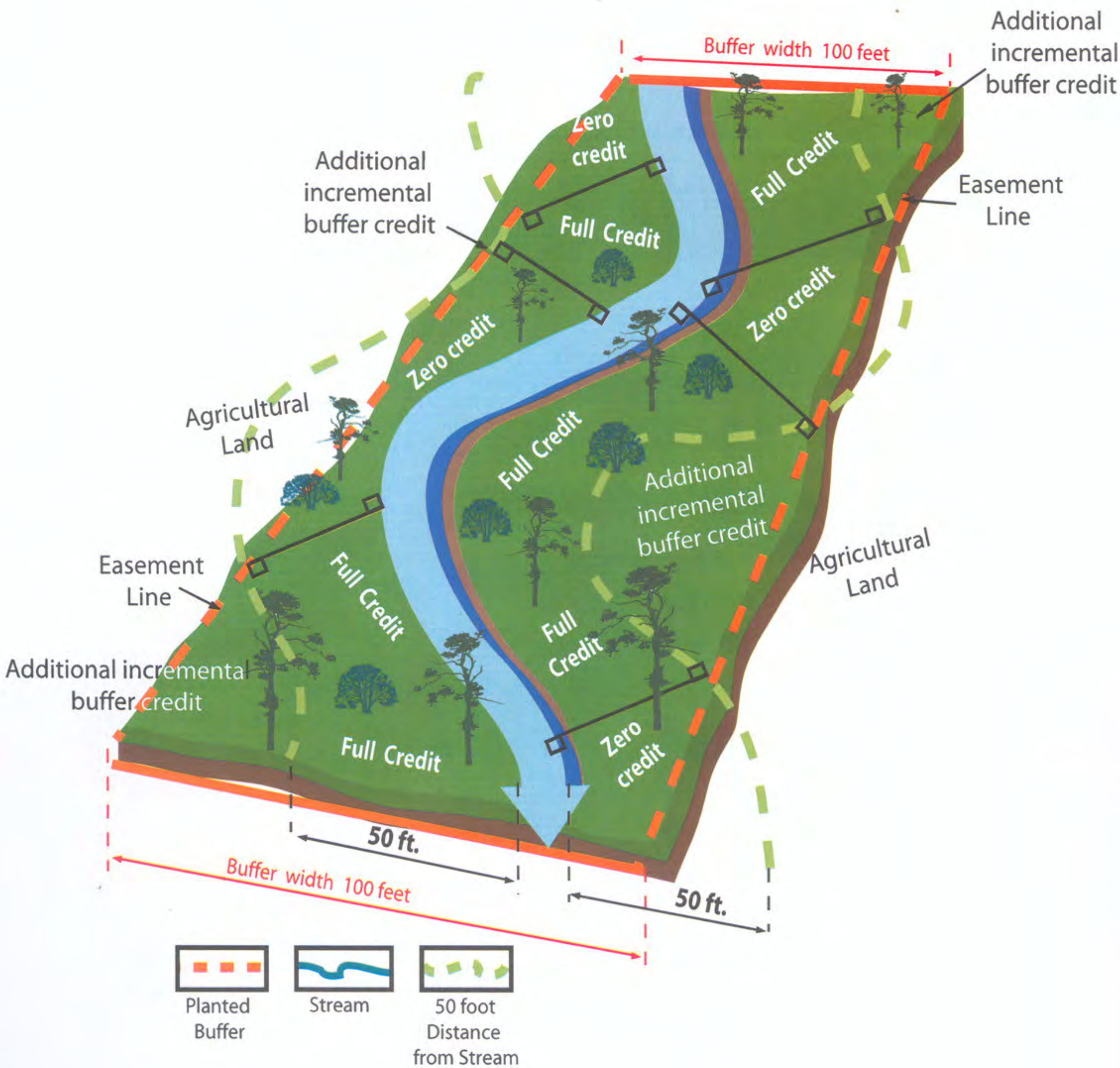
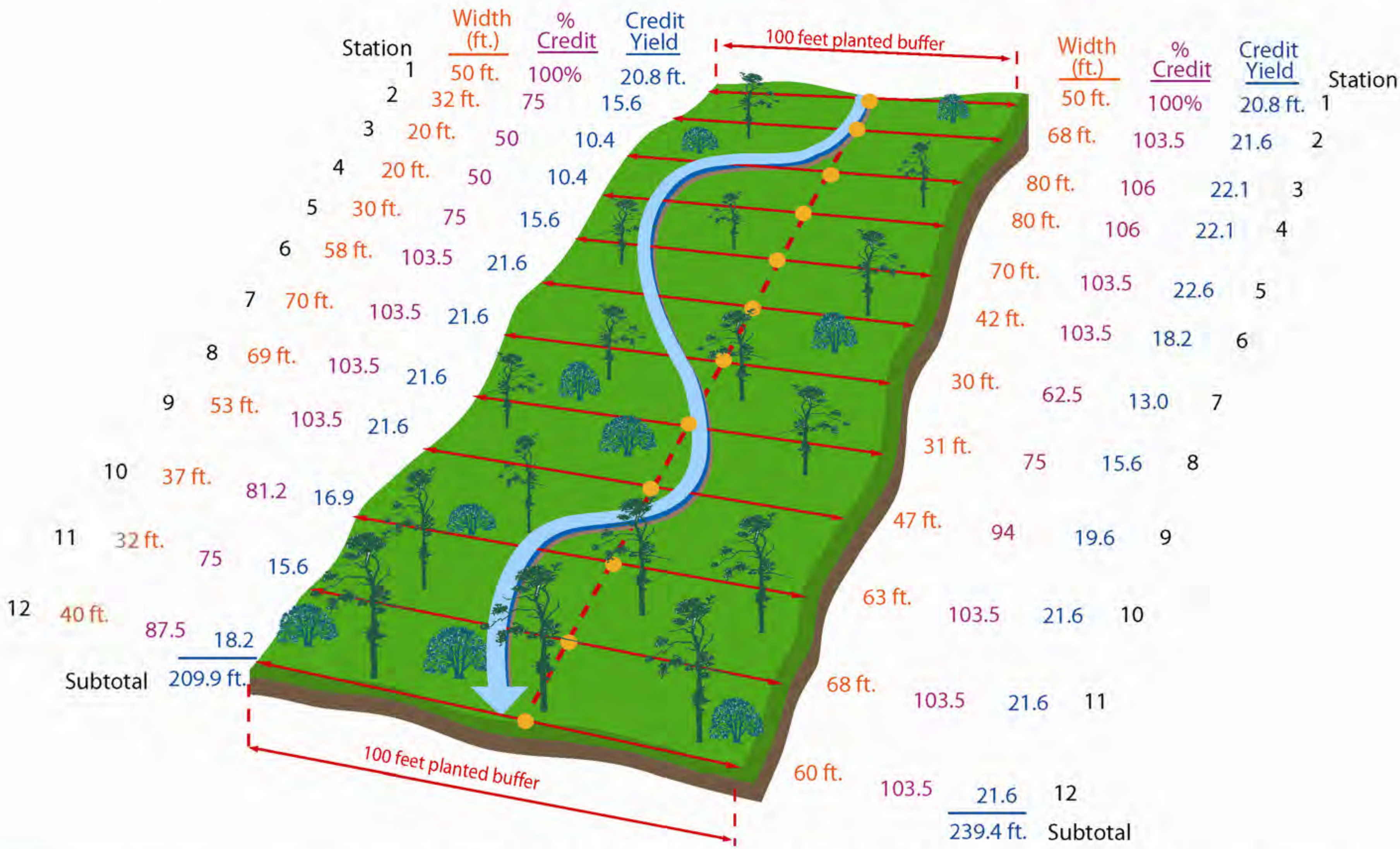
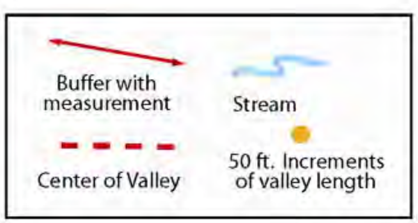


Figure 6 : Total Riparian Buffer width of 100 feet with a meandering stream width in the piedmont or coastal plain. Measurement method- measure from stream bank at center of valley. Total new stream length = 500 feet





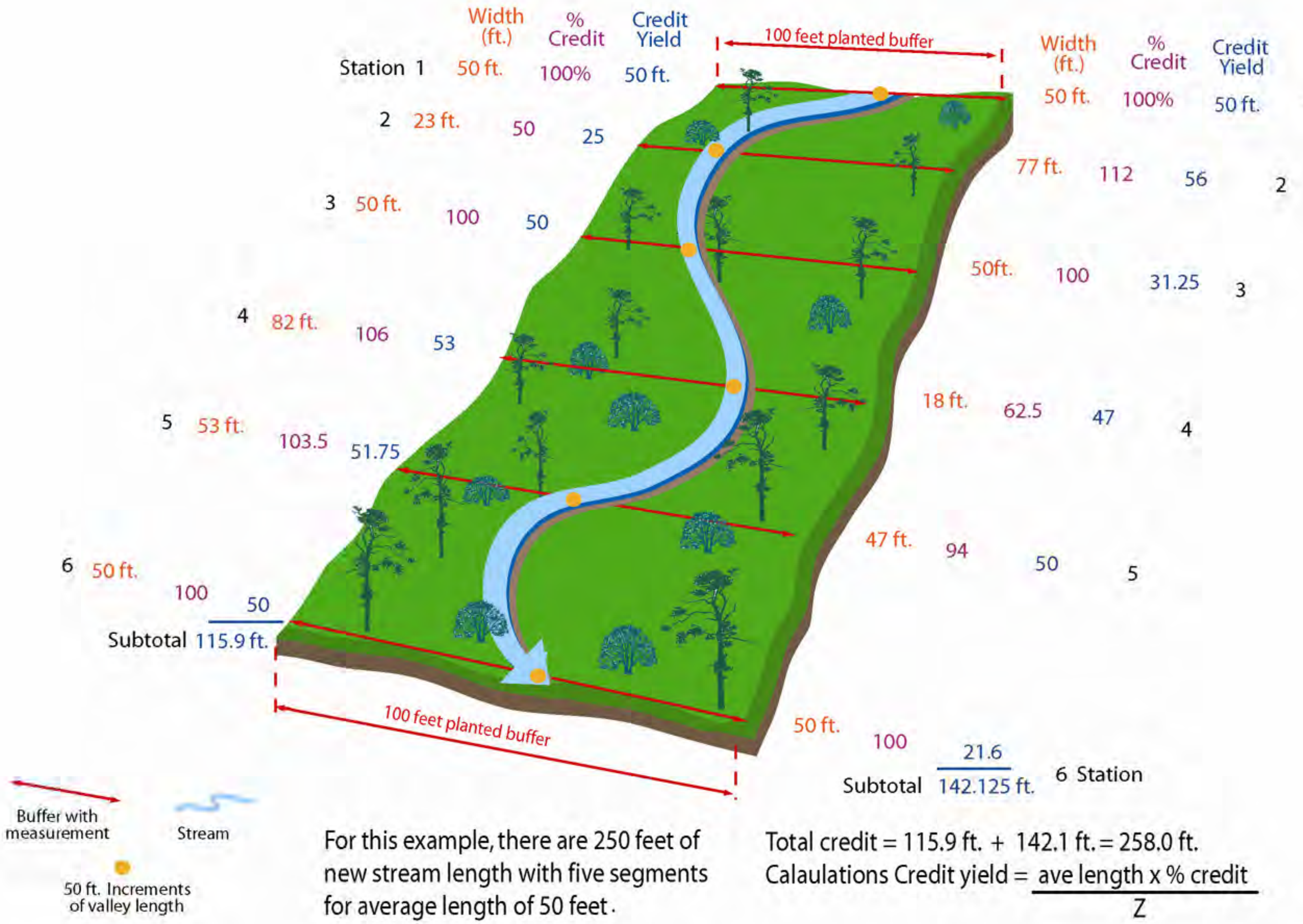
For this example, there are 500 feet of stream length with 12 segments = 41.7 feet (ave. length)

Therefore, each side is 41.7/2 = 20.85 feet

Calculations: $\text{Credit yield} = \dfrac{\text{ave. length} \times \%\ \text{credit}}{2}$

Total credit = 209.9 ft. + 239.4 ft. = 449.3 ft. for the 500 feet of stream channel

Figure 7 : Total Riparian Buffer width of 100 feet with a meandering stream width in the piedmont or coastal plain. Total new stream length 250 feet. Measurement method- measure from the stream bank 50 foot increments along relocated channel to shortest distance to planted buffer.



For this example, there are 250 feet of new stream length with five segments for average length of 50 feet.

Total credit = 115.9 ft. + 142.1 ft. = 258.0 ft.

Calaulations Credit yield = $\frac{\text{ave length x \% credit}}{\text{Z}}$

UT to Town Creek Restoration Project - Option A
Mitigation Credit Calculations for Additional Riparian Buffer

Segment 1 Left Floodplain (Reach 1)

Stream SMUs		Reach Length	Buffer Area (ft^2)	Avg Buffer Width	% Credit	SMU Credit Yield
1,192		1,192	152,576	128	10.0%	**1,311.30**

Segment 1 Right Floodplain

Stream SMUs		Reach Length	Buffer Area (ft^2)	Avg Buffer Width	% Credit	SMU Credit Yield
1,192		1,192	83,440	70	3.5%	**1,233.81**

Avg. % increase =	6.75%
Increase in Stream Credit =	**80**
Total Stream Credits =	**1,273**

Segment 2 & 3 Left Floodplain (Reach 2)

Stream SMUs		Reach Length	Buffer Area (ft^2)	Avg Buffer Width	% Credit	SMU Credit Yield
1,783		1,783	203,262	114	10.0%	**1,961.30**

Segment 2 & 3 Right Floodplain

Stream SMUs		Reach Length	Buffer Area (ft^2)	Avg Buffer Width	% Credit	SMU Credit Yield
1,783		1,783	174,734	98	6.0%	**1,889.98**

Avg. % increase =	8.0%
Increase in Stream Credit =	**143**
Total Stream Credits =	**1,926**

Segment 4 Left Floodplain (Reach 3)

Stream SMUs		Reach Length	Buffer Area (ft^2)	Avg Buffer Width	% Credit	SMU Credit Yield
803		803	85,921	107	10.0%	**883.67**

Segment 4 Right Floodplain

Stream SMUs		Reach Length	Buffer Area (ft^2)	Avg Buffer Width	% Credit	SMU Credit Yield
803		803	89,936	112	10.0%	**883.67**

Avg. % increase =	10.00%
Increase in Stream Credit =	**80**
Total Stream Credits =	**884**

Avg. % increase =	8.0%
Total Increase in Stream Credits =	**303**
Total Stream Credits =	**4,082**

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

January 10, 2013

Regulatory Division

Re: Final Approval (Closeout) of North Carolina Ecosystem Enhancement Program In-Lieu Fee (ILF) Mitigation Sites for the 2012 Closeout Year

Ms. Suzanne Klimek
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Ms. Klimek:

Please reference the letters of November 30, 2012, from Mr. Tim Baumgartner with the North Carolina Ecosystem Enhancement Program (NCEEP), which transmitted Closeout summaries and final debit ledgers for selected projects. The purpose of these letters was to provide information necessary for final U.S. Army Corps of Engineers (USACE) approval (Closeout) of the referenced projects. Included among these projects are several that were previously presented for Closeout in earlier years but were not approved due to various issues. Any projects with contingencies that have now been resolved have been included with the projects approved for Closeout with this letter.

This letter is intended to provide verification of all projects that have received Closeout approval through 2012. Attached to this letter is a copy of the most recent version of the USACE Wilmington District Closeout Process for NCEEP Mitigation Projects, which includes expectations and procedures for future Closeout years. We continue to operate in a transitional phase between the 2007 Memorandum of Agreement and the NCEEP In-Lieu Fee Instrument (Instrument), which became effective on July 28, 2010. As such, we understand that projects that are proposed for Closeout this year and in the next several years may not be able to meet all of the requirements of these procedures; however, we continue to encourage you and your staff to comply with these provisions to the extent possible.

Please note that Closeouts approved by this letter and the attached procedures only refer to mitigation sites associated with permits authorized under Section 404 and 401 of the Clean Water Act by the USACE and the North Carolina Division of Water Quality (NCDWQ). Separate closure is required from the NCDWQ for all sites that provide buffer credits or nutrient offsets as required by state authorizations.

Currently Approved Closeout Sites

Per the correspondence of November 30, 2012 and the supporting documents, the following 32 mitigation sites have been reviewed and Closeout is now approved:

NCEEP Project ID	Project Name	County	Initial Closeout Year
92526	Anderson Swamp*	Edgecombe	2012
19	Bailey Fork (EBX)	Burke	2011
92217	Beaverdam Creek	Mecklenburg	2012
439	Bold Run Creek	Wake	2012
92207	Brown Farm	Durham	2012
54	Brush Creek	Alleghany	2012
69	Cane Creek	Alamance	2012
79	Charles Creek	Pasquotank	2012
93	Cleghorn Creek	Rutherford	2011
92226	Conoconnara Swamp	Halifax	2012
92329	Crowns West	Onslow	2012
65	Dula Thorofare at Bishop Site	Anson	2012
92350	Dula Thorofare at Camp Branch	Anson	2012
92206	Glen Raven	Alamance	2012
147	Goose Creek	Durham	2012
158	Grove Creek	Duplin	2012
92327	Lloyd Site	Onslow	2012
256	Mocassin Creek	Wake	2012
92227	Modlin Site	Martin	2012
441	Nicholls Farm (Troublesome Creek)	Bertie	2012
92702	Paint Fork Creek (Fosson)	Madison	2009
92607	Plemmons-Kirkpatrick Spring Creek	Madison	2012
289	Prestonwood G.C.*	Wake	2012
291	Price Park	Guilford	2012
92220	Reeds Creek	Iredell	2012
333	Shepherd's Tree	Iredell	2012
92218	Silver Creek-Conway	Burke	2012
340	Sleepy Creek	Lenoir	2010
363	Stillhouse Creek	Orange	2012
402	UT to Rocky River (Smith Tract)	Chatham	2012
412	Warrior Creek	Wilkes	2012
420	Whitelace Creek	Lenoir	2012

* These projects were closed with existing contingencies. See the table for a description of the required contingency tasks.

Attached to this letter is a complete list of all NCEEP sites that were scheduled to come due for Closeout through 2012 based on their monitoring schedule. The list indicates whether sites have been approved for closeout, along with a brief description of why the sites have not been closed. Some of the sites have been closed with contingencies, in which case the required contingency actions are briefly described on the list. In these cases, approval is provided with the understanding that the contingency tasks will be completed by NCEEP prior to the transfer of the sites to the long-term steward. No additional monitoring data or verification is required unless the USACE or NCIRT members specifically ask NCEEP to provide documentation that such contingency treatments have been completed.

Also attached to this letter is a final debit ledger for all 32 sites that have received Closeout approval with this correspondence. These ledgers list the final approved balance of stream and wetland credits (expressed in feet and acres) generated by the site, along with the individual debits associated with NCDWQ (401) and USACE (404) permit actions, and the remaining balance available at each closed site.

In accordance with the attached Closeout Process, NCEEP shall transfer all preservation mechanisms for closed sites to the long-term steward within 60 days from the date of this letter. Furthermore, any requirements of the long-term financing mechanism necessary to fund the long-term steward (e.g., non-wasting endowments, contractual funding requirements, etc.) must also be provided by the deadlines explained above. If there are sites where it is not possible to meet these requirements, you must notify the USACE prior to the deadlines to request an extension.

Please note that once site Closeout has been approved, the individual debits listed for each site must remain with that site. Additionally, as any remaining balance for each site is debited and associated with a particular USACE or NCDWQ permit action, that permit action must also remain associated with that site. Any deviation from this requirement must be brought to the immediate attention of the USACE and NCIRT for approval on a case-by-case basis. Once a mitigation site has received Closeout approval, all future credit transactions will be reported in the ledgers submitted with the NCEEP Annual Report.

Thank you for your continued efforts in improving this process, and if you have any questions regarding this letter, or the requirements of the Mitigation Rule, please call me at 919-846-2564.

Sincerely,

TUGWELL.TODD.JASON.1048429293
2013.01.10 16:59:11 -05'00'

Todd Tugwell
Special Projects Manager

Enclosures

Electronic Copies Furnished:
NCIRT Distribution List

Appendix H

Recorded Conservation Easement and Plat

Filed: 10/10/2013 02:39:31 PM
Suzanne W. Lowder, Register of Deeds
Stanly County, NC

REAL ESTATE EXCISE TAX: $754.00

BOOK 1468 PAGE 143(16) 359198

$30
16

Prepared by and return to:
Robert H. Merritt, Jr.
P. O. Box 1351
Raleigh, NC 27602

STATE OF NORTH CAROLINA

STANLY COUNTY

CONSERVATION EASEMENT PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT NO. 003277

REV - $754.00

SPO File Number: 84-T
EEP SITE ID# 94648

THIS CONSERVATION EASEMENT DEED, made this 10th day of October, 2013 by MARCUS JOHN HARWARD and wife, PATTY R. HARWARD, ("**Grantor**"), whose mailing address is P. O. Box 465, Richfield, North Carolina 28137, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Ecosystem Enhancement Program (formerly known as the Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between

MICHAEL BAKER ENGINEERING, INC., 8000 Regency Parkway, Suite 200, Cary, North Carolina 27511, and the North Carolina Department of Environment and Natural Resources, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environment and Natural Resources Purchase and Services Contract Number 003277.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (the "MOA") duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Ecosystem Enhancement Program is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Ecosystem Enhancement Program in the Department of Environment and Natural Resources, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple four (4) tracts of real property situated, lying, and being in Ridenhour Township, Stanly County, North Carolina (the "**Property**"), being more particularly described as that certain parcel of land containing approximately 7.9 acres, more or less (PIN No.: 662102855222), another parcel of land containing approximately 36.2 acres, more or less (PIN No.: 662102758987), another parcel of land containing approximately 78 acres, more or less (PIN No.: 662104749221), and another parcel of land containing approximately 3.3 acres, more or less (PIN No.: 662102854715), each of the foregoing tracts being acquired by the Grantor pursuant to the Last Will and Testament of Johnny B. Harward, probated on or about November 26, 2003, in the Office of the Clerk of Court, Stanly County, North Carolina, File Number 03 E 487; and

WHEREAS, Grantor is willing to grant a Conservation Easement over the herein described areas of the Property, thereby restricting and limiting the use of the included areas of the Property to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept such Conservation Easement for the protection and benefit of the UT to Town Creek project, Stanly County, North Carolina.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access, as follows:

The Easement Area Consists of the following:

> Conservation Easements identified as CE-1, CE-2, and CE-3, as shown on a Plat entitled "Conservation Easement Survey for State of North Carolina – Ecosystem Enhancement Program on the Property of Marcus John Harward" dated October 1, 2013, certified by Marshall Wright, PLS, and recorded in Plat Book 23, Page 202-203, Stanly County Registry.
>
> TOGETHER WITH an easement for access, ingress, egress and regress as described on the above-referenced recorded plat and this Conservation Easement Deed.
>
> The Conservation Easements described above are hereinafter referred to as the "Easement Area" or the "Conservation Easement" and are further set forth in a metes and bounds description attached hereto as Exhibit 1 and incorporated herein by reference.

The purposes of this Conservation Easement are to maintain, restore, enhance, create and preserve wetland and/or riparian resources in the Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

This Conservation Easement shall be perpetual. It is an easement in gross, runs with the land, and is enforceable by Grantee against Grantor, their personal representatives, heirs, successors, and assigns, lessees, agents, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITES

The Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement.

Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. The following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Usage of motorized vehicles in the Easement Area is prohibited.

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Easement Area not inconsistent with this Conservation Easement, and the right of access to the Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. Vegetative Cutting. Except as related to the removal of non-native plants, diseased or damaged trees, and vegetation that obstructs, destabilizes or renders unsafe the Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Easement Area, including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Easement Area.

H. Roads and Trails. There shall be no construction of roads, trails, walkways, or paving in the Easement Area.

I. Signs. No signs shall be permitted in the Easement Area except interpretive signs describing restoration activities and the conservation values of the Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances or machinery, or other material in the Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials in the Easement Area.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticides or biocides in the Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Easement Area may temporarily be used for good cause shown as needed for the survival of livestock and agricultural production on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no subdivision, partitioning, or dividing of the underlying Property owned by the Grantor in fee simple ("fee") that is subject to this Easement is allowed. Unless agreed to by the Grantee in writing, any future conveyance of the underlying fee and the rights as conveyed herein shall be as a single block of property. Any future transfer of the fee is subject to the Grantee's right of ingress, egress, and regress over and across the Property to the Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is consistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the N.C. Ecosystem Enhancement Program, whose mailing address is 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction and Inspection. The Grantee, its employees and agents, successors and assigns, receive the perpetual Right of Access to the Easement Area over the Property at reasonable times to undertake any activities to restore, manage, maintain, enhance, and monitor the stream, wetland and other riparian resources in the Easement Area in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities with the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. The Grantee, its employees and agents, successors or assigns, shall be permitted to place fencing on the Property to restrict livestock access. Although the Grantee is not responsible for fence maintenance, the Grantee reserves the right to repair the fence, at its sole discretion.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Easement Area that is inconsistent with the purposes of this Easement and to require the restoration of such areas or features of the Easement Area that may have been damaged by such activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, their successors or assigns, that comes to the attention of the Grantee, the Grantee shall, except as provided below, notify the Grantor, their successors or assigns in writing of such breach. The Grantor shall have ninety (90) days after receipt of such notice to correct the conditions constituting such breach. If the breach remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by appropriate legal proceedings including damages, injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief if the breach of the term of this Conservation Easement is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement. The Grantor and Grantee acknowledge that under such circumstances damage to the Grantee would be irreparable and remedies at law will be inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the

Grantor, their successors or assigns are complying with the terms, conditions and restrictions of this Conservation Easement.

C. **Acts Beyond Grantor's Control.** Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor, their successors or assigns, for any injury or change in the Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life, damage to property or harm to the Property resulting from such causes.

D. **Costs of Enforcement.** Beyond regular and typical monitoring, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, their successors or assigns, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. **No Waiver.** Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown above or to other address(es) as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees to make any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in a writing signed by all parties hereto, or their successors or assigns, and provided such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property. Such notification shall be addressed to Justin McCorkle, General Counsel, US Army Corps of Engineers, 69 Darlington Avenue, Wilmington, NC 28403.

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

H. Patty R. Harward executes this Conservation Easement Deed for purposes of conveying her marital rights in the real property transferred herein.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Easement Area, and the right of quiet enjoyment of the Easement Area.

TO HAVE AND TO HOLD the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes.

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same are free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever. The easements, leases, restrictions and rights-of-way reserved herein or of record constituting exceptions to title are as follows:

1. Reservation of rights as set forth in Article II, above.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

Marcus John Harward (SEAL)
Marcus John Harward, Grantor

Patty R Harward (SEAL)
Patty R. Harward, Grantor

NORTH CAROLINA
COUNTY OF WAKE

I, Robert H. Merritt, JR., a Notary Public, do hereby certify that Marcus John Harward and wife, Patty R. Harward, personally appeared before me this day and acknowledged to me that they voluntarily signed the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 10th day of October, 2013.

Robt H Merritt
Notary Public
Robert H. Merritt, JR.
Printed Name of Notary Public

My commission expires: 5-1-2017

ROBERT H. MERRITT, JR.
NOTARY
PUBLIC
WAKE COUNTY, NC

00318870

Exhibit 1
Legal Description
Permanent Conservation Easements
UT to Town Creek
Stanly County, NC

1. Permanent Conservation Easement (Ref: PIN: 662102758987) CE- 1 (8987A)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, and recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662102758987), more particularly described as follows:

Commencing at the northwesterly most point of CE- 1, point #36 on the above referenced plat, said point being common to the terminus of L27 and the beginning of L28, and furthermore, located on the southerly right-of-way of Misenheimer Road (SR 1440), with NC Grid coordinates of X= 1,628,192.69, Y= 616,607.24, said point being the POINT AND PLACE OF BEGINNING. Thence continuing with the southerly right-of-way of Misenheimer Road(SR 1440) the following courses and distances:

N81°44'22"E, 29.74', thence
N76°22'19"E, 62.67', thence
N69°18'44"E, 72.36', thence leaving the southerly right-of-way of Misenheimer Road(SR 1440) and continuing along the westerly right-of way of Old Salisbury Road(SR 1400) :
S15°27'53"E, 460.10', thence
S17°26'40"E, 233.15', thence leaving the westerly right-of way of Old Salisbury Road (SR 1400) and continuing along a portion of the common line for (PIN: 662102758987) and (PIN: 662102854715),
S87°23'47"W, 234.18', thence leaving said common line and continuing
N23°45'53"W, 119.31', thence
N08°11'31"W, 405.37', thence
N05°05'47"W, 121.95', to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE- 1 (8987A)** on this parcel containing **3.19** acres, more or less.

2. Permanent Conservation Easement (Ref: PIN: 662102758987) CE- 1 (8987B)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, and recorded in Plat Book 23, Pages 202 - 203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662102758987), more particularly described as follows:

Commencing at the point common to the terminus of L19, and the beginning of L20, point #27 on the above referenced plat, with NC Grid coordinates of X=1,628,036.11, Y= 615,550.96; said point being the POINT AND PLACE OF BEGINNING. Thence continuing the following courses and distances:

N84°42'33"E, 253.00', to a point on a portion of the common line for (PIN: 662102854715), and (PIN: 662102758987), and continuing:
S07°14'07"E, 153.20', thence leaving said common line and continuing:
S53°24'36"W, 50.40', thence
N88°32'16"W, 193.39', thence
N13°40'47"W, 158.25' to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE- 1 (8987B)** on this parcel containing **0.94** acres, more or less.

3. Permanent Conservation Easement (Ref: PIN: 662102854715) CE-1 (4715)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, and recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662102854715), more particularly described as follows:

Commencing at a point on a portion of the common line for (PIN: 662102854715), and (PIN: 662102758987), point #33 at the terminus of L24 on the above referenced plat, with NC Grid coordinates of X=1,628,309.36, Y= 615,975.34; said point being the POINT AND PLACE OF BEGINNING.

Thence continuing the following courses and distances:

N87°23'47"E, 234.18', to a point on the westerly right-of way of Old Salisbury Road (SR 1400), and continuing along said right-of- way S17°26'40"E, 47.22', thence leaving said right-of- way and continuing along a portion of the common line for (PIN: 62102854715) and (PIN: 662102855222),
S04°02'32"E, 486.43', thence
N84°19'42"W, 77.94', thence leaving said common line and continuing:
N41°29'05"W, 60.37', thence
S70°56'33"W, 98.13', to a point on said common line, thence
N84°19'42"W, 82.45' to a point on a portion of the common line for (PIN: 662102854715) and (PIN: 662102758987) and continuing
N07°14'07"W, 90.26', thence leaving said common line and continuing:

N75°23'43"E, 114.73', thence
N07°24'27"W, 76.72', thence

N12°54'07"W, 245.47', thence
N23°45'53"W, 62.03' to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE-1 (4715)** on this parcel containing **2.58** acres, more or less.

4. Permanent Conservation Easement (Ref: PIN: 662104749221) CE-1 (9221)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, and recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662104749221), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X= 1,628,389.52, Y= 614,867.88 and identified as Control Point #20 on the above referenced plat and running N57°00'31"E, 48.15' to point #9 on a portion of the common line for (PIN: 62104749221) and (PIN: 662102855222). Thence leaving said common line and continuing:

S82°20'35"W, 34.51', thence
N31°03'35"W, 51.40', thence
N89°43'34"W, 47.99', thence
N38°56'32"W, 53.00', thence
N11°31'27"W, 227.63', thence
N18°06'05"E, 121.21', thence
S19°40'15"E, 445.11', to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE-1 (9221)** on this parcel containing **0.73** acres, more or less.

5. Permanent Conservation Easement (Ref: PIN: 662102855222) CE-1 (5222A)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, and recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662102855222), more particularly described as follows:
Commencing at an iron bar and cap with NC Grid coordinates of X= 1,628,389.52, Y= 614,867.88 and identified as Control Point #20 on the above referenced plat and running N57°00'31"E, 48.15' to point #9 on a portion of the common line for (PIN:62104749221) and (PIN: 662102855222). Thence continuing along said common line:

N19°40'15"W, 445.11', thence leaving said common line and continuing:

N18°06'05"E, 53.45', thence
N33°20'05"W, 123.99', thence
N19°32'59"E, 42.17', thence
N52°43'41"E, 135.08', thence
N16°20'45"E, 174.94', thence
N41°29'05"W, 48.75', thence
S84°19'42"E, 77.94', thence
N04°02'32"W, 486.43' to a point on the westerly right-of-way of Old Salisbury Road(SR 1400), and continuing along said right-of-way the following courses and distances:

S17°26'40"E, 445.64', thence along a curve to the right with an arc length of 349.83', a radius of 605.00', and a chord and chord bearing of 344.98' at S00°52'45"E,

Thence along a curve to the left with an arc length of 331.96', a radius of 853.00', and a chord and chord bearing of 329.87' at S04°32'14"E, thence

S06°36'41"E, 263.20', thence leaving the westerly right-of-way of Old Salisbury Road (SR 1400) and continuing:

S82°20'35"W, 124.66' to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE-1 (5222A)** on this parcel containing **4.90** acres, more or less.

6. Permanent Conservation Easement (Ref: PIN: 662102855222) CE-1 (5222B)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, and recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662102855222), more particularly described as follows:

Commencing at the point common to the terminus of L-15, and the beginning of L-16, point #23 on the above referenced plat, with NC Grid coordinates of X= 1,628,381.45, Y= 615,476.60 , point being the POINT AND PLACE OF BEGINNING. Thence continuing the following courses and distances:

S53°46'59"W, 91.87', thence
N07°14'07"W, 62.94', thence
S84°19'42"E, 82.45', to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE- 1 (5222B)** on this parcel containing **0.06** acres, more or less.

7. Permanent Conservation Easement (Ref: PIN: 662104749221) CE-2 (9221)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662104749221), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X= 1,628,178.82, Y= 614,053.85 and identified as Control Point #19 on the above referenced plat and running S76°51'29"W, 194.82' to point #51 on the above referenced plat, said point being the POINT AND PLACE OF BEGINNING. Thence continuing the following courses and distances:

N81°18'00"E, 150.53', thence
S88°14'33"E, 195.91', thence
N68°38'02"E, 214.45', thence
N15°23'59"E, 93.92', thence
N10°23'03"W, 303.53', thence
N82°20'35"E, 94.84', to a point on a portion of the common line for (PIN: 662104749221) and (PIN: 662102855222). Thence continuing along said common line
S19°40'15"E, 1187.14' to a point; thence leaving said common line and continuing the following courses and distances:

S75°27'06"W, 225.49', thence
N27°05'04"W, 138.79', thence
N05°37'56"W, 403.10', thence
N13°34'17"W, 139.96', thence
S73°29'38"W, 310.26', thence
N89°15'09"W, 217.22', thence
S84°19'40"W, 93.06', thence
N22°51'00"W, 121.11', to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE- 2 (9221)** on this parcel containing **6.29** acres, more or less.

8. Permanent Conservation Easement (Ref: PIN: 662102855222) CE-2 (5222)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 622102855222), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X= 1,628,536.62, Y= 614,537.74 and identified as Control Point #20 on the above referenced plat and running S62°40'08"E, 68.71' to point #57 on the above referenced plat, said point being on a portion of the common line for (PIN: 662104749221) and (PIN: 662102855222), and being the POINT AND PLACE OF BEGINNING. Thence continuing the following courses and distances:

N82°20'35"E, 110.80' to a point on the westerly right-of- way of Old Salisbury Road (SR 1400). Thence continuing with the westerly right-of- way of Old Salisbury Road the following courses and distances:

S06°36'41"E, 89.96', thence along a curve to the left with an arc length of 161.60', a radius of 798.27', and a chord and chord bearing of 161.33' at S12°24'23"E. Thence

S18°12'16"E, 920.66', thence leaving the westerly right-of- way of Old Salisbury Road and continuing:

S75°27'06"W, 44.26', to a point along a portion of the common line for (PIN: 662102855222) and (PIN: 662104749221) , N19°40'15"W, 1187.14' to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE- 2 (5222)** on this parcel containing **1.68** acres, more or less.

9. Permanent Conservation Easement (Ref: PIN: 662104749221) CE-3 (9221)

A permanent conservation easement over a portion of land in Ridenhour Township, Stanly County, North Carolina, as shown on map entitled *"Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of Marcus John Harward"*, dated October 1, 2013, recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry, and being a portion of the parcel owned by Marcus John Harward, (PIN: 662104749221) , more particularly described as follows:

Commencing at the northeasterly most point of CE- 3, point #58 on the above referenced plat, with NC Grid coordinates of X= 1,627,969.03, Y= 614,005.70, said point being common to the terminus of L80 and the beginning of L61 and being the POINT AND PLACE OF BEGINNING. Thence continuing the following courses and distances:

S22°52'44"E, 114.72', thence
S66°12'00"W, 231.52', thence
S59°31'21"W, 291.86', thence
S03°42'44"W,136.53', thence
S24°37'51"W, 266.48', thence
S44°50'37"W, 114.57', thence
S63°06'11"W, 202.04', thence
N00°43'01"W, 135.88', thence

N50°02'03"E, 180.80', thence
N28°39'11"E, 131.29', thence
N18°45'19"E, 170.49', thence
N68°17'47"W, 202.72', thence
N45°40'34"W, 100.54', thence
N00°00'00"W, 54.00', thence
N48°32'07"E, 99.29', thence
S51°29'41"E, 182.89', thence
S78°55'29"E, 99.28', thence
N56°16'54"E, 240.81', thence
N65°37'07"E, 193.11', thence
N78°02'03"E, 116.66' to the POINT AND PLACE OF BEGINNING.

Said portion of permanent conservation easement **CE-3 (9221)** on this parcel containing **4.73** acres, more or less.

10. Access to the Permanent Conservation Easements

Access to and through the permanent conservation easement described above and conveyed herein, shall be (1) as provided in this deed, (2) as provided on the Plat referenced below (see Note 8., Sheet 1 of 2), and (3), from the 60' Public Right-of-Way of Old Salisbury Road (NCSR 1400); to provide ingress, egress, and regress for purposes of accessing the permanent conservation easement(s) set forth above, and as shown on the map recorded in Plat Book 23, Pages 202-203 of the Stanly County Registry.

00355880

OWNER'S CERTIFICATE

PIN: 662102758987
PIN: 662104749221
PIN: 662102854715
PIN: 662102855222

I, MARCUS JOHN HARWARD, HEREBY CERTIFY THAT I AM THE OWNER OF THE PROPERTIES SHOWN AND DESCRIBED HEREON, WHICH WERE CONVEYED(DEVISED) TO ME BY THE LAST WILL AND TESTAMENT OF JOHNNY B. HARWARD, AS FILED WITH THE CLERK OF SUPERIOR COURT OF STANLY COUNTY, NORTH CAROLINA AS FILE No. 03-E-487 ON NOVEMBER 28, 2003. THE AFOREMENTIONED PROPERTIES WERE ACQUIRED THROUGH DEEDS RECORDED IN DEED BOOK 374, PAGE 413 (PIN:662102758987), DEED BOOK 307, PAGE 942 (PIN:662104749221), DEED BOOK 218, PAGE 136 (PIN:662102854715), AND DEED BOOK 203, PAGE 368 (PIN:662102855222) OF THE STANLY COUNTY REGISTRY. MY WIFE, PATTY R. HARWARD, EXECUTES THIS PLAT FOR THE PURPOSE OF EVIDENCING HER TRANSFER OF HER MARITAL RIGHTS WITH RESPECT TO THE REAL PROPERTY DESCRIBED IN THE CONSERVATION EASEMENT SHOWN ON THIS PLAT. FURTHER, I HEREBY ADOPT THIS PLAN OF SUBDIVISION AND GRANT AND CONVEY THE EASEMENTS HEREIN WITH FREE CONSENT AND HEREBY CERTIFY THAT THE LAND AS SHOWN HEREON IS WITHIN THE SUBDIVISION REGULATION JURISDICTIONS OF STANLY COUNTY, NORTH CAROLINA.

Marcus John Harward — 10-10-13
MARCUS JOHN HARWARD — DATE

Patty R. Harward — 10-10-13
PATTY R. HARWARD — DATE

STATE OF NORTH CAROLINA
COUNTY OF WAKE

I, Robert H. Merritt, Jr. A NOTARY PUBLIC FOR THE COUNTY AND STATE AFORESAID, DO HEREBY CERTIFY THAT MARCUS JOHN HARWARD AND WIFE, PATTY R. HARWARD, PERSONALLY APPEARED BEFORE ME THIS DAY AND ACKNOWLEDGED THE DUE EXECUTION OF THE FOREGOING INSTRUMENT.

WITNESS MY HAND AND OFFICIAL STAMP OR SEAL THIS 10th DAY OF October, 2013.

Robert H Merritt

MY COMMISSION EXPIRES: 5-1-2017

ROBERT H. MERRITT, JR. NOTARY PUBLIC WAKE COUNTY, NC

NOTES

1. THE PURPOSE OF THIS PLAT IS TO IDENTIFY THE EXTENT AND LOCATION OF CONSERVATION EASEMENTS DEPICTED AS CE-1, CE-2, AND CE-3, HEREIN.

2. BOUNDARY INFORMATION IS DERIVED FROM FIELD SURVEY, DEEDS, PLATS, GIS DATA, AND TAX RECORDS OF THE STANLY COUNTY REGISTRY AS SHOWN HEREON. SURVEYED BOUNDARY LINES ARE SHOWN AS SOLID LINES.

APPROXIMATELY 3600' OF OLD SALISBURY ROAD (SR 1400) AND 1600' OF MISENHEIMER ROAD (SR 1440) IN THE PROXIMITY OF THE CONSERVATION EASEMENT(S) WAS FIELD LOCATED DURING THIS SURVEY.

THE EASTERLY MARGINS OF CE-1 AND CE-2 ARE COINCIDENT WITH THE WESTERLY RIGHT-OF WAY OF OLD SALISBURY ROAD (SR 1400).

THE NORTHERLY MARGIN OF CE-1 IS COINCIDENT WITH THE SOUTHERLY RIGHT-OF WAY OF MISENHEIMER ROAD (SR 1440).

3. NORTH CAROLINA GRID COORDINATES FOR GPS DERIVED CONTROL POINTS WERE ESTABLISHED BY MICHAEL BAKER ENGINEERING, INC. (COMBINED FACTOR=0.99985338D)

4. ALL DISTANCES ARE HORIZONTAL GROUND UNLESS OTHERWISE NOTED.

5. THE BEARING BASIS FOR THIS PLAT IS NAD 83 (NC GRID).

6. ALL AREAS SHOWN WERE CALCULATED BY COORDINATE COMPUTATION.

7. ALL CONSERVATION EASEMENT POINTS ARE MONUMENTED WITH REBAR AND CAP.

8. THE RIGHT(S) OF NON-EXCLUSIVE INGRESS, EGRESS, AND REGRESS OVER AND ALONG ANY AND ALL EXISTING PATHS/ROADS (INCLUDING PUBLIC R/W), TRANSECTING SUBJECT PROPERTY ARE RESERVED BY THE GRANTOR(S) AND THE GRANTEE(S) OF THE CONSERVATION EASEMENTS FOR THE USES AND PURPOSES NOT INCONSISTENT WITH THE USES OF CE-1 THRU CE-3, DESCRIBED HEREON FOR CONSERVATION EASEMENT PURPOSES.

CE-1

LINE	BEARING	DISTANCE
L1	S15°27'53"E	460.10'
L2	S17°26'40"E	233.15'
L3	S17°26'40"E	47.22'
L4	S17°26'40"E	445.64'
L5	S06°36'41"E	263.20'
L6	S82°20'35"W	124.66'
L7	N19°40'15"W	445.11'
L8	N18°06'05"E	53.45'
L9	N33°20'05"W	123.99'
L10	N19°32'59"E	42.17'
L11	N52°43'41"E	135.08'
L12	N16°20'45"E	174.94'
L13	N41°29'05"W	48.75'
L14	N41°29'05"W	60.37'
L15	S70°56'33"W	98.13'
L16	S53°46'59"W	91.87'
L17	S53°24'36"W	50.40'
L18	N88°32'16"W	193.39'
L19	N13°40'47"W	158.25'
L20	N84°42'33"E	253.00'
L21	N75°23'43"E	114.73'
L22	N07°24'27"W	76.72'
L23	N12°54'07"W	245.47'
L24	N23°45'53"W	62.03'
L25	N23°45'53"W	119.31'
L26	N06°11'31"W	405.37'
L27	N05°05'47"W	121.95'
L28	N81°44'22"E	29.74'
L29	N76°22'19"E	62.67'
L30	N69°18'44"E	72.36'
L31	N87°25'47"E	234.18'
L32	S04°02'32"E	486.43'
L33	N84°19'42"W	77.94'
L34	N84°19'42"W	82.45'
L35	N07°14'07"W	153.20'
L36	S82°20'35"W	34.51'
L37	N31°03'35"W	51.40'
L38	N89°43'34"W	47.99'
L39	N38°56'32"W	53.00'
L40	N11°31'27"W	227.63'
L41	N18°06'05"E	121.21'

CURVE	LENGTH	RADIUS	CHORD	CH. BEARING
C1	349.83'	605.00'	344.98'	S00°52'45"E
C2	331.96'	853.00'	329.87'	S04°32'14"W

CE-2

LINE	BEARING	DISTANCE
L42	S06°36'41"E	89.96'
L43	S18°12'16"E	920.66'
L44	S75°27'06"W	44.26'
L45	S75°27'06"W	225.49'
L46	N27°05'04"W	138.79'
L47	N05°37'56"W	403.10'
L48	N13°34'17"W	139.96'
L49	S73°29'38"W	310.26'
L50	N89°15'09"W	217.22'
L51	S84°19'40"W	93.06'
L52	N22°51'00"W	121.11'
L53	N81°15'00"E	150.53'
L54	S88°14'33"E	195.91'
L55	N68°38'02"E	214.45'
L56	N15°23'59"E	93.92'
L57	N10°23'03"W	303.53'
L58	N62°20'35"E	94.84'
L59	N82°20'35"E	110.80'
L60	S19°40'15"E	1187.14'

CURVE	LENGTH	RADIUS	CHORD	CH. BEARING
C3	161.60'	798.27'	161.33'	S12°24'23"E

REVIEW OFFICER CERTIFICATION

STATE OF NORTH CAROLINA
COUNTY OF STANLY

I, Michael M Sandy REVIEW OFFICER OF STANLY COUNTY. CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATE IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

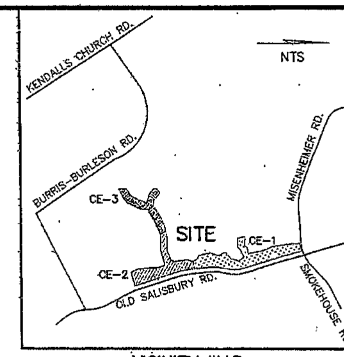
REVIEW OFFICER — 10-10-13
DATE

CE-3

LINE	BEARING	DISTANCE
L61	S22°52'44"E	114.72'
L62	S66°12'00"W	231.52'
L63	S59°31'21"W	291.85'
L64	S03°42'44"W	136.53'
L65	S24°37'51"W	266.48'
L66	S44°50'37"W	114.57'
L67	S63°06'11"W	202.04'
L68	N00°43'01"W	135.88'
L69	N50°02'03"E	180.80'
L70	N28°39'11"E	131.29'
L71	N18°45'19"E	170.49'
L72	N68°17'47"W	202.72'
L73	N45°40'34"W	100.54'
L74	N00°00'00"W	54.00'
L75	N46°32'07"E	99.29'
L76	S51°29'41"E	182.89'
L77	S78°55'29"E	99.28'
L78	N56°16'54"E	240.81'
L79	N65°37'07"E	193.11'
L80	N78°02'03"E	116.66'

CONSERVATION EASEMENT AREA SUMMARY

CE-1 PIN: 662102758987(A)	3.19 Acres	
CE-1 PIN: 662102758987(B)	0.94 Acres	
CE-1 PIN: 662104749221	0.73 Acres	
CE-1 PIN: 662102854715	2.58 Acres	
CE-1 PIN: 662102855222(A)	4.90 Acres	
CE-1 PIN: 662102855222(B)	0.06 Acres	12.40 Acres (Total CE-1)
CE-2 PIN: 662102855222	1.68 Acres	
CE-2 PIN: 662104749221	6.29 Acres	7.97 Acres (Total CE-2)
CE-3 PIN: 662104749221	4.73 Acres	4.73 Acres (Total CE-3)
TOTAL	25.10 Acres	



VICINITY MAP

NTS

REFERENCES

STANLEY COUNTY REGISTRY

ESTATE FILE 03-E-487
DB 374, PG 413
DB 307, PG 942
DB 218, PG 136
DB 203, PG 368
DB 347, PG 245
DB 575, PG 124
DB 312, PG 970
DB 356, PG 566
DB 290, PG 406

THIS PLAT IS APPROVED BY THE STANLY COUNTY PLANNING DEPARTMENT.

PLANNING OFFICER — DATE 10-10-13

Filed: 10/10/2013 02:39:30 PM
Suzanne W. Lowder, Register of Deeds
Stanly County, NC

SURVEYOR'S CERTIFICATION

I, MARSHALL WIGHT, DO HEREBY CERTIFY THAT THIS SURVEY IS OF ANOTHER CATEGORY AND IS AN EXCEPTION TO THE DEFINITION OF SUBDIVISION.

Marshall Wight
MARSHALL WIGHT, PLS — L-5034

I, MARSHALL WIGHT, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION USING REFERENCES SHOWN HEREON; THAT THE BOUNDARIES NOT SURVEYED ARE SHOWN AS BROKEN LINES PLOTTED FROM INFORMATION SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS 1:10,000+; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 4 DAY OF October, 2013.

NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

BOOK 23 PAGE 202(2) 359197

Marshall Wight
MARSHALL WIGHT, PLS — L-5034

Page 1 of 2

EEP PROJECT NAME: 'UT to TOWN CREEK'

Drawing No: UT to Town Creek_94648_CE_Baker_FINAL.dwg

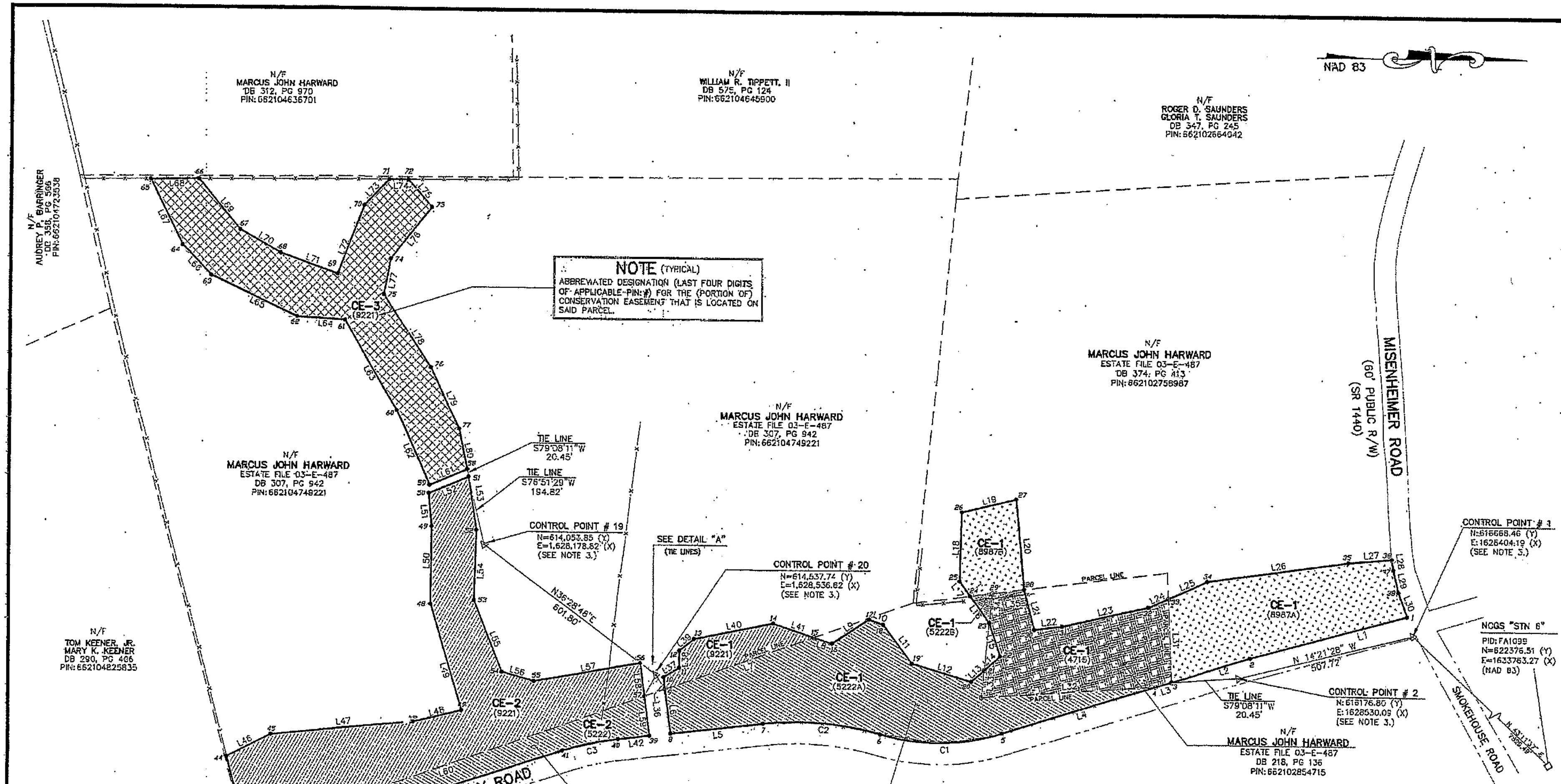
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
License: F-1084

CONSERVATION EASEMENT SURVEY
FOR
STATE OF NORTH CAROLINA — ECOSYSTEM ENHANCEMENT PROGRAM
ON THE PROPERTY OF
MARCUS JOHN HARWARD

RIDENHOUR TOWNSHIP — STANLY COUNTY — NORTH CAROLINA

EEP PROJECT No.: 94648
SPO FILE No.: 84-T
Baker Project No.: 120857
Date: October 1, 2013

SHEET 1 of 2



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Page 2 of 2

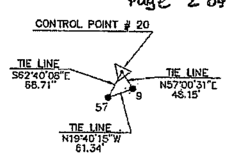
EASEMENT CORNERS

PT.#	NORTHING	EASTING
1	616651.84	1628350.73
2	616208.40	1628473.41
3	615985.98	1628543.30
4	615940.93	1628557.46
5	615515.79	1628691.05
6	615170.85	1628696.35
7	614842.02	1628670.25
8	614580.57	1628700.56
9	614563.96	1628577.01
10	614559.36	1628542.81
11	614603.39	1628516.29
12	614603.62	1628468.30
13	614644.84	1628434.99
14	614867.88	1628389.52
15	614983.09	1628427.18
16	615030.84	1628443.78
17	615137.45	1628375.65
18	615177.22	1628389.76
19	615259.02	1628497.25
20	615426.69	1628546.48
21	615463.41	1628514.19
22	615508.64	1628474.20
23	615476.60	1628381.45
24	615422.31	1628307.33
25	615392.27	1628266.86
26	615397.21	1628073.53
27	615550.96	1628036.11

PT.#	NORTHING	EASTING
28	615574.29	1628268.03
29	615484.74	1628299.40
30	615603.22	1628398.06
31	615679.31	1628389.17
32	615918.56	1628334.36
33	615975.34	1628309.36
34	616084.54	1628261.28
35	616485.77	1628203.52
36	616607.24	1628192.69
37	616611.51	1628222.12
38	616626.28	1628263.03
39	614520.86	1628707.47
40	614431.60	1628717.82
41	614274.04	1628752.48
42	613399.46	1629040.11
43	613386.34	1628097.27
44	613331.70	1628779.01
45	613455.26	1628715.82
46	613856.42	1628676.26
47	613992.47	1628643.41
48	613904.32	1628345.94
49	613907.15	1628128.74
50	613697.95	1628036.14
51	614009.56	1627989.11
52	614032.33	1628137.91
53	614026.32	1628333.73
54	614104.45	1628533.43

PT.#	NORTHING	EASTING
55	614195.00	1628558.37
56	614493.56	1628503.66
57	614506.19	1628597.66
58	614005.70	1627969.03
59	613900.00	1628013.63
60	613806.58	1627801.80
61	613658.54	1627550.26
62	613522.30	1627541.42
63	613280.07	1627430.36
64	613196.84	1627349.57
65	613107.44	1627169.39
66	613243.31	1627167.69
67	613358.44	1627306.26
68	613474.66	1627369.22
69	613636.10	1627424.04
70	613711.06	1627235.68
71	613781.31	1627163.76
72	613535.31	1627163.76
73	613901.06	1627238.17
74	613787.19	1627381.29
75	613768.12	1627478.72
76	613901.80	1627679.02
77	613961.52	1627854.91

Filed: 10/10/2013 02:39:30 PM
Suzanne W. Lowder, Register of Deeds
Stanly County, NC



DETAIL "A"
(TIE LINES)
NTS

NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-5034 MARSHALL G. WIGHT

LEGEND

PROPERTY LINE SURVEYED
PROPERTY LINE(R/W) NOT SURVEYED
CONSERVATION EASEMENT
EXISTING FENCE
EASEMENT CORNER
CALCULATED POINT (NO MONUMENT SET)
CONTROL POINT SET
PIN .... PARCEL IDENTIFICATION NUMBER

GRAPHIC SCALE

200 0 200 400

1"=200'
(US Ft.)

EEP PROJECT NAME: "UT to TOWN CREEK"

Drawing No: UT to Town Creek_94648_CE_Baker_final.dwg

Baker

Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
License: F-1084

CONSERVATION EASEMENT SURVEY
FOR
STATE OF NORTH CAROLINA – ECOSYSTEM ENHANCEMENT PROGRAM
ON THE PROPERTY OF
MARCUS JOHN HARWARD

RIDENHOUR TOWNSHIP | STANLY COUNTY | NORTH CAROLINA

EEP PROJECT No.: 94648
SPO FILE No.: 84-T
Baker Project No.: 120857
Date: October 1, 2013

SHEET 2 of 2

Appendix I

FEMA Floodplain Checklist

FIRM Panel 6621

HEC – RAS Output

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. Edward Curtis), NC Floodplain Mapping Unit (attn. John Gerber) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	UT to Town Creek Restoration Project
Name if stream or feature:	Unnamed Tributary to Town Creek
County:	Stanly
Name of river basin:	Yadkin
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Stanly County
DFIRM panel number for entire site:	6621J
Consultant name:	Kristi Suggs, Project Manager Michael Baker Engineering, Inc.
Phone number:	704-665-2206
Address:	5550 Seventy-Seven Center Drive, Suite 320 Charlotte, NC 28217

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1” = 500”.

The UT to Town Creek Stream and Wetland Mitigation Project (Project) is located in Stanly County, approximately 1.7 miles west of the Town of New London within cataloging unit 03040105, and NC Division of Water Resources (NCDWR) sub-basin 03-07-13 of the Yadkin Pee-Dee River Basin (see Figure 1). The Project is located in a North Carolina Ecosystem Enhancement Program (NCEEP) -Targeted Local Watershed (HUC 03040105060-040), and will involve stream restoration and enhancement and wetland restoration, creation, and enhancement on UT to Town Creek and several of its tributaries. A recorded conservation easement consisting of 25.1 acres will protect all stream reaches, wetlands, constructed wetland BMPs, and riparian buffers in perpetuity.

Summarize stream reaches or wetland areas according to their restoration priority.

Reach	**Length**	**Priority**
Reach 1	*1,224*	*One (Restoration)*
Reach 2	*1,806*	*One (Restoration)*
Reach 3	*780*	*One (Restoration)*
Reach 4	*445*	*Three (Enhancement I)*
Reach 5	*347*	*Four (Enhancement II)*
Reach 6	*1,370*	*One (Restoration)*
Reach 7	*400*	*One (Restoration)*
Mitigation	**Acreage**	
Restoration	*1.64*	
Creation	2.32	
Enhancement	*1.00*	

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

○ Yes ◉ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☐ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies: ☑ AE Zone ○ Floodway ○ Non-Encroachment ◉ None ☐ A Zone ○ Local Setbacks Required ○ No Local Setbacks Required
If local setbacks are required, list how many feet:
Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks? ○ Yes ◉ No
Land Acquisition (Check) ☐ State owned (fee simple) ☐ Conservation easment (Design Bid Build) ☑ Conservation Easement (Full Delivery Project) Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)
Is community/county participating in the NFIP program? ◉ Yes ○ No Note: if community is not participating, then all requirements should be addressed to NFIP (attn: Edward Curtis, (919) 715-8000 x369)
Name of Local Floodplain Administrator: Michael Sandy Phone Number: 704-986-3665

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☑ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision (CLOMR)

☐ Other Requirements

List other requirements:

Comments:

Name: Kristi Suggs

Signature: Kristi Suggs

Title: Project Manager

Date: 4/25/14

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://FRIS.NC.GOV/FRIS

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
OTHER AREAS	Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Accredited or Provisionally Accredited Levee, Dike, or Floodwall
	Non-accredited Levee, Dike, or Floodwall
	BM5510 North Carolina Geodetic Survey bench mark
	BM5510 National Geodetic Survey bench mark
	BM5510 Contractor Est. NCFMP Survey bench mark
	012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at http://www.ncfloodmaps.com, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

This map may include approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

CBRS Area

Otherwise Protected Area

SCALE

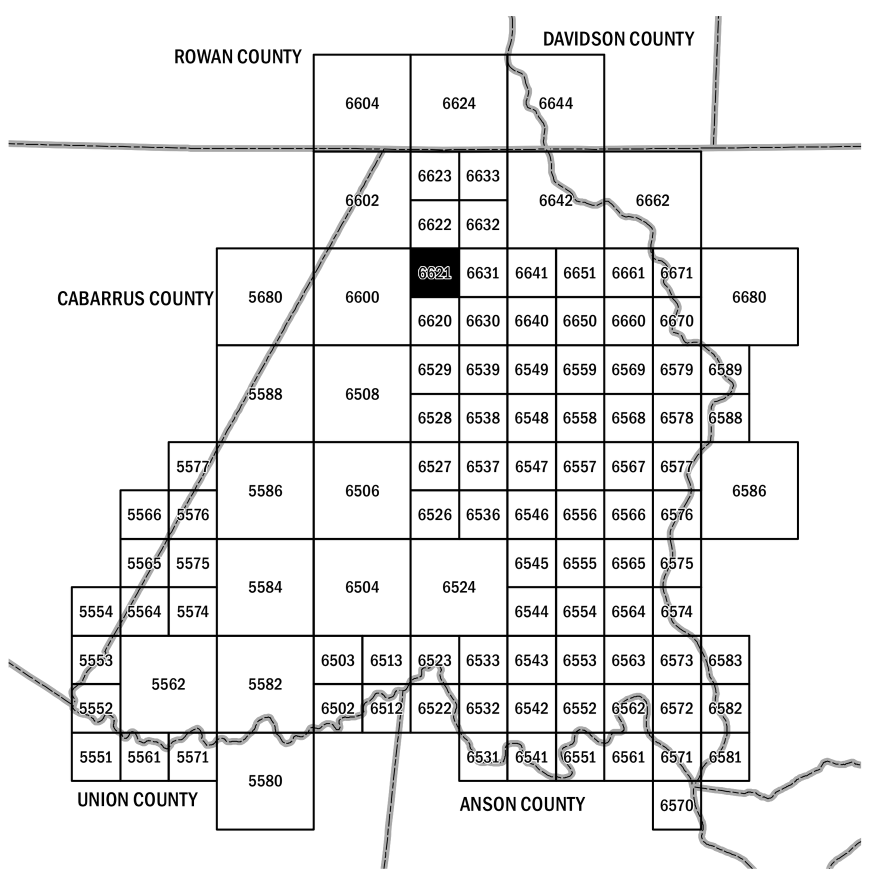
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR



NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL **6621**

FEMA
National Flood Insurance Program

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
RICHFIELD, TOWN OF	370511	6621	J
STANLY COUNTY	370361	6621	J

MAP NUMBER
3710662100J

MAP REVISED
9/3/2008

HEC -RAS Results for Hyrdologic Trespass
UT to Town Creek Restoration Site - Option A
NCEEP Contract No. 003277; Project No. 94648

Reach	River Station	Profile	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Adjacent Roadway Elevation (ft)
REACH 1	38+03.16	100 YR	574.55	578.60	585.32
	36+78.64	100 YR	573.83	577.63	588.62
	35+45.80	100 YR	572.90	576.28	591.74
	34+15.66	100 YR	571.90	575.20	593.38
	32+74.88	100 YR	570.96	574.00	592.65
	30+21.40	100 YR	568.40	571.25	589.93
	28+27.74	100 YR	566.47	569.53	589.42
	27+00.52	100 YR	565.32	568.73	588.57
REACH 2	25+83.35	100 YR	564.00	567.03	586.48
	24+12.05	101 YR	561.22	564.56	581.90
	22+71.33	100 YR	560.00	564.06	579.39
	21+39.76	100 YR	558.95	563.98	582.45
	20+67.67	100 YR	558.47	563.95	582.89
	19+36.18	100 YR	557.64	563.89	583.13
	17+85.79	100 YR	556.47	563.88	580.31
	16+25.21	100 YR	555.27	563.88	575.61
	15+31.82	100 YR	554.46	563.88	571.42
	14+74.15	100 YR	553.96	563.87	569.71
	14+53.34	100 YR	553.74	563.87	569.17
	14+28.69	CULVERT			
	13+99.23	100 YR	552.62	556.52	568.15
	13+72.55	100 YR	551.74	556.00	567.78
	13+09.71	100 YR	552.63	555.75	567.47
	11+44.59	100 YR	552.04	555.87	564.89
	9+27.26	100 YR	549.56	554.02	560.80
REACH 3	7+16.00	100 YR	548.75	553.04	557.66
	5+51.30	100 YR	548.39	551.60	555.62
	3+86.10	100 YR	547.48	550.72	555.00
	2+38.50	100 YR	546.56	550.34	554.59
	0+92.55	100 YR	545.71	550.15	554.30
	0+08.71	100 YR	545.16	549.73	553.97

Appendix J

BMP Design Calculations

Constructed Wetland Reach 4 - Water Quality Calculations

Hydrograph Information:

Qp=		cfs
Tp=		min
dT=	2.0	min

Orifice: Water Quality

N =	1	
D =	2	in
Cd =	0.6	
Inv =	0	ft

Water Quality

A=	9.62	ac.
Q*=	0.42	in

Storage **14666.652** (Q*)*(1/12)*D.A.

Stage Storage:

Ks=	16654
b=	1.1665

y=16768.5x
Stage 0' - 1'

0.021816616	$\pi*(d/2)^2$	0.02492918	
1.196629224	Storage/(Td*k_o*√(32.2*H_o	0.00793521	
54.84944335	Time to drain in (hr)	0.08907977	
		0.17815954	ft
	Pipe sized required to drain in exactly 48hr	2.13791452	in

Initial Water Level:

Zi=	0	ft

Computed Results

Norm surf. Area =	0.00	ac.
Max. sur. Area =	0.44	ac.
Peak stage =	**0.90**	ft
Rise =	0.90	ft
Peak Outflow =	0.09	cfs
Storage @ 48Hrs =	2913.73	ft^3
Stage @ 48Hrs=	0.22	ft
5% Max Storage	733.35	ft3

Constructed Wetland Reach 7 - Water Quality Calculations

Hydrograph Information:

Qp=		cfs
Tp=		min
dT=	2.0	min

Orifice: Water Quality

N =	1	
D =	2	in
Cd =	0.6	
Inv =	0	ft

Water Quality

A=	9.62	ac.
Q*=	0.42	in

Storage **14666.652** (Q*)*(1/12)*D.A.

Stage Storage:

Ks=	16654
b=	1.1665

y=16768.5x
Stage 0' - 1'

0.021816616	$\pi*(d/2)^2$	0.02492918
1.196629224	$Storage/(Td*k_o*\sqrt{(32.2*H_o}$	0.00793521
54.84944335	Time to drain in (hr)	0.08907977
		0.17815954 ft
	Pipe sized required to drain in exactly 48hr	2.13791452 in

Initial Water Level:

Zi=	0	ft

Computed Results

Norm surf. Area =	0.00	ac.
Max. sur. Area =	0.44	ac.
Peak stage =	**0.90**	ft
Rise =	0.90	ft
Peak Outflow =	0.09	cfs
Storage @ 48Hrs =	2913.73	ft^3
Stage @ 48Hrs=	0.22	ft
5% Max Storage	733.35	ft3

Appendix K

NCEEP Letter to IRT – Dated May, 2013

May 13, 2013

Mr. Todd Tugwell
U.S. Army Corps of Engineers
11405 Falls of Neuse Road
Wake Forest, NC 27587

Re: EEP sites-seven year monitoring

Dear Mr. Tugwell:

At a recent IRT meeting, I presented a list of Full-Delivery sites (9) that EEP had acquired but had forgotten to require seven years of monitoring in the RFP. Currently, these sites are contracted for five years of monitoring for wetlands:

EEP ID	Site	Phase
94151	North Fork Mountain	MY 2
94642	Hermann Dairy	MY 1
94645	Upper Silver Creek	C
94646	Summit Seep	MY 3
94640	Little Troublesome	MY 2
94641	Underwood	MY 1
94643	Lyle Creek	MY 1
94647	Buffalo Flats	MY 2
94648	UT to Town Creek	C

As I stated in the IRT meeting, EEP does not plan to make contractual changes at this time. In the fourth year of monitoring, EEP will decide if the specific site may qualify to close out after five successful monitoring years. For those, EEP will submit to the IRT for early closure. For any of the sites that EEP does not think meet early closeout criteria, EEP will contract out to complete the final two years.

Please contact me with any questions (919-707-8291).

Respectfully,

Jeff Jurek, Operations

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	120857	1	43

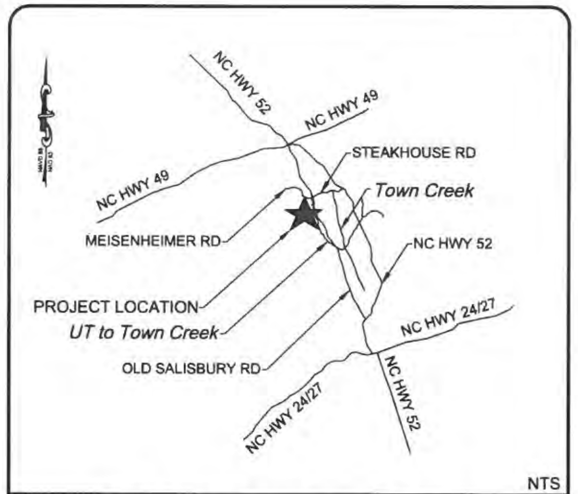
PROJECT: 120857 UNNAMED TRIBUTARY TO TOWN CREEK

NC ECOSYSTEM ENHANCEMENT PROGRAM

STANLY COUNTY

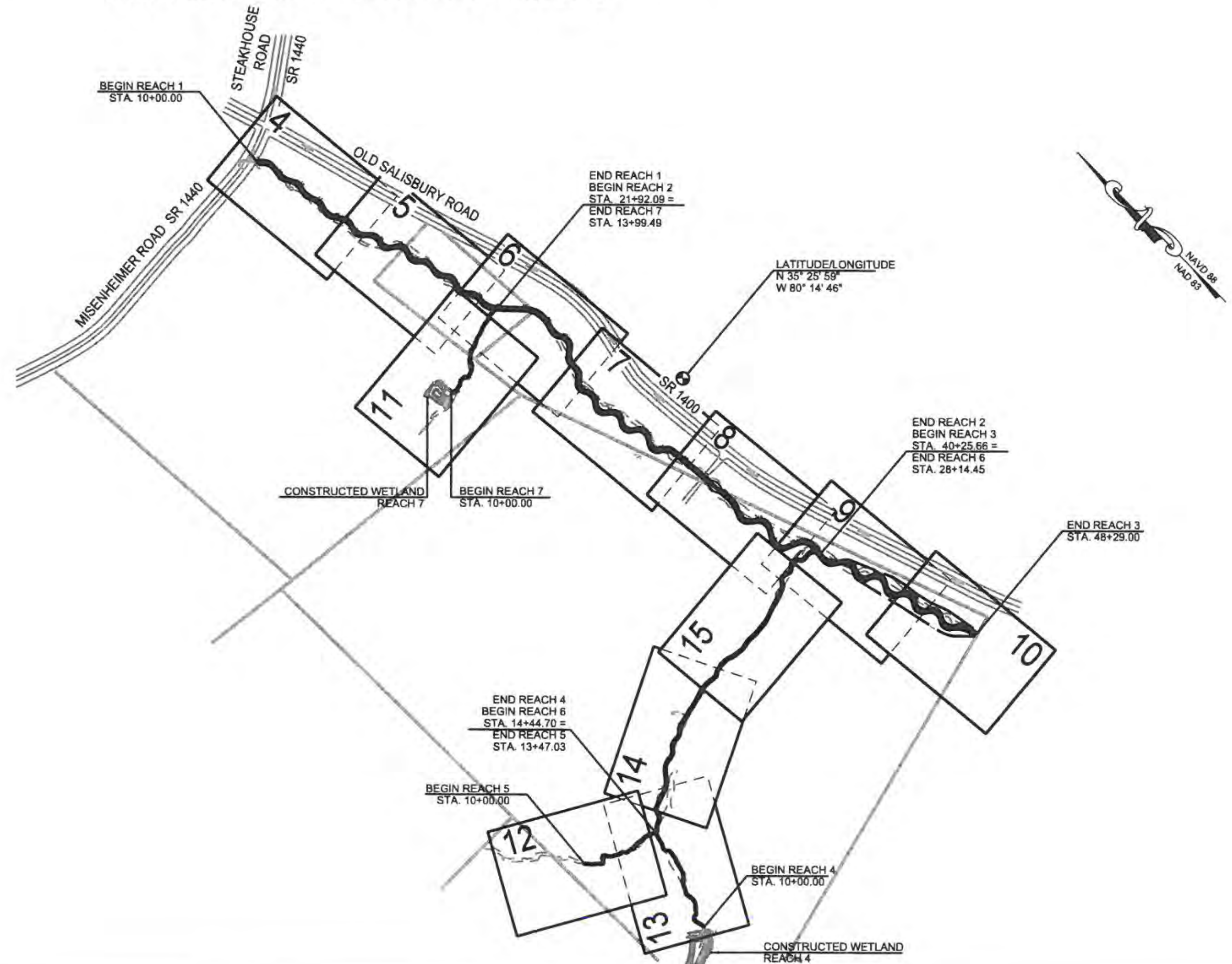
LOCATION: APPROXIMATELY 9 MILES NORTH OF ALBEMARLE, NC NEAR THE INTERSECTION OF MISENHEIMER ROAD AND OLD SALISBURY ROAD

TYPE OF WORK: STREAM RESTORATION & ENHANCEMENT
WETLAND RESTORATION & CREATION
CONSTRUCTED WETLAND BMP'S



VICINITY MAP

SHEET INDEX



NCEEP PROJECT NO.: 94648
NCDENR CONTRACT NO.: 003277

GRAPHIC SCALES

20 0 20 40
PLANS
20 0 20 40
PROFILE (HORIZONTAL)
4 0 4 8
PROFILE (VERTICAL)

STREAM LENGTH SUMMARY

REACH NAME	EXISTING LENGTH (LF)	PROPOSED LENGTH (LF)
1	1,181	1,192
2	1,672	1,833
3	721	803
4	404	444
5	324	347
6	1,349	1,370
7	386	399
TOTAL	6,037	6,388

WETLAND ACREAGE SUMMARY

DESCRIPTION	ACREAGE
WETLAND RESTORATION	2.56
WETLAND ENHANCEMENT	1.00
WETLAND CREATION	1.56
CONSTRUCTED WETLAND REACH 4	0.13
CONSTRUCTED WETLAND REACH 7	0.08

PREPARED FOR THE OFFICE OF:

Ecosystem Enhancement Program

N. C. Ecosystem Enhancement Program
5 Ravenscroft Drive, #102
Asheville, North Carolina
28801

NCEEP CONTACT: HARRY TSOMIDES
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Baker

Michael Baker Engineering Inc.
5550 Seventy-Seven Center Drive, Suite 320
Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

KRISTI SUGGS
PROJECT MANAGER

WILLIAM SCOTT HUNT III, PE
PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

SIGNATURE: P.E.

2/26/03

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1-B

- ROCK J-HOOK
- ROCK VANE
- OUTLET PROTECTION
- ROCK CROSS VANE
- DOUBLE DROP ROCK CROSS VANE
- BOULDER STEP
- ROOT WAD
- LOG J-HOOK
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- GRADE CONTROL LOG JAM
- LOG AND ROCK STEP POOL
- EXISTING WOOD LINE
- —△— SAFETY FENCE
- —TF— TAPE FENCE
- PROPOSED FENCE
- —FP— 100 YEAR FLOOD PLAIN
- —CE— CONSERVATION EASEMENT
- – –xxx– – EXISTING MAJOR CONTOUR
- – – – – – EXISTING MINOR CONTOUR
- —xxx— PROPOSED MAJOR CONTOUR
- ——— PROPOSED MINOR CONTOUR
- LIMITS OF DISTURBANCE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- CHANNEL PLUG
- CHANNEL FILL
- BRUSH MATTRESS
- GEOLIFT

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

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL INSTREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS (3' x 2' x 2'), 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 2014.
4. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)
5. ENGINEER WILL FLAG SIGNIFICANT TREES TO BE SAVED PRIOR TO CONSTRUCTION.

PROJECT REFERENCE NO.	SHEET NO.
120857	1A

PROJECT ENGINEER

Baker

Michael Baker Engineering Inc.
5550 Seventy-Seven Center Dr., Suite 320
Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

STANDARD SPECIFICATIONS

NORTH CAROLINA
EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009

- 6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
- 6.60 TEMPORARY SEDIMENT TRAP
- 6.62 TEMPORARY SILT FENCE
- 6.63 TEMPORARY ROCK DAM
- 6.70 TEMPORARY FORD STREAM CROSSING

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14

VEGETATION SELECTION

NOTE: SPECIES SELECTIONS MAY CHANGE DUE TO REFINEMENT OR AVAILABILITY AT THE TIME OF PLANTING

RIPARIAN ZONE PLANTINGS (8'X8' SPACING-APPLICATION RATE 680 TREES & SHRUBS/ACRE)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
TREE SPECIES			
Betula nigra	River Birch	5%	FACW
Celtis laevigata	Sugarberry	8%	FACW
Diospyros virginiana	Persimmon	3%	FAC
Fraxinus pennsylvanica	Green Ash	12%	FACW
Liriodendron tulipfera	Tulip Poplar	7%	FAC
Platanus occidentalis	Sycamore	15%	FACW-
Quercus lyrata	Overcup Oak	5%	OBL
Quercus michauxii	Swamp Chestnut Oak	3%	FACW-
Quercus phellos	Willow Oak	2%	FACW
SHRUB SPECIES			
Alnus serrulata	Tag Alder	10%	FACW+
Asimina triloba	Paw paw	5%	FAC
Carpinus caroliniana	Ironwood	5%	FAC
Cornus amomum	Silky dogwood	10%	FACW+
Sambucus canadensis	Elderberry	10%	FACW-

WETLANDS ZONE PLANTINGS (8'X8' SPACING-APPLICATION RATE 680 TREES & SHRUBS/ACRE)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
TREE SPECIES			
Platanus occidentalis	Sycamore	15%	FACW-
Fraxinus pennsylvanica	Green Ash	15%	FACW
Betula nigra	River Birch	15%	FACW
Quercus lyrata	Overcup Oak	10%	OBL
Quercus phellos	Willow Oak	10%	FACW
SHRUB SPECIES			
Alnus serrulata	Tag Alder	10%	FACW+
Cornus amomum	Silky dogwood	10%	FACW+
Sambucus canadensis	Elderberry	5%	FACW-
Salix sericea	Silky Willow	10%	OBL

UPLAND ZONE PLANTINGS (8'X8' SPACING-APPLICATION RATE 680 TREES & SHRUBS/ACRE)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
TREE SPECIES			
Liriodendron tulipfera	Tulip Poplar	15%	FAC
Diospyros virginiana	Persimmon	10%	FAC
Quercus michauxii	Swamp Chestnut Oak	8%	FACW-
Nyssa sylvatica	Black Gum	10%	FAC
Quercus falcata	Southern red Oak	12%	FACU-
Quercus alba	White Oak	10%	FACU
SHRUB SPECIES			
Carpinus caroliniana	Ironwood	10%	FAC
Asimina triloba	Paw paw	5%	FAC
Cercis canadensis	Redbud	5%	FACU
Cornus florida	Flowering dogwood	10%	FACU
Corylus americana	Hazelnut	5%	FACU

CONSTRUCTED WETLANDS

HERBACEOUS PLUGS (2'X2' SPACING)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
Juncus effusus	Soft Rush	30%	FACW+
Carex lurida	Lurid Sedge	25%	OBL
Scirpus cyperinus	Wool Grass	20%	OBL
Acorus calamus	Sweet Flag	15%	OBL
Lobelia cardinalis	Cardinal Flower	5%	FACW+
Hibiscus moscheutos	Swamp Hibiscus	5%	OBL

LIVE STAKES (3'x3' SPACING, ON OUTSIDE MEANDER BENDS AND 4'X4' SPACING 4' ALONG RIFFLE SECTIONS)
BRUSH MATTRESS MATERIAL
GEOLIFT MATERIAL

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
Cornus amomum	Silky dogwood	35%	FACW+
Salix nigra	Black Willow	10%	OBL
Salix sericea	Silky willow	35%	OBL
Sambucus canadensis	Elderberry	20%	FACW-

PERMANENT RIPARIAN SEEDING (TO BE PLANTED AT 15 LB/AC IN ALL PLANTING AREAS DENOTED IN PLANTING PLAN)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
Agrostis alba	Red Top	10%	FACW
Elymus virginicus	Virginia Wild Rye	15%	FAC
Panicum virgatum	Switchgrass	15%	FAC+
Tripsicum dactyloides	Gamma grass	5%	FAC+
Polygonum pennsylvanicum	Pennsylvania smartweed	5%	FACW
Schizachyrium scoparium	Little bluestem	5%	FACU
Juncus effusus	Soft rush	5%	FACW+
Bidens aristosa	Tickseed	10%	FACW
Coreopsis lanceolata	Lance-leaved coreopsis	10%	FAC
Dichanthelium clandestinum	Deer tongue	10%	FACW
Andropogon gerardii	Big bluestem	5%	FAC
Sorgastrum nutans	Indiangrass	5%	FACU

TEMPORARY SEEDING - PLANTED WITH PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
Summer Seeding (May 1 - August 15)	Application Rate
Browntop Millet- Panicum ramosum	13 lbs/acre
Winter Seeding (August 15 - May 1)	Application Rate
Rye Grain- Secale cereale	44 lbs/acre
TEMPORARY SEEDING - PLANTED WITHOUT PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
Summer Seeding (May 1 - August 15)	Application Rate
Browntop Millet- Panicum ramosum	44 lbs/acre
Winter Seeding (August 15 - May 1)	Application Rate
Rye Grain- Secale cereale	130 lbs/acre

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PROJECT REFERENCE NO.	SHEET NO.
120857	1B

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.2.14

*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
- Property Corner
- Property Monument
- Parcel/Sequence Number
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary
- Proposed Wetland Boundary
- Existing Endangered Animal Boundary
- Existing Endangered Plant Boundary

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
- 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
- Proposed Control of Access
- 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
- Storm Sewer

UTILITIES:

POWER:

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

TELEPHONE:

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

WATER:

- Water Manhole
- 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
- Designated U/G Gas Line (S.U.E.*)
- 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
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	2

PROJECT ENGINEER

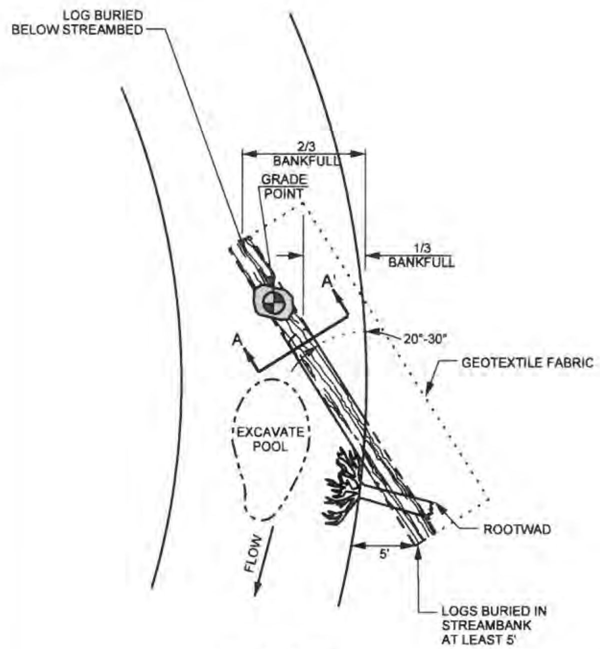
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12/22/14

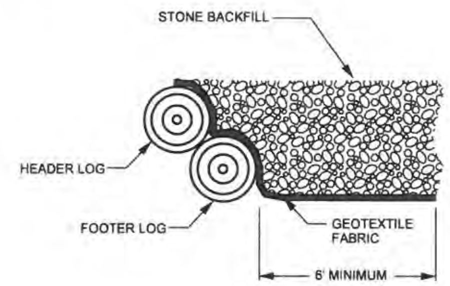
Baker

Michael Baker Engineering Inc.
5550 Seventy-Seven Center Dr., Suite 320
Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

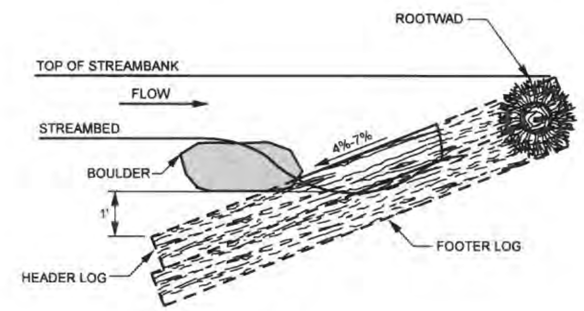
LOG VANE



PLAN VIEW



SECTION A - A'

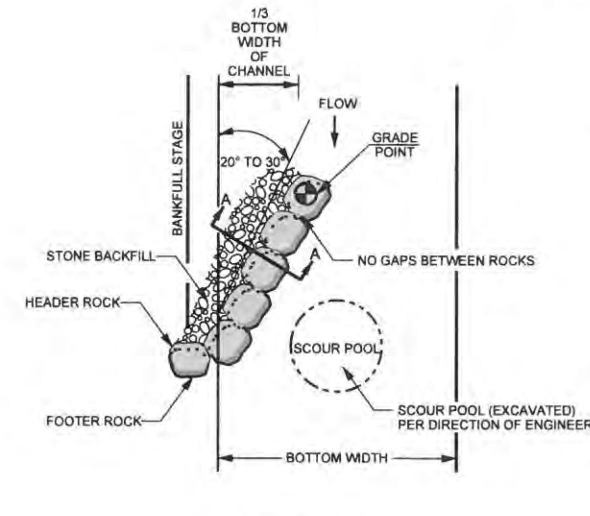


PROFILE VIEW

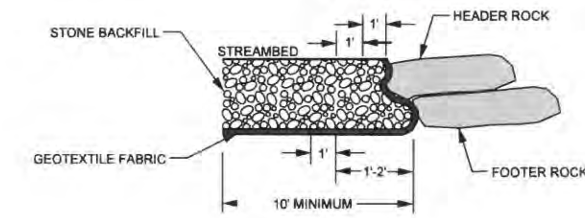
NOTES:

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.

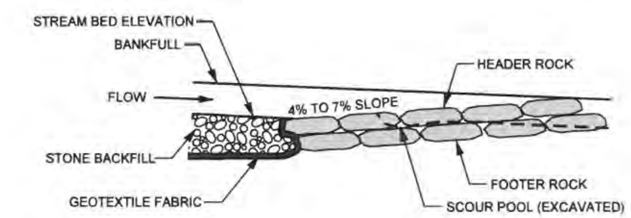
ROCK VANE



PLAN VIEW



SECTION A - A

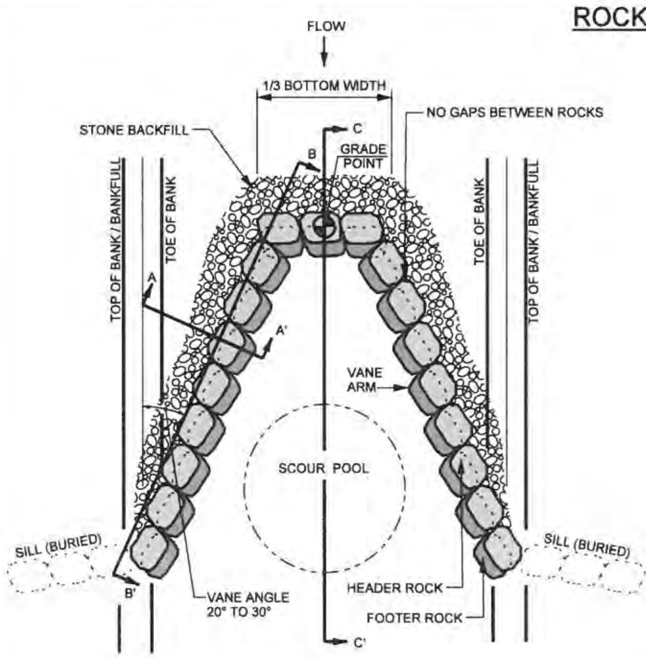


PROFILE VIEW

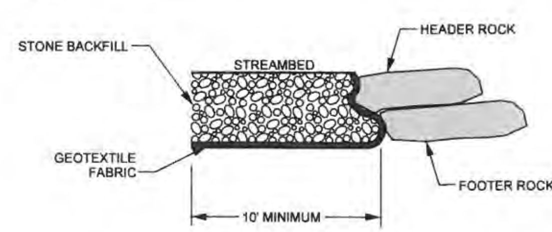
NOTES FOR ALL VANE STRUCTURES:

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

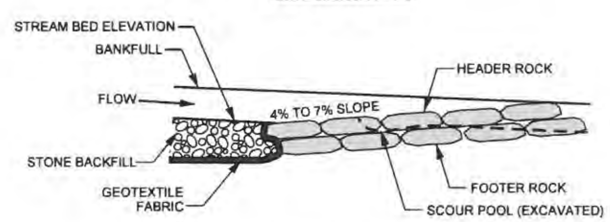
ROCK CROSS VANE



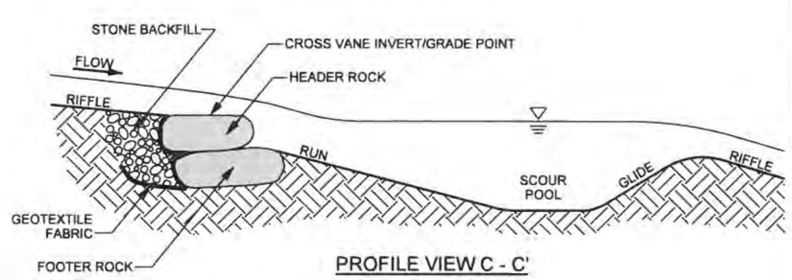
PLAN VIEW



SECTION A - A'



PROFILE VIEW B - B'
VANE ARM

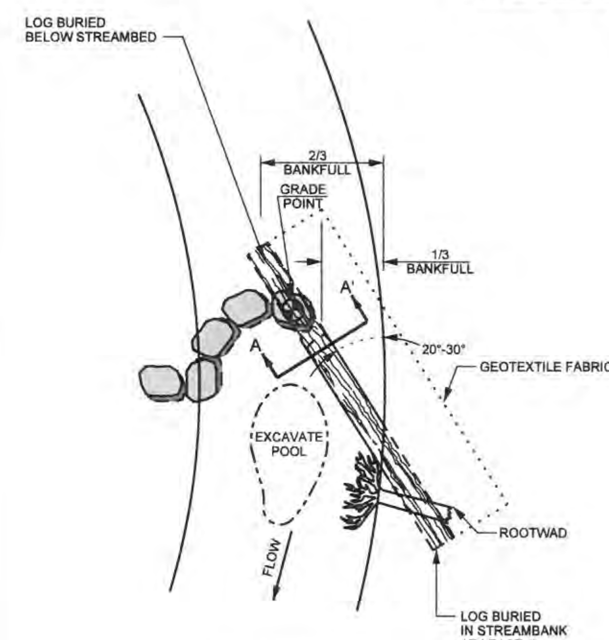


PROFILE VIEW C - C'

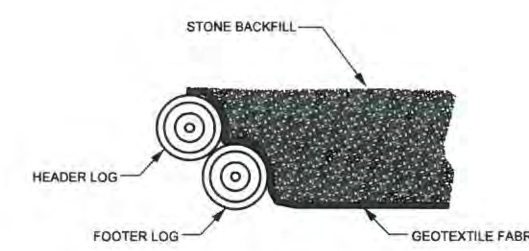
NOTES FOR ALL VANE STRUCTURES:

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.

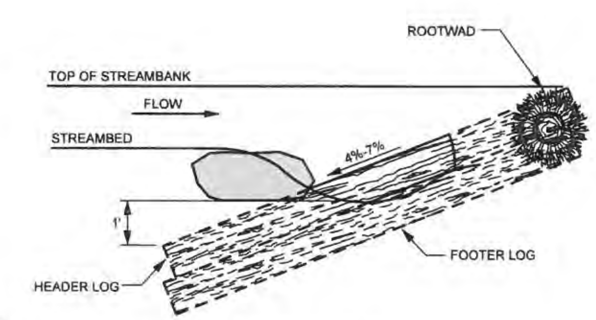
GRADE CONTROL LOG J-HOOK VANE



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. HEADER BOULDERS TO BE PLACED 0.5 TO 0.75 FEET APART.
7. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
8. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	2A

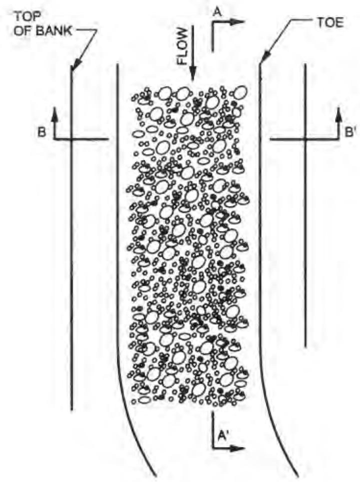
PROJECT ENGINEER

Baker

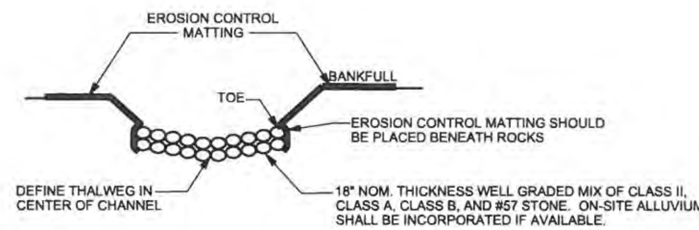
Michael Baker Engineering Inc.
5550 Seventy-Seven Center Dr., Suite 320
Charlotte, NORTH CAROLINA 28217
Phone: 704 665 2200
Fax: 704 665 2201
License #: F-1084

2/26/03

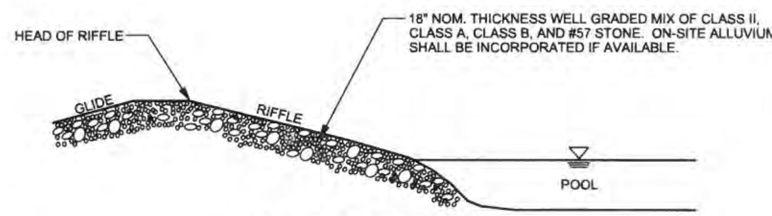
CONSTRUCTED RIFFLE



PLAN VIEW



SECTION B - B'

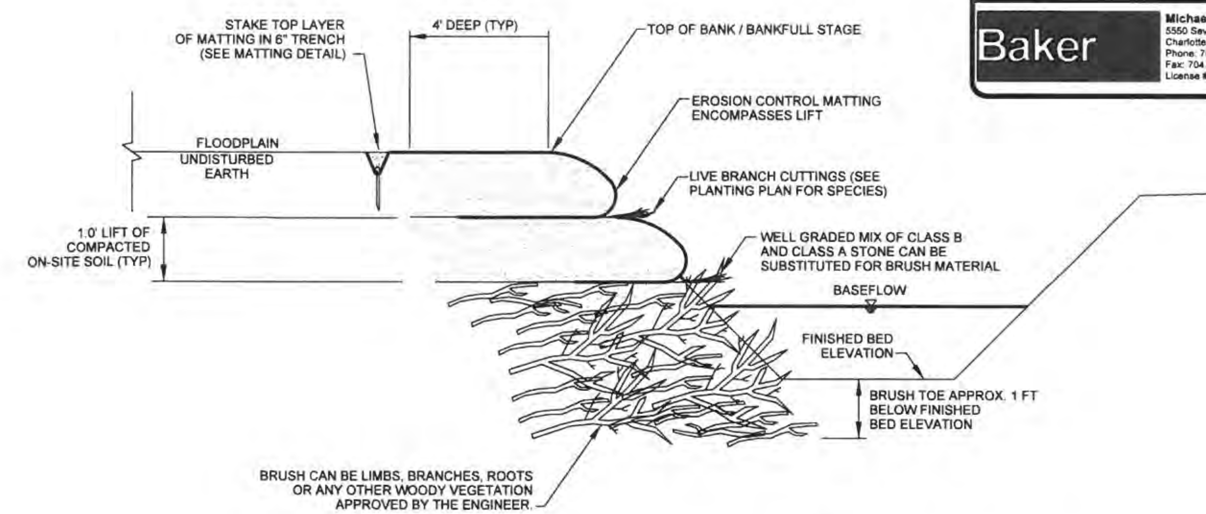


PROFILE A - A'

NOTES:

1. DIG A TRENCH BELOW THE BED FOR THE BED MATERIAL INSTALLATION.
2. FILL TRENCH WITH WELL GRADED MIX OF CLASS 2, CLASS A, CLASS B, AND #57 STONE. TO THE BED ELEVATION OF THE CHANNEL. ON-SITE ALLUVIUM SHALL BE INCORPORATED IF AVAILABLE.
3. DEFINE THALWEG IN CENTER OF CHANNEL.

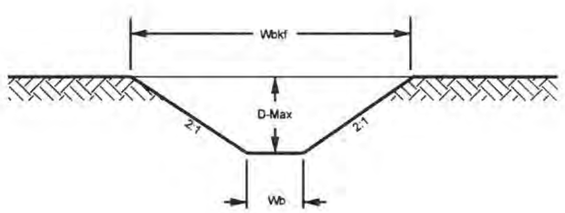
GEOLIFT WITH BRUSH TOE



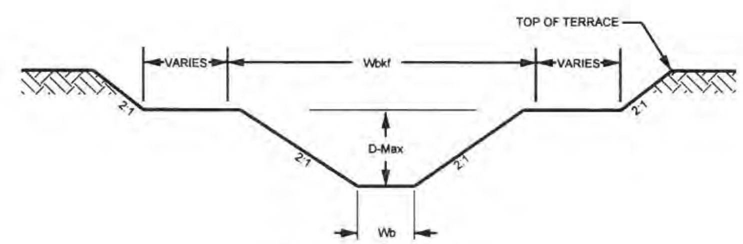
NOTES:

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. GEOLIFTS TO BE INSTALLED IN CHANNEL SECTIONS ALONG SIDE SLOPES STEEPER THAN 2:1 AND/OR ADJACENT TO HILL SLOPES.

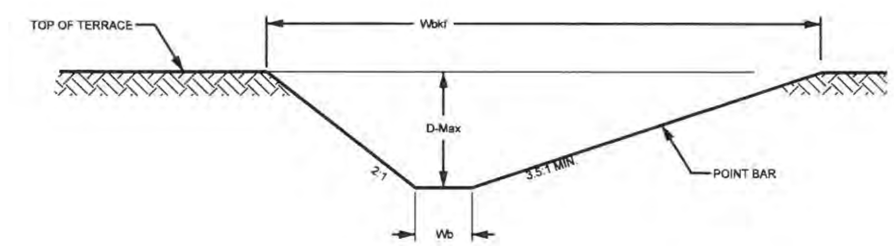
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS



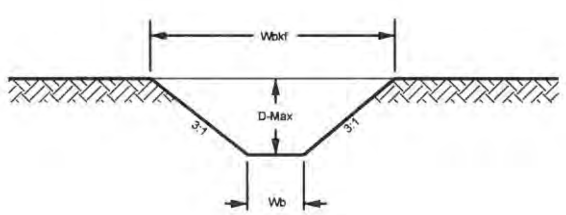
RIFFLE



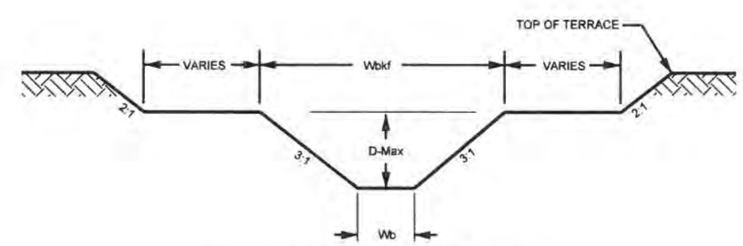
RIFFLE WITH BANKFULL BENCH



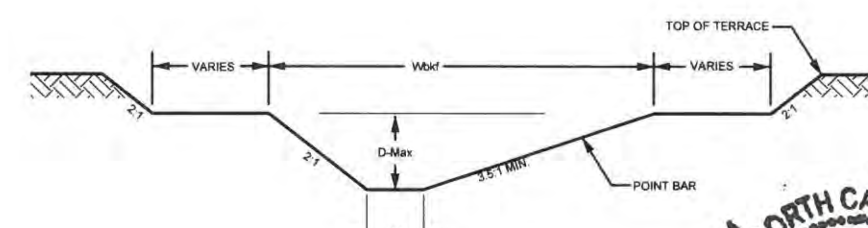
POOL



STEP - POOL



STEP - POOL WITH BANKFULL BENCH



POOL WITH BANKFULL BENCH

REACH 1		REACH 2		REACH 3		REACH 4		REACH 5		REACH 6		REACH 7		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
13.0	17.5	14.0	18.5	15.1	21.0	6.2	11.0	6.6	8.5	8.1	11.0	5.1	7.0	WIDTH OF BANKFULL (Wbkf)
1.0	1.6	1.1	1.6	1.2	1.7	0.5	1.1	0.5	0.8	0.6	1.1	0.4	0.7	AVERAGE DEPTH
1.2	2.7	1.3	2.8	1.4	3.0	0.7	1.8	0.6	1.5	0.8	2.0	0.5	1.2	MAXIMUM DEPTH (D-Max)
13.0	11.3	13.0	11.3	13.0	12.3	13.0	10.3	13.0	10.1	13.0	10.1	13.0	10.2	WIDTH TO DEPTH RATIO (Wbkf / D)
13.0	27.2	15.0	30.2	17.5	36.0	3.0	11.7	3.4	7.1	5.0	12.0	2.0	4.8	BANKFULL AREA (Abkf)
8.1	2.7	8.7	3.1	9.4	3.0	3.0	2.0	3.2	1.0	3.9	1.0	2.4	1.0	BOTTOM WIDTH (Wb)

NOTES:

1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14

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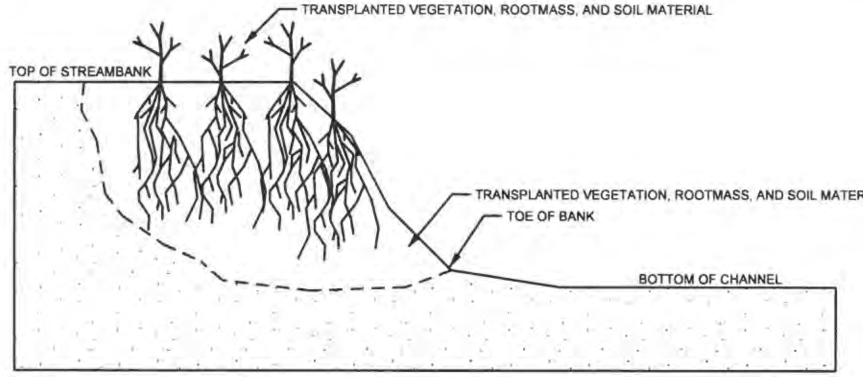
BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	2B

PROJECT ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

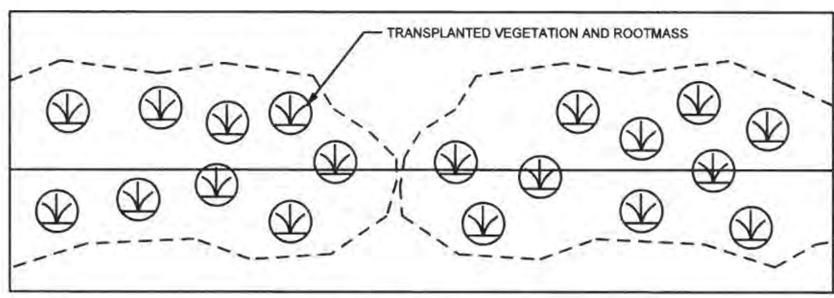
Baker
Michael Baker Engineering Inc.
5550 Seventy-Seven Center Dr., Suite 320
Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

TRANSPLANTED VEGETATION



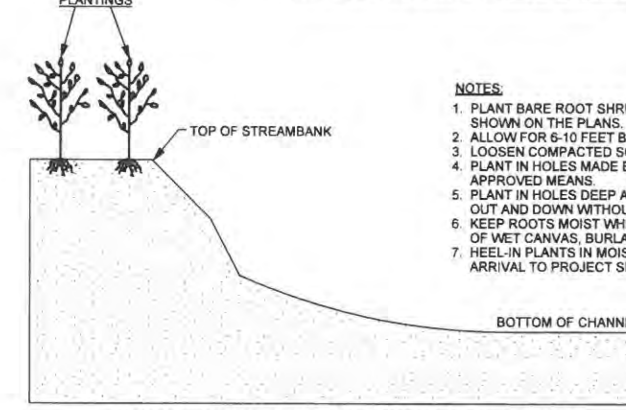
CROSS SECTION VIEW

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.



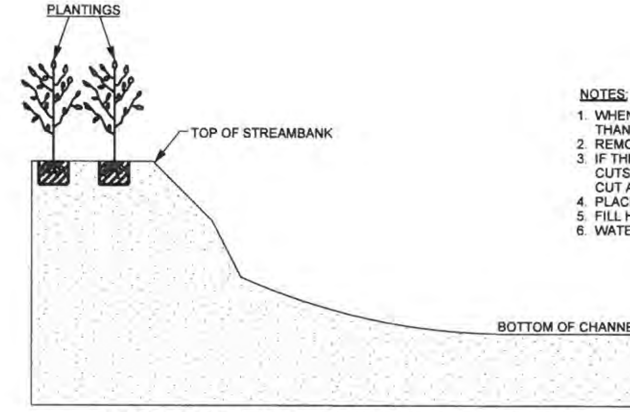
PLAN VIEW

PLANTING SPECIFICATIONS



NOTES:
1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER 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.

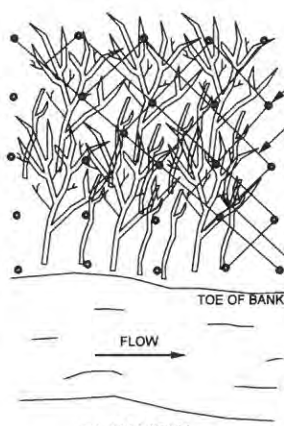
CROSS SECTION VIEW OF BARE ROOT PLANTING



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

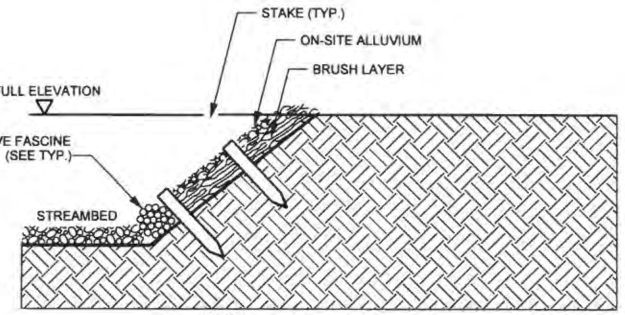
CROSS SECTION VIEW OF CONTAINER PLANTING

BRUSH MATTRESS



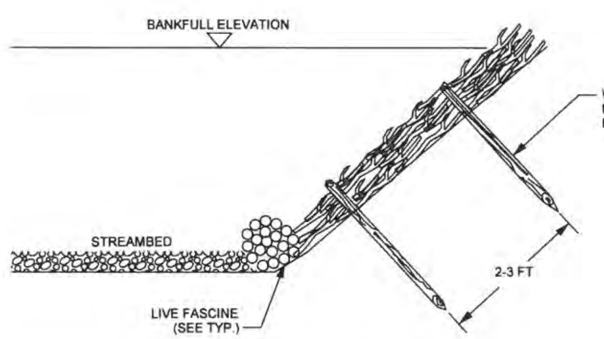
PLAN VIEW

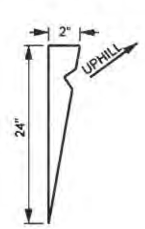
NOTES:
1. BRUSH MATTRESS SHOULD BE INSTALLED DURING VEGETATION DORMANCY.
2. ONLY USE SPECIES SPECIFIED UNDER LIVE STAKES SECTION OF VEGETATION SELECTION.



NOTES:
1. CREATE 12" DEEP TRENCH
2. STAKE AND WIRE BRUSH LAYER INTO TRENCH
3. BACK FILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER

CROSS SECTION

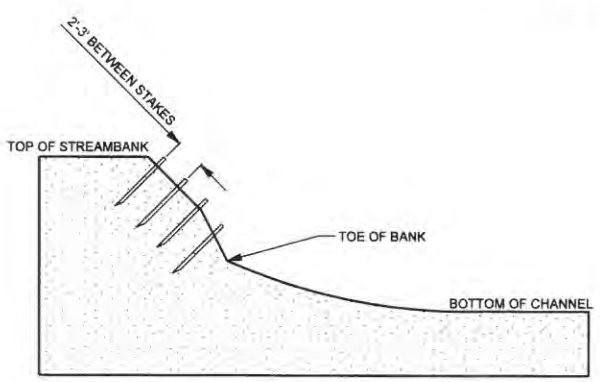




TYPICAL STAKE

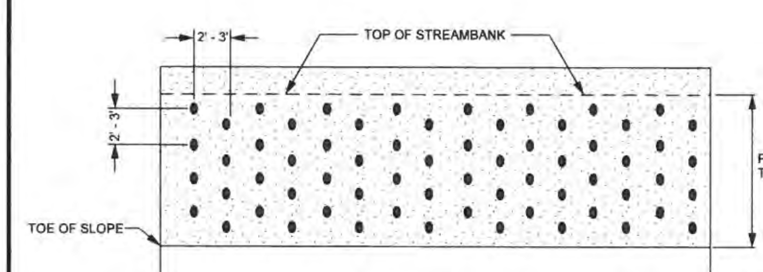
NOTES:
1. BOARD FOR STAKE SHOULD BE 2" x 4" x 24".
2. SAW 2" x 4" TIMBER DIAGONALLY TO PRODUCE 2 DEAD STOUT STAKES.

LIVE STAKING

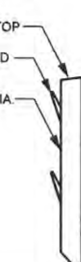


CROSS-SECTION VIEW OF LIVE STAKING SPECIFICATION

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 18" TO 30" LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.



PLAN VIEW OF LIVE STAKING SPECIFICATION



LIVE STAKE DETAIL

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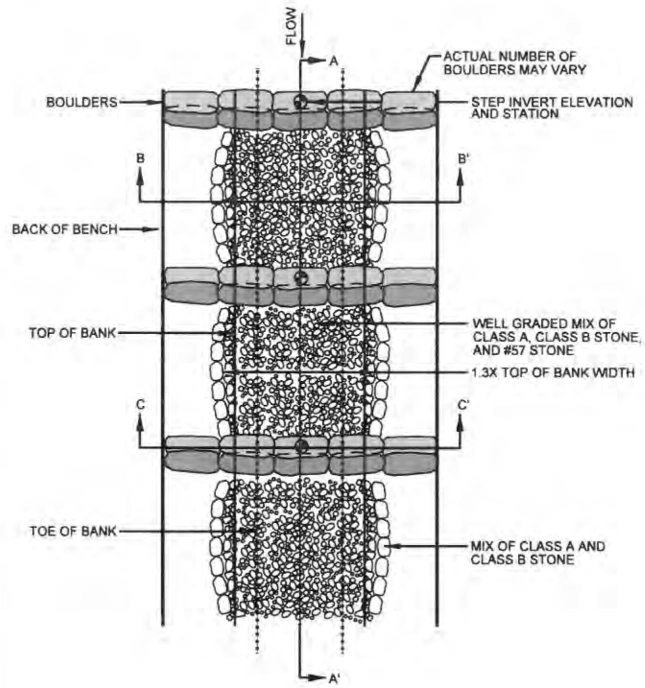
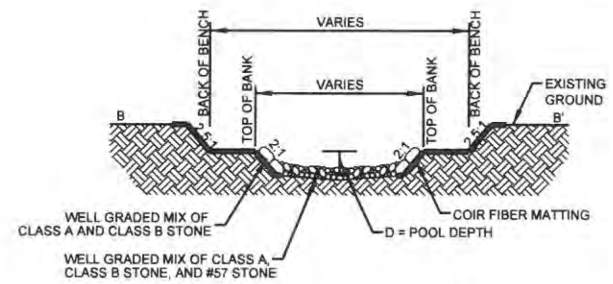
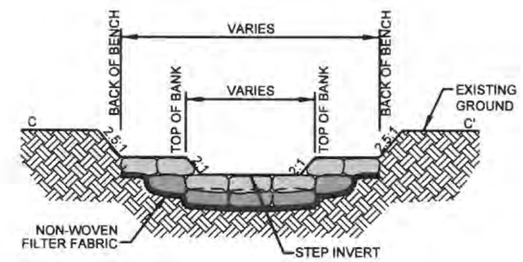
BOULDER STEP



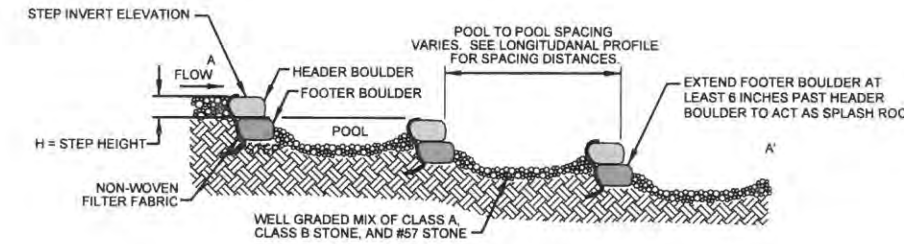
PLAN VIEW



POOL CROSS SECTION B-B'



POOL CROSS SECTION C-C'



PROFILE VIEW A-A'

NOTES:

1. HEADER BOULDERS MUST BE 2' X 2' X 2' AND FOOTERS SHALL NOT EXCEED 3' X 2' 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 POOL BED ELEVATION 8 INCHES TO ALLOW FOR 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. INSTALL WELL GRADED MIX OF CLASS A AND CLASS B STONE 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 1.0 FT.
10. MINIMUM POOL DEPTH (D) SHALL BE NO LESS THAN 1.3 FT.

LOG AND ROCK STEP / POOL

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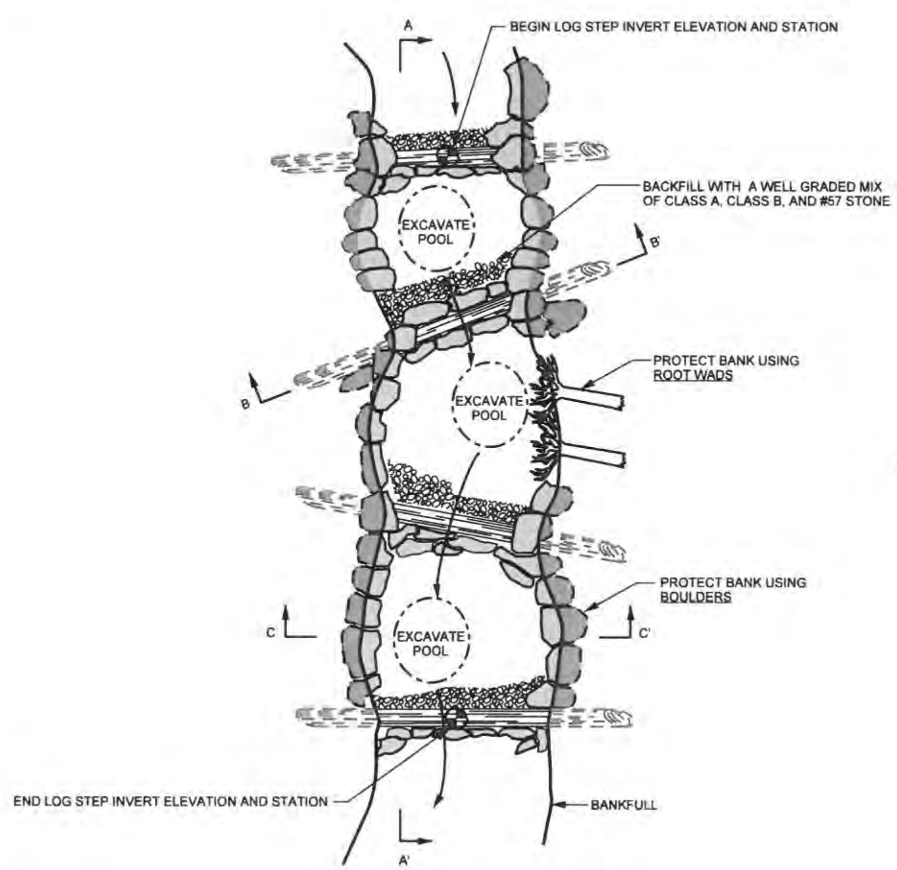
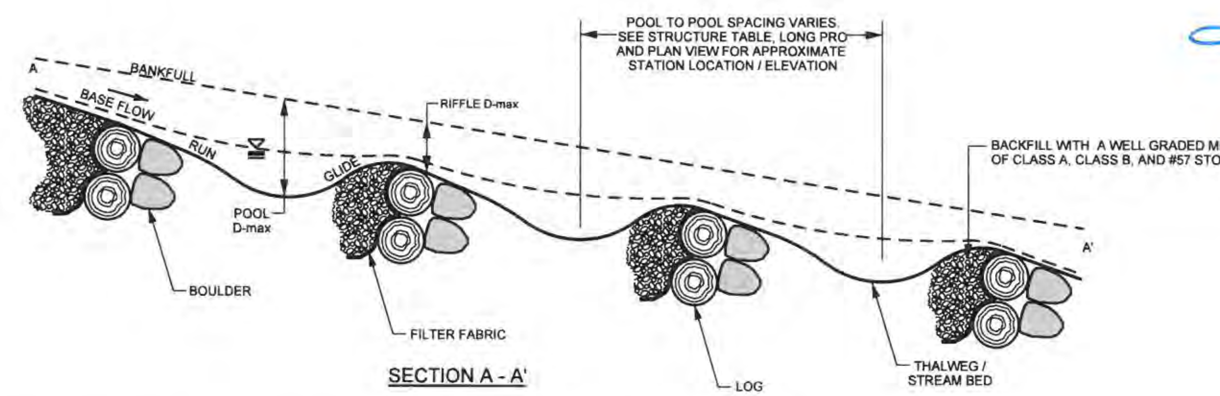
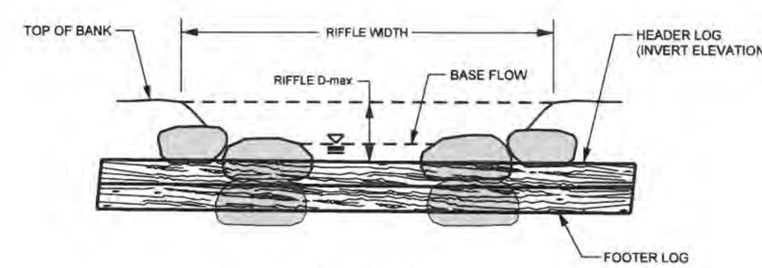
12.22.14



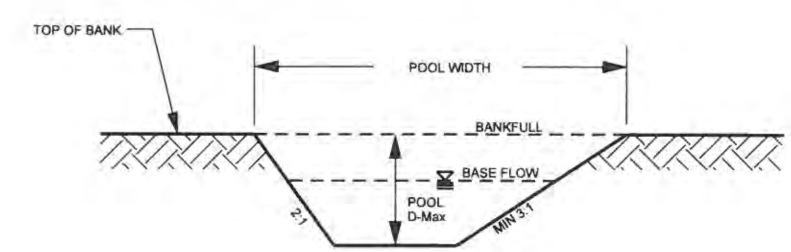
PLAN VIEW



SECTION A - A'



SECTION B - B'



SECTION C - C'

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. NON-WOVEN FILTER FABRIC SHOULD BE NAILED/STAPLED TO THE LOG BELOW THE BACKFILL.
4. BOULDERS SHOULD BE 3' X 2' X 2' AND PLACED ON TOP OF HEADER LOG FOR ANCHORING.
5. LOGS SHOULD BE ANGLED 60° - 70° FROM THE STREAM BANK AND CROSS SLOPES SHOULD NOT EXCEED 2%.
6. STEP HEIGHTS/DROPS SHALL NOT EXCEED 0.4 FT AND POOL DEPTHS NOT TO EXCEED 1.8 FT.
7. THE NUMBER LOG STEPS MAY VARY BETWEEN BEGIN AND END STATIONING DEPENDING ON LOG DIAMETER SIZE. SEE LONGITUDINAL PROFILE AND STRUCTURE TABLE FOR STATION AND ELEVATION.

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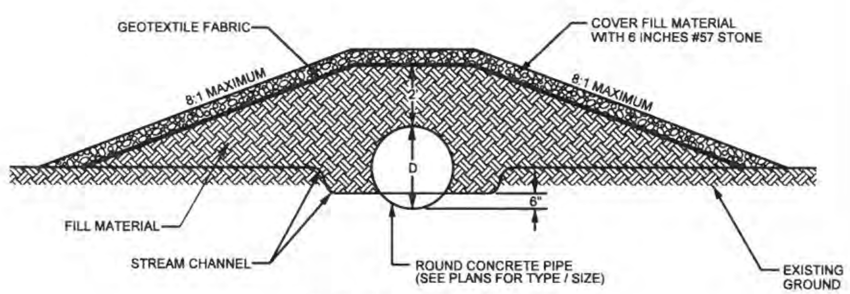
PERMANENT CULVERT STREAM CROSSING

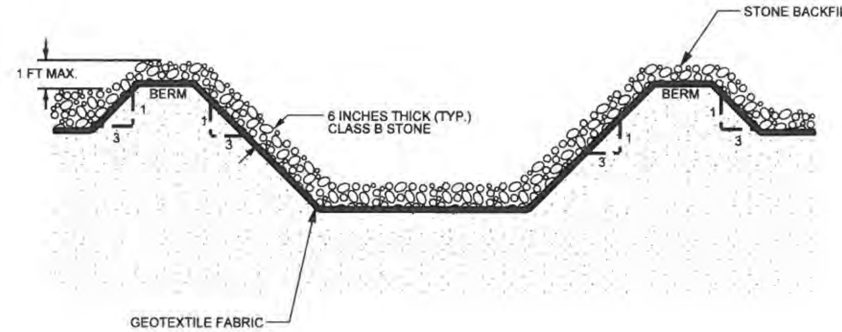


CROSS SECTION VIEW

NOTES:

1. APPLY SUFFICIENT FILL (18" MIN) OVER CULVERT TO PREVENT COLLAPSE.
2. STABILIZE SIDE SLOPES WITH EROSION CONTROL MATTING AND FILL AROUND CULVERTS WITH CLASS II STONE.

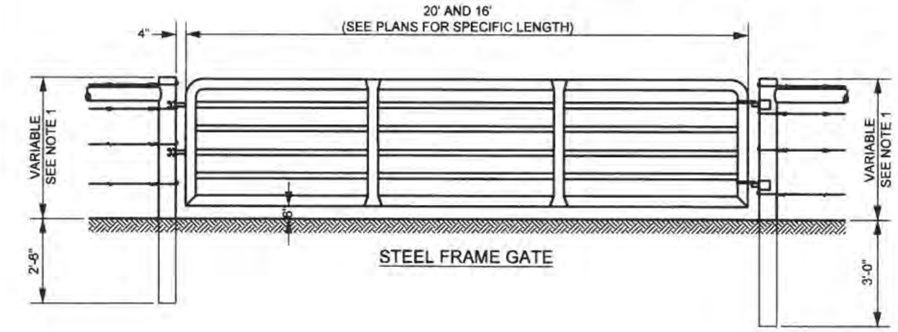
PERMANENT FORD STREAM CROSSING



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 3:1 SLOPE. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. A STABILIZED PAD OF STONE BACKFILL, 6 INCHES THICK, LINED WITH GEOTEXTILE FABRIC SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
8. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.

STEEL GATES

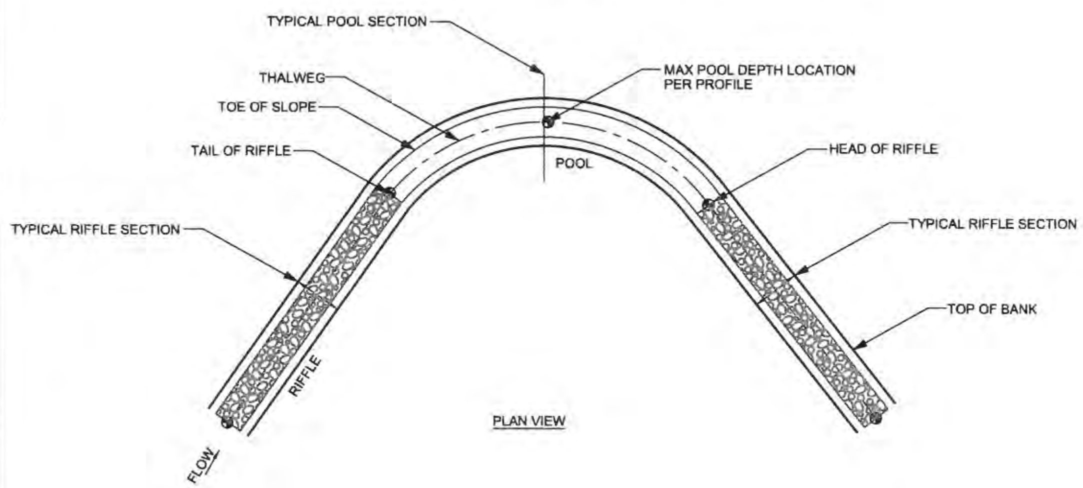


STEEL FRAME GATE

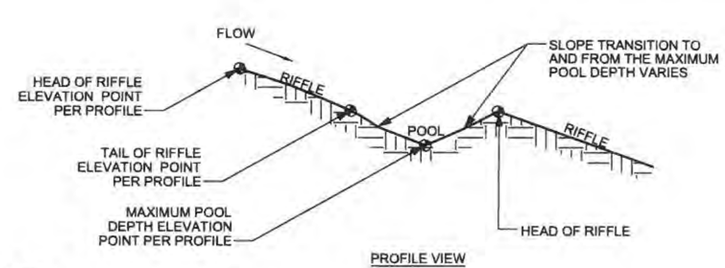
NOTES:

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

RIFFLE TO POOL TRANSITION



PLAN VIEW

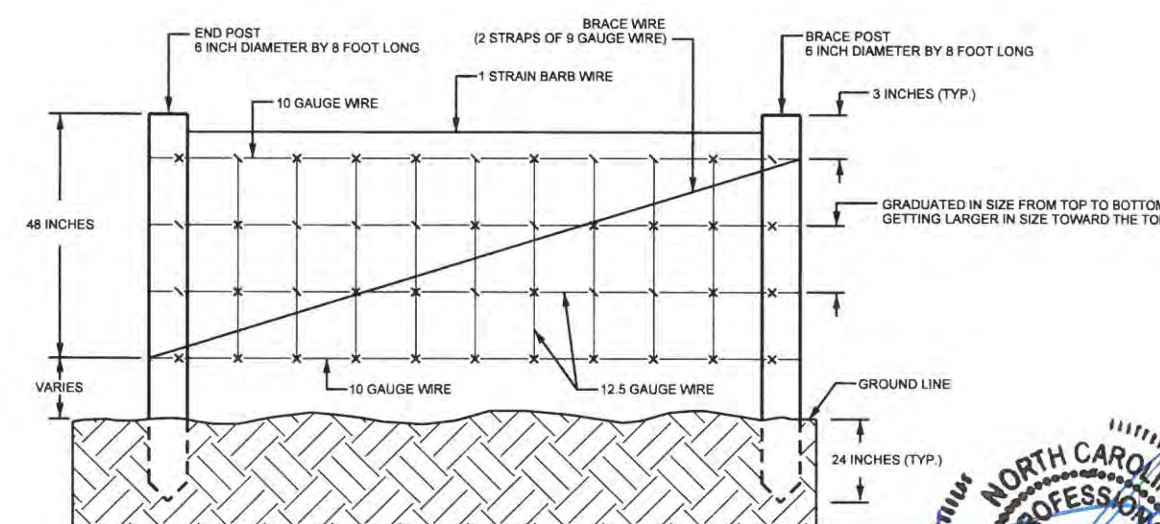


PROFILE VIEW

RIFFLE TO POOL TRANSITION NOTES:

1. THE POINTS SHOWN, E.G. HEAD OF RIFFLE, TAIL OF RIFFLE AND MAXIMUM DEPTH OF POOL, ARE THE CONTROL POINTS USED TO ESTABLISH THE PROFILE. HOWEVER, THE CONTRACTOR SHALL CREATE SMOOTH TRANSITIONS BETWEEN CONTROL POINTS AS SHOWN ABOVE.
2. THE DOWNSTREAM HEAD OF RIFFLE ELEVATION SHALL NOT EXCEED THE UPSTREAM TAIL OF RIFFLE ELEVATION EXCEPT WHERE GRADE CONTROL STRUCTURES (I.E. J-HOOKS, CROSS VANES, ETC.) ARE PLACED AT THE UPSTREAM TAIL OF RIFFLE.
3. STREAM CROSS-SECTION SHALL TRANSITION DIMENSION FROM THE TYPICAL POOL SECTION AT THE MAXIMUM POOL DEPTH LOCATION TO THE TYPICAL RIFFLE SECTION.

WOVEN FIELD FENCE



NOTE:

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

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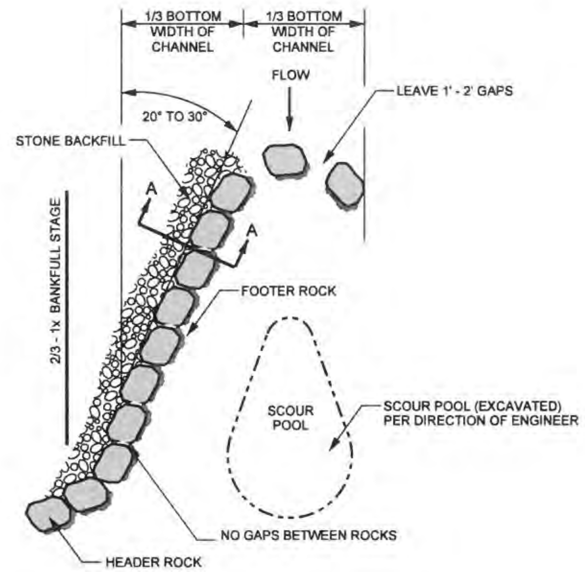
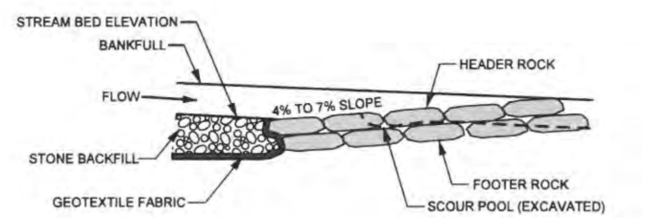
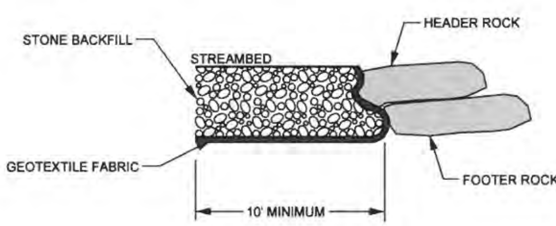
J-HOOK VANE



PLAN VIEW



PROFILE VIEW

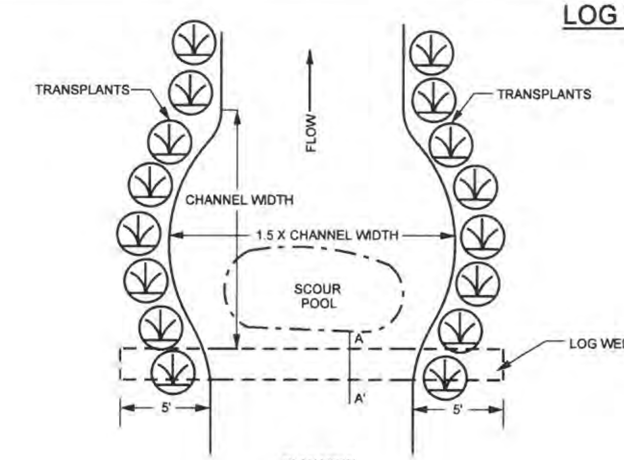


SECTION A - A

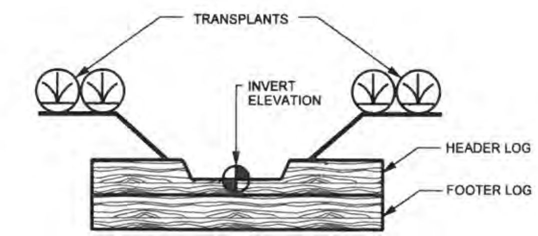
NOTES FOR ALL VANE STRUCTURES:

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

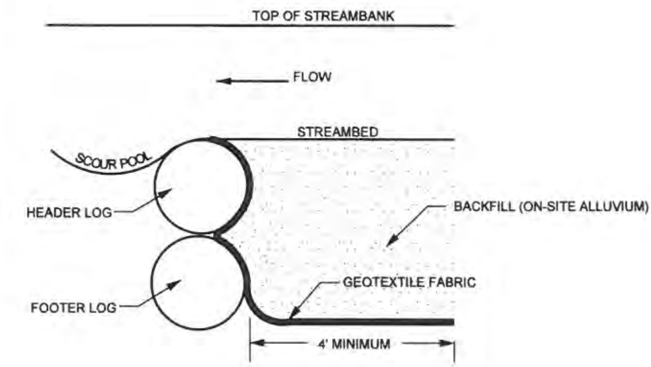
LOG WEIR



PLAN VIEW



CROSS SECTION VIEW



SECTION A-A'

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.

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Michael Baker Engineering, Inc. will provide construction observation during the construction phase of this project. The following construction sequence shall be used during implementation of the plan. Contractor shall refer to the approved erosion and sedimentation control plan for specific construction sequence items and shall be responsible for following the approved plans and permit conditions.

GENERAL CONSTRUCTION SEQUENCE

1. Preparation for site access. Contractor must call 1-800-632-4949 to locate all underground utilities before mobilizing to the site. Contractor must schedule and attend a pre-construction conference with the NCDENR Dept. of Land Quality Sediment and Erosion Control Inspector, the Engineer, and appropriate utility companies.
2. Equipment and materials shall be mobilized to the site. The Contractor shall install the erosion and sedimentation control measures as shown on the plans prior to any grading activities. Measures and devices shall be installed and maintained by the Contractor in accordance with the approved plan to protect jurisdictional waters from significant runoff prior to permanent site stabilization. Measures and devices to be used are shown on the plans (e.g. silt fence, check dams, temporary construction entrances, temporary stream crossings, haul road, etc.).
3. A temporary gravel construction entrance shall be installed at access points that connect to a public road. See plan set for construction entrance locations and installation details.
4. Set up all staging areas and install haul roads as shown on plans. All existing roads or farm paths used for construction activities such as haul roads and site access shall be repaired, if necessary, to the pre-construction condition or better.
5. Contractor is to not disturb more than can be stabilized within the same day. Contractor is not to disturb any areas outside the limits of disturbance and shall minimize disturbance to areas in and around the existing wetlands. Contractor shall minimize disturbance to existing buffer vegetation and construction corridor to the extent practical.
6. Clearing and Grubbing activities shall be limited to the minimal amount necessary for haul roads, channel relocations, and stockpile areas and can be accomplished with an excavator and track truck; therefore, additional equipment, such as a pan or off-road dump trucks, are not required. Waste material is to be disposed within the project limits as depicted on the plan set. Where feasible, the channel construction should always begin at the upstream extents and work downstream. When access to a construction area requires crossing a delineated jurisdictional feature, impacts shall be minimized by placing a temporary stream/wetland crossing across the feature prior to accessing the area with heavy equipment per the approved plans and specifications.
7. Work within the specific project areas shall be divided into phases as outlined in "BMP Wetland Construction" and "Channel Construction" below. Work will follow these outlined phases and as a general rule will start on the upstream. The Contractor will not be allowed to advance to the next phase until the current phase is completed and stabilized. Constructed wetland installations and floodplain wetland grading shall be conducted prior to stream construction. Contractor shall use temporary stream crossings to access the constructed wetland installation and floodplain wetland grading areas.
8. Temporary rock check dams shall be installed at the end of the reach that is under construction within the current phase and at the end of the construction limits. See plan set for check dam installation areas. The Contractor shall be responsible for inspecting the temporary rock check dams on a daily basis and cleaning or repairing them as needed. The Contractor shall be required to remove sediment from the check dams once the depth of sediment reaches 12 inches.
9. Contractor is required to remove existing topsoil layer and stockpile in designated areas separate from other stockpiled soil for reapplication to the excavated floodplain and constructed wetlands.
10. Contractor shall construct the new stream channel off-line where feasible as described below. In-line construction will be necessary in areas where the proposed channel crosses the existing channel. See "Off-line Channel Construction" and "Pump-around Channel Construction". The Contractor must establish temporary vegetation in accordance with the plans and technical specifications before turning water into the new stream channel segments.
11. After construction on a reach is complete, stabilize banks with erosion control matting and temporary/permanent vegetation before proceeding to the next reach. No more area is to be disturbed than what can be stabilized within the work day. All disturbed areas are to be stabilized at the end of each work day. Disturbed areas shall be seeded and mulched per the plans and technical specifications. Temporary seeding shall be placed on all disturbed areas within 24 hours and all slopes steeper than 3:1 shall be stabilized with ground cover as soon as practicable within 7 calendar days. All other disturbed areas and slopes flatter than 3:1 shall be stabilized within 14 calendar days from the last land-disturbing activity. Permanent seeding shall be placed on all disturbed areas within 15 working days or 90 calendar days (whichever comes first) following construction completion.
12. The Engineer must approve all grading activities and groundcover stabilization prior to riparian vegetation planting.
13. Demobilize from site as described in "Construction Demobilization".

BMP WETLAND CONSTRUCTION

14. No lime shall be incorporated with the seeding and planting areas unless otherwise directed by the engineer.
15. Site stabilization shall occur at the end of every work day and prior to any rain event. Stabilization measures shall consist of temporary seeding, mulching, and erosion control matting on all disturbed areas within the constructed wetlands.
16. The Engineer must approve all grading activities and groundcover stabilization prior to riparian vegetation planting and acceptance of flow through the constructed wetland.
17. Contractor is responsible for pumping excess water from each constructed wetland site, as needed, in order to grade contours to the design elevations specified in the plan set.
18. Contractor shall remove topsoil layer and stockpile in designated stockpile areas separate from other soil material for reapplication to constructed wetlands. The remaining soil (non-topsoil layer) shall be stockpiled in designated areas as shown on the plans.
19. Contractor shall construct the wetlands such that when the stockpiled topsoil layer is reapplied the finished grades shall match design grades as noted in the plans.
20. Permanent and temporary seed and mulch all disturbed areas below the permanent pool. Permanent and temporary seed, mat, and mulch all other disturbed areas before proceeding to the next area.

CHANNEL CONSTRUCTION (PUMP-AROUND OPERATION)

21. Pump-around areas of construction where proposed channel intersects existing channel frequently and where concentrated flow enters the main stem. Contractor shall stage work to minimize the length and duration of pump-around operations.
22. Install impervious dikes at upstream and downstream ends of pump around locations. The pump-around operation shall be performed between these locations as described in plan details.
23. Construct channel and floodplain between upstream and downstream dike locations.
24. Remove topsoil layer and stockpile in designated stockpile areas separate from other stockpiled soil for reapplication to the floodplain.
25. Contractor shall excavate the floodplain such that when the stockpiled topsoil layer is reapplied the finished grades match the lines and grades as noted in the plans.
26. Stockpile remaining soil (non-topsoil layer) in designated stockpile areas or backfill existing channel. Contractor shall verify that a continuous channel exists at all times in order to carry overflow during heavy rainfall events. Silt fence shall be installed on the stream side(s) of the base of the stockpiles and maintained when sediment has accumulated above one third of the height of the silt fence and/or before the silt fence has failed.
27. In-stream channel work shall be constructed within the isolated channel section.
28. Reapply stockpiled topsoil on excavated floodplain and apply permanent and temporary seed, mat, and mulch banks and floodplain areas.
29. Once disturbed areas and exposed slopes are stabilized and accepted by the Engineer; plug existing channel, remove impervious dikes, and turn water into the new channel. Stockpile any remaining coarse bed material separately from the excavated soil for later use.
30. Backfill abandoned channel sections with stockpiled soil (non-topsoil layer). Non-native and invasive vegetation (i.e. *Chinese privet*, *Microstegium* sp., and *Myriophyllum aquaticum*) shall be removed from the existing channel prior to backfilling. Excess soil shall be hauled to the designated permanent stockpile location and stabilized as shown on the plans before demobilization.
31. Permanent and temporary seed, mat, and mulch backfill sections before proceeding to the next work area.

CONSTRUCTION DEMOBILIZATION

32. Plant woody vegetation and live stakes according to planting details and specifications. Contractor shall complete the reforestation (bare-root planting) phase of the project and apply permanent seeding at the appropriate time of the year. Bank and floodplain vegetation, including brush materials and live stakes, are preferably installed during the dormant season (November to March).
33. Staging and stockpile areas, and silt fences shall be removed and the ground shall be repaired to its original condition once planting is complete or once they are no longer needed.
34. The Contractor shall ensure that the site is free of trash and leftover materials prior to demobilization of equipment from the site.
35. Demobilize grading equipment from the site.
36. Temporary seeding shall be applied on all disturbed areas susceptible to erosion (i.e. disturbed ditch banks, steep slopes, and spoil areas) within 24 hours and all slopes steeper than 3:1 shall be stabilized with ground cover as soon as practicable within 7 calendar days. All other disturbed areas and slopes flatter than 3:1 shall be stabilized within 14 calendar days from the last land-disturbing activity. Permanent ground cover shall be established for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction. Seed, mulch, and stabilize all disturbed areas including, but limited to staging areas, stockpiles, permanent stockpiles, haul roads, and construction entrances.

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III
12.22.14

2/26/03
12/22/2014
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BAKER PROJECT REFERENCE NO. 120857 | SHEET NO. 4

PROJECT ENGINEER

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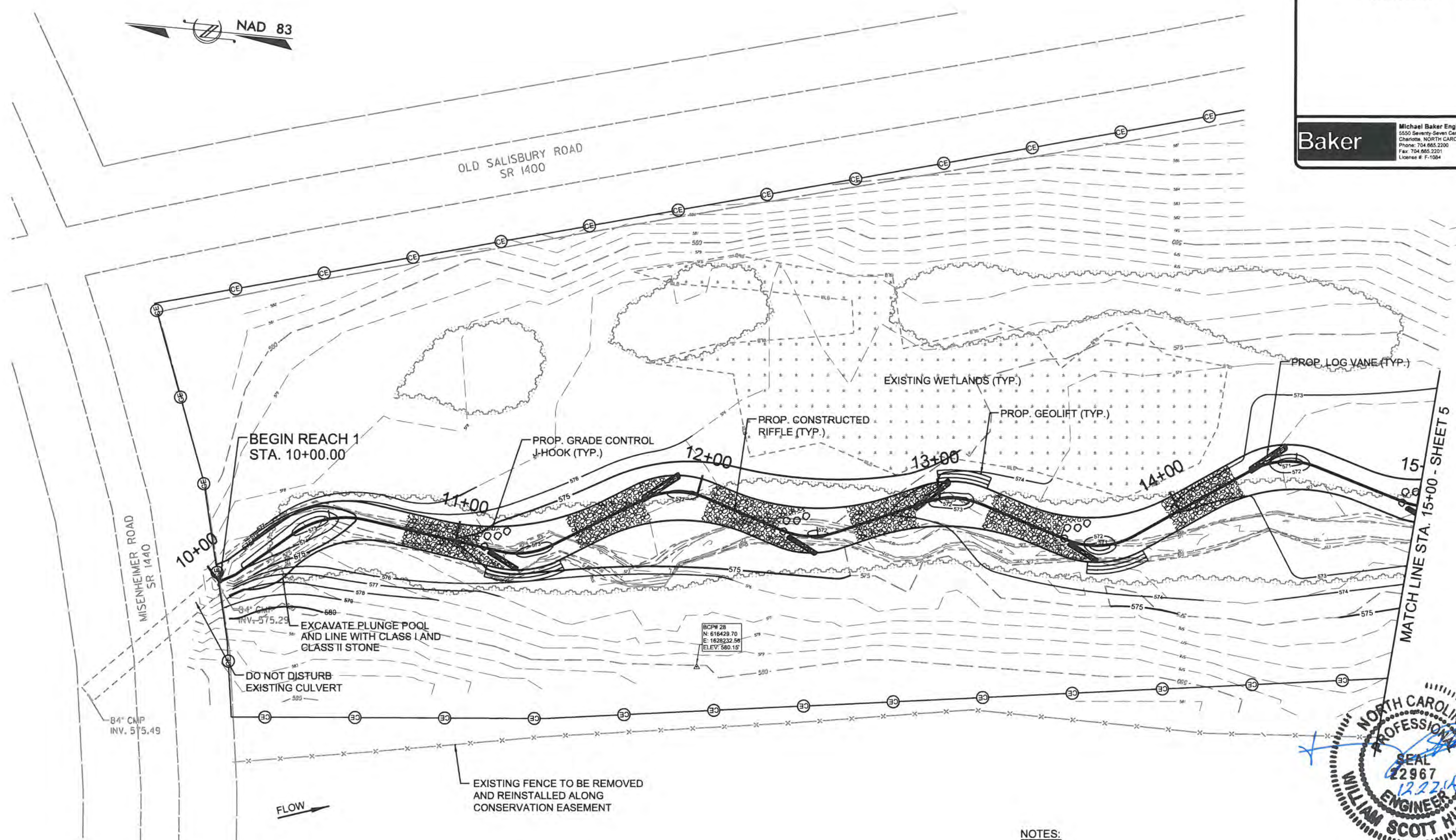

NOTES:

1. ON-SITE LOGS SHALL BE USED FOR GRADE CONTROL J-HOOKS AND VANES UNTIL SUPPLY IS EXHAUSTED AT WHICH POINT THE CONTRACTOR CAN USE BOULDERS OR LOGS.
2. CONTRACTOR MAY USE ROOTWADS OR TRANSPLANTS IN PLACE OF GEOLIFTS OR BRUSH MATTRESSES UPON APPROVAL FROM THE ENGINEER.
3. CONTRACTOR SHALL MINIMIZE DISTURBANCE WITHIN EXISTING WETLAND AREAS.

WETLAND RESTORATION

WETLAND CREATION

UT TO TOWN CREEK
Reach 1

20 0 20 40
SCALE (FT)

12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	5

PROJECT ENGINEER

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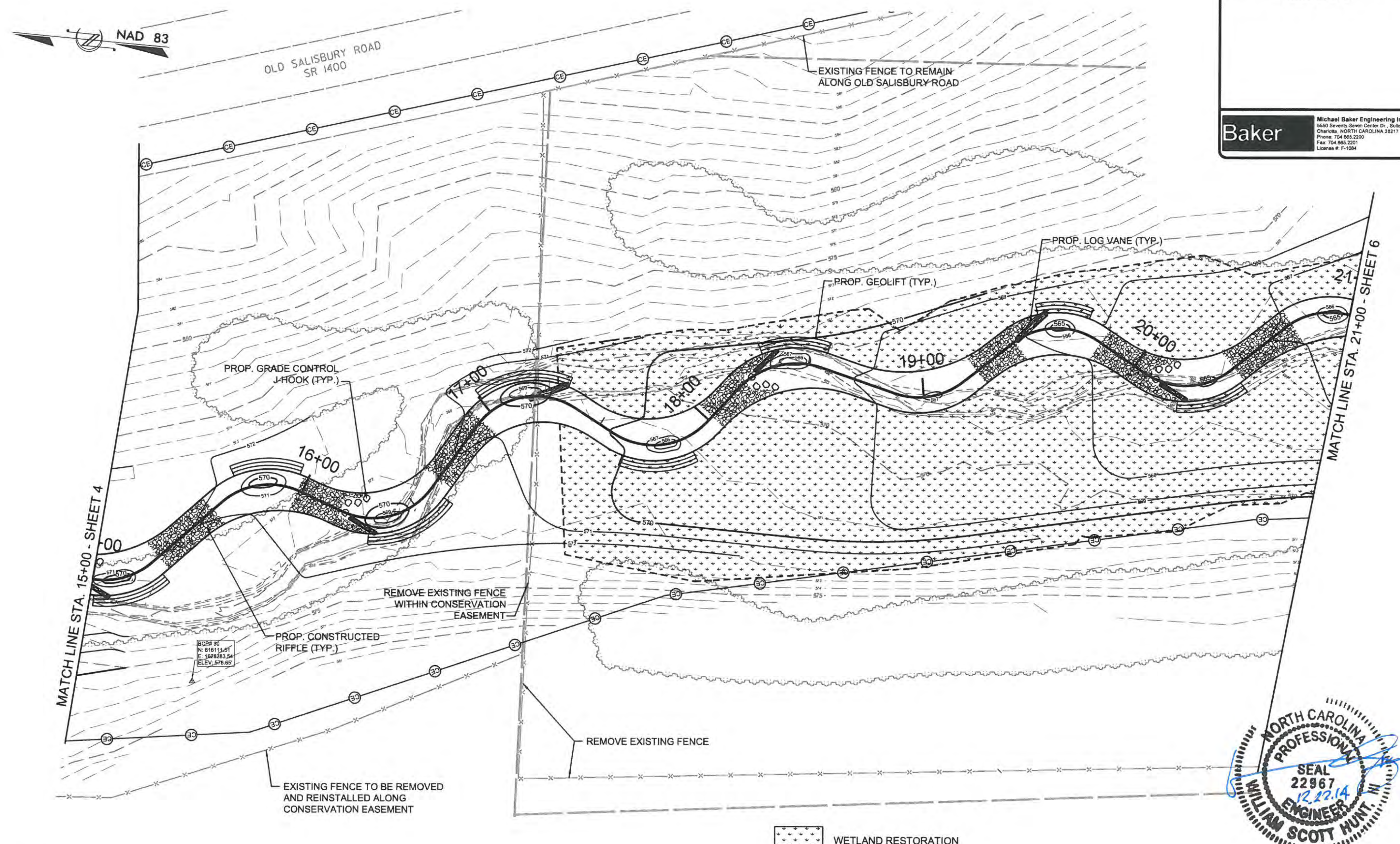

WETLAND RESTORATION

WETLAND CREATION

NOTES:

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UT TO TOWN CREEK
Reach 1

20 0 20 40
SCALE (FT)

2/26/03

12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	6

PROJECT ENGINEER

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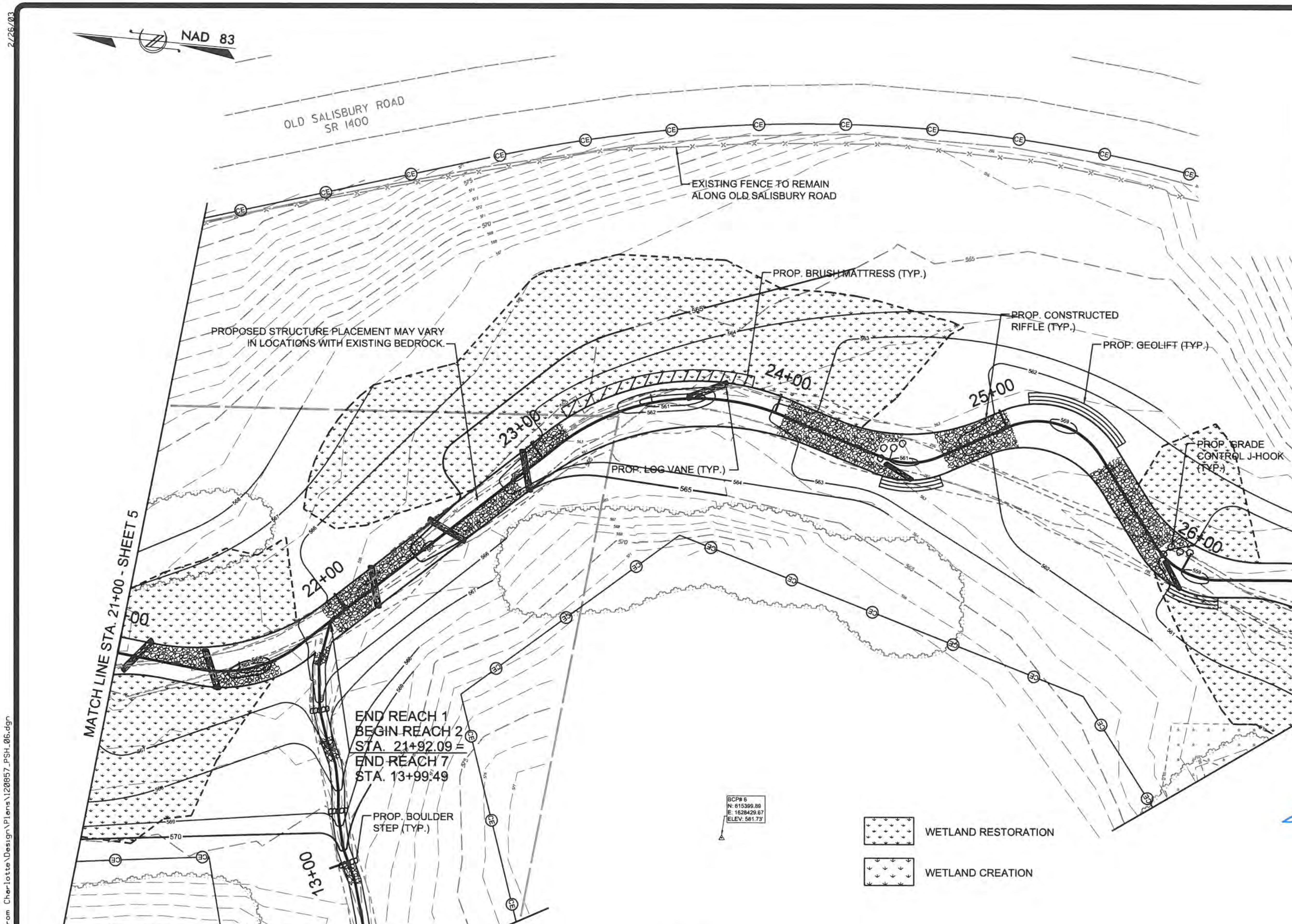

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

NOTES:

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UT TO TOWN CREEK
Reach 1, Reach 2 & Reach 7

20 0 20 40
SCALE (FT)

2/26/03

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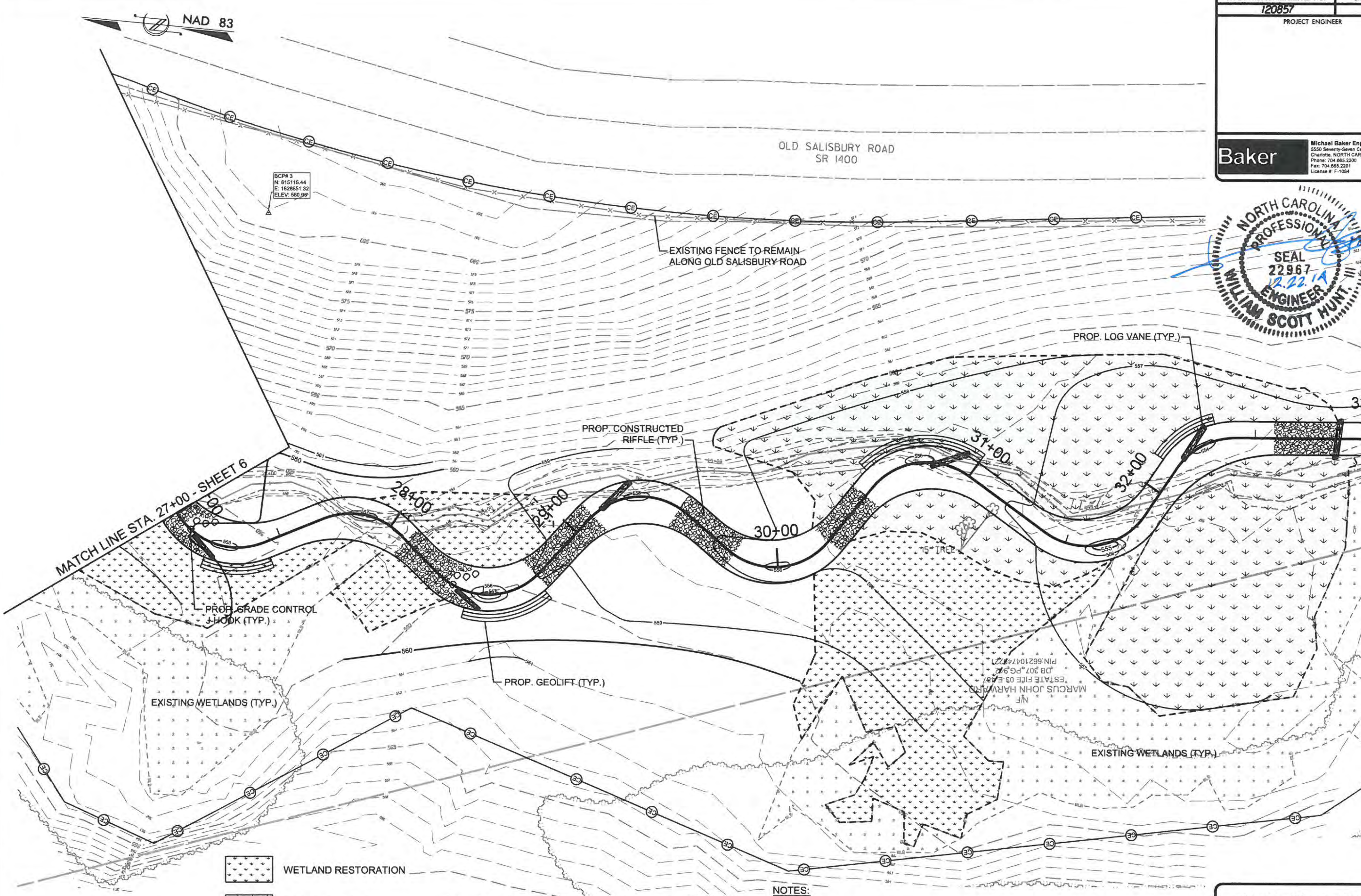

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	7

PROJECT ENGINEER

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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT 12.22.14

NOTES:

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UT TO TOWN CREEK
Reach 2

SCALE (FT) 20 0 20 40

12/23/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	8

PROJECT ENGINEER

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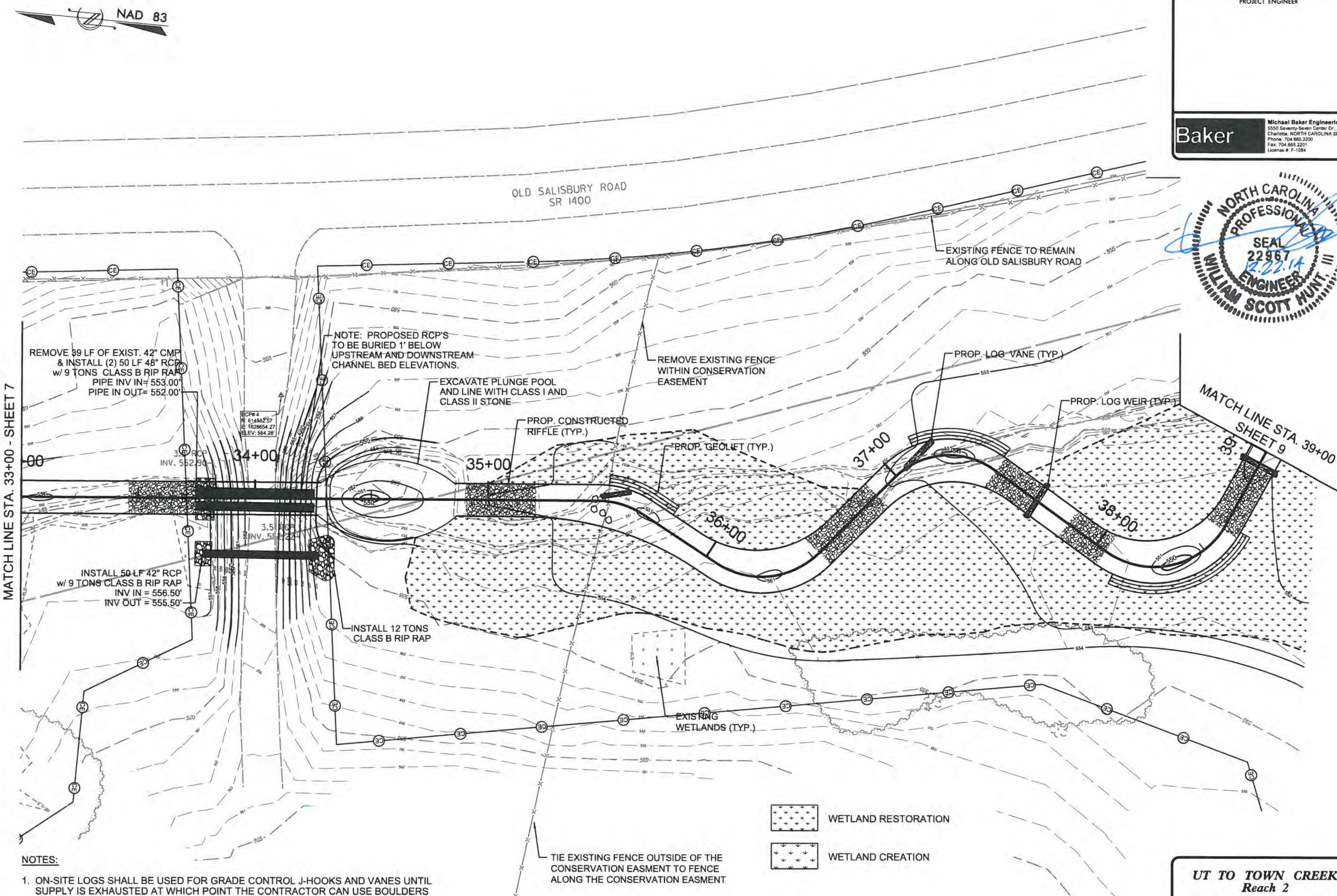

NOTES:

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UT TO TOWN CREEK
Reach 2

20 0 20 40
SCALE (FT)

12/22/2014
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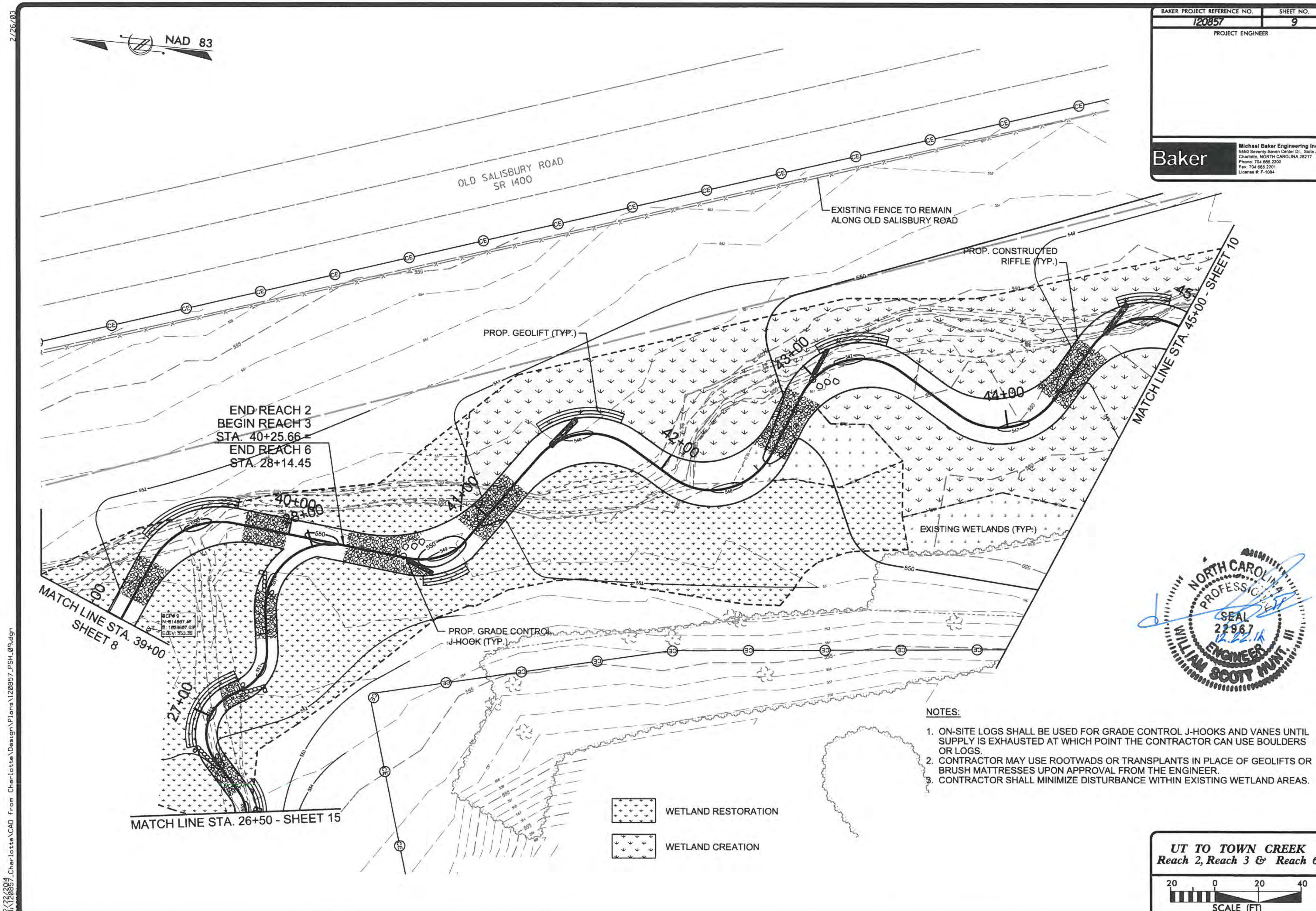
BAKER PROJECT REFERENCE NO. 120857
SHEET NO. 9
PROJECT ENGINEER
Baker
Michael Baker Engineering Inc.
NAD 83
OLD SALISBURY ROAD
SR 1400
EXISTING FENCE TO REMAIN ALONG OLD SALISBURY ROAD
PROP. CONSTRUCTED RIFFLE (TYP.)
PROP. GEOLIFT (TYP.)
END REACH 2
BEGIN REACH 3
STA. 40+25.66 =
END REACH 6
STA. 28+14.45
MATCH LINE STA. 45+00 - SHEET 10
MATCH LINE STA. 39+00
SHEET 8
MATCH LINE STA. 26+50 - SHEET 15
EXISTING WETLANDS (TYP.)
PROP. GRADE CONTROL J-HOOK (TYP.)
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14
NOTES:
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3. CONTRACTOR SHALL MINIMIZE DISTURBANCE WITHIN EXISTING WETLAND AREAS.
WETLAND RESTORATION
WETLAND CREATION
UT TO TOWN CREEK
Reach 2, Reach 3 & Reach 6
20 0 20 40
SCALE (FT)

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	10

PROJECT ENGINEER

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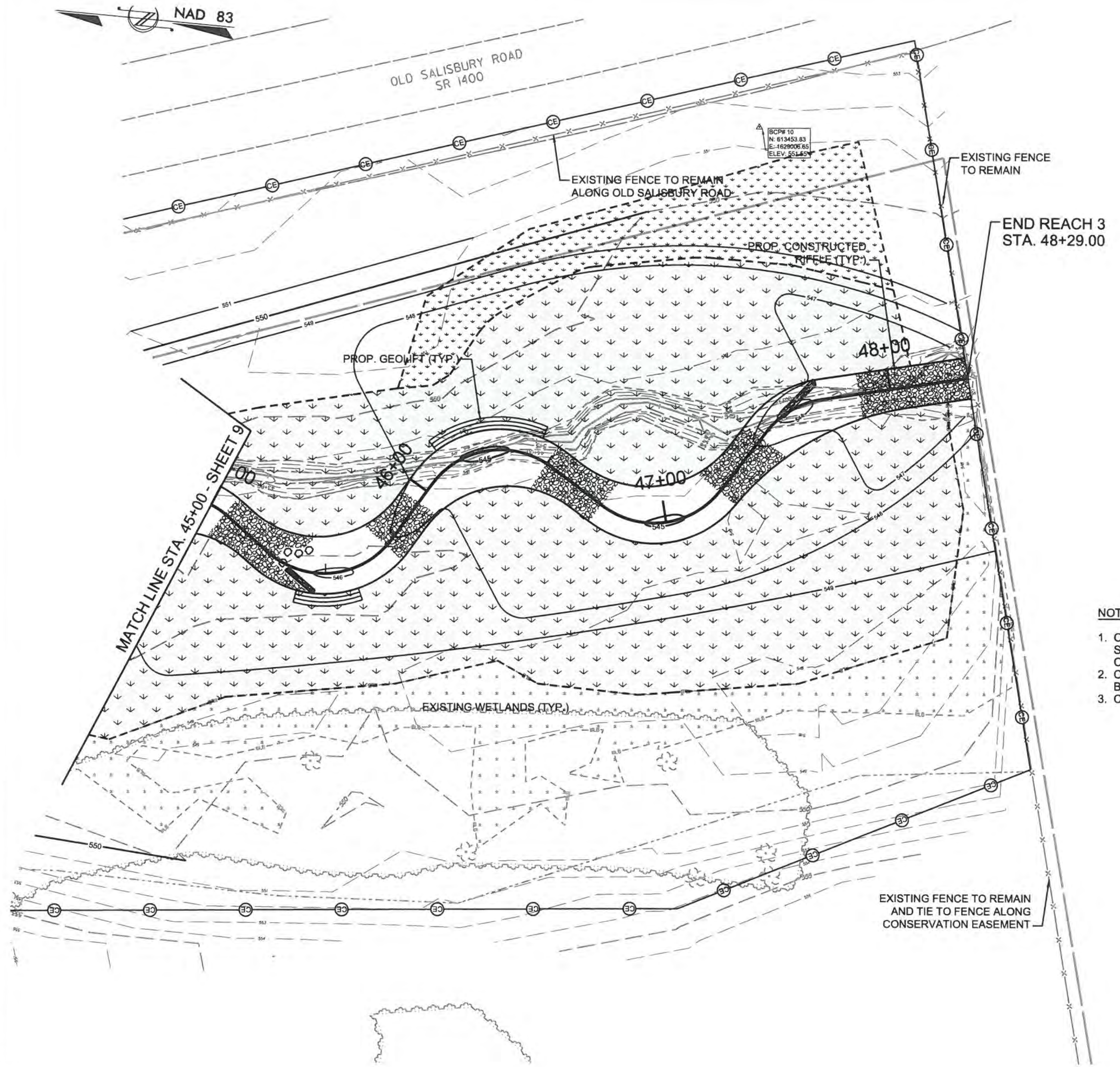

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WETLAND RESTORATION

WETLAND CREATION

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III

12.22.14

UT TO TOWN CREEK
Reach 3

20 0 20 40
SCALE (FT)

2/26/03

12/22/2014
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PROJECT ENGINEER

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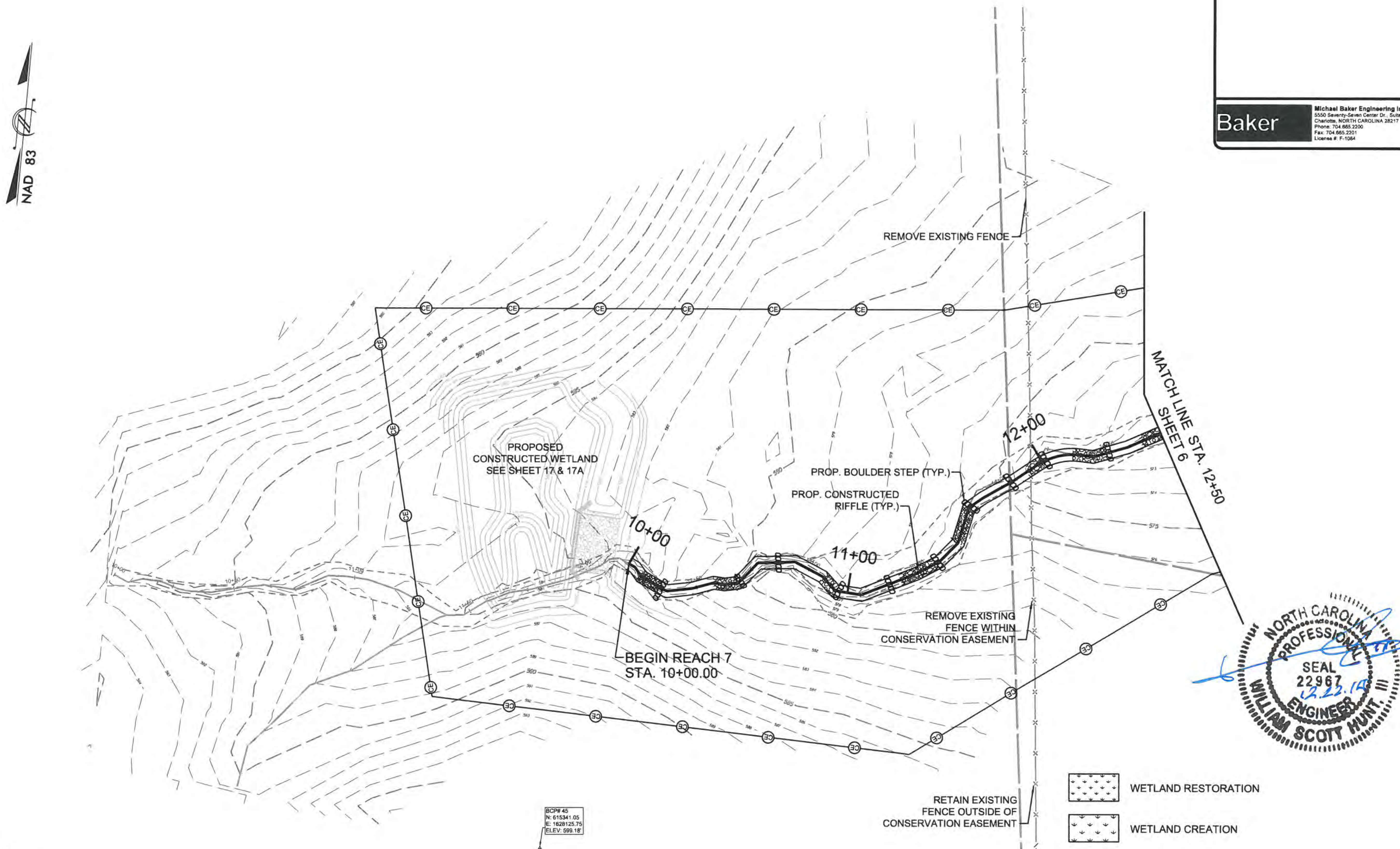

NOTES:

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2. CONTRACTOR MAY USE ROOTWADS OR TRANSPLANTS IN PLACE OF GEOLIFTS OR BRUSH MATTRESSES UPON APPROVAL FROM THE ENGINEER.
3. REACH 7 WILL HAVE A MINIMUM COMBINED BENCH WIDTH OF 5 FEET.
4. CONTRACTOR SHALL MINIMIZE DISTURBANCE WITHIN EXISTING WETLAND AREAS.

UT TO TOWN CREEK
Reach 7

20 0 20 40
SCALE (FT)

2/26/03
12/22/2014
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BAKER PROJECT REFERENCE NO. 120857 | SHEET NO. 12

PROJECT ENGINEER

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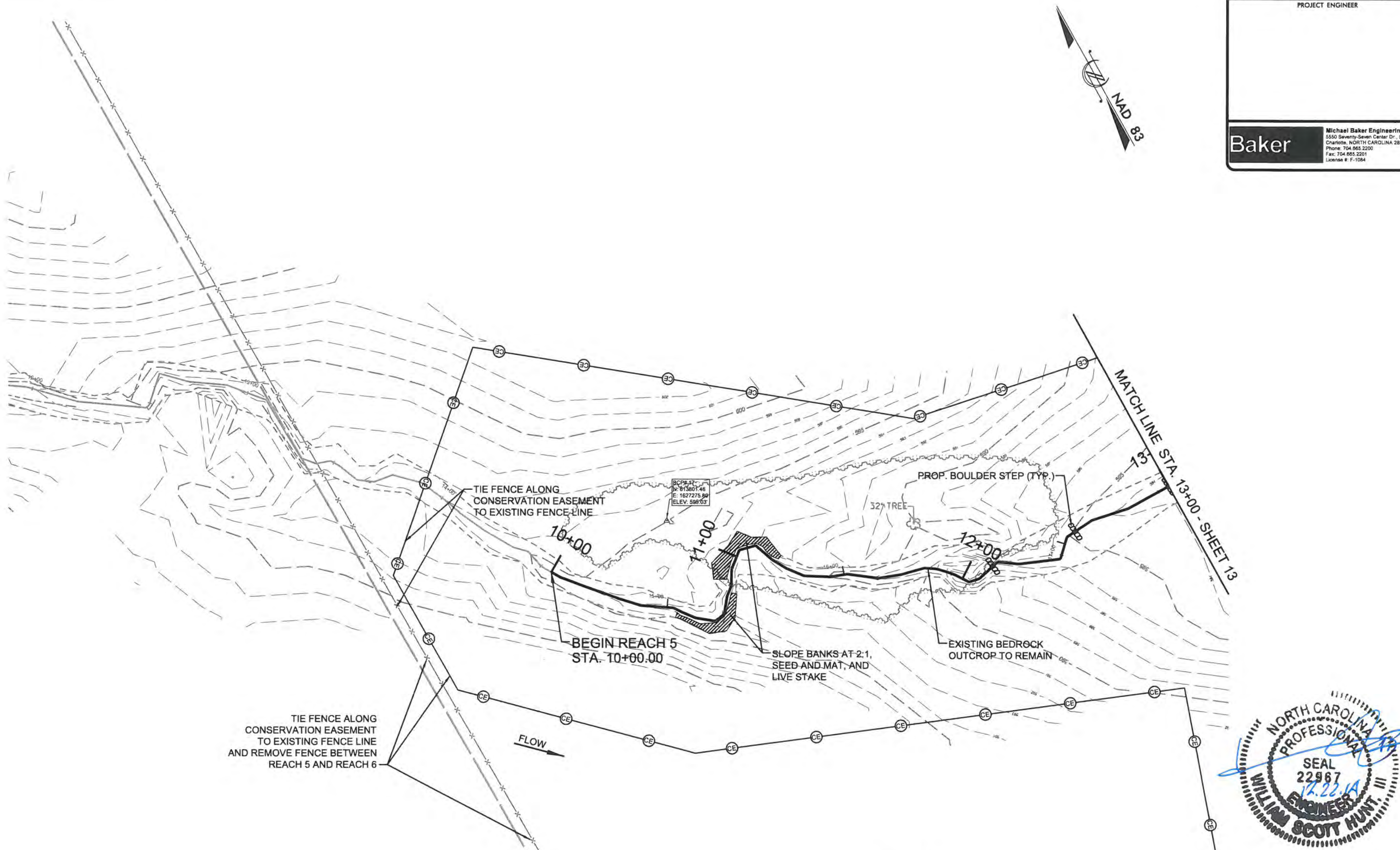

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WETLAND RESTORATION

WETLAND CREATION

UT TO TOWN CREEK
Reach 5

20 0 20 40
SCALE (FT)

12/22/2014
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	13

PROJECT ENGINEER

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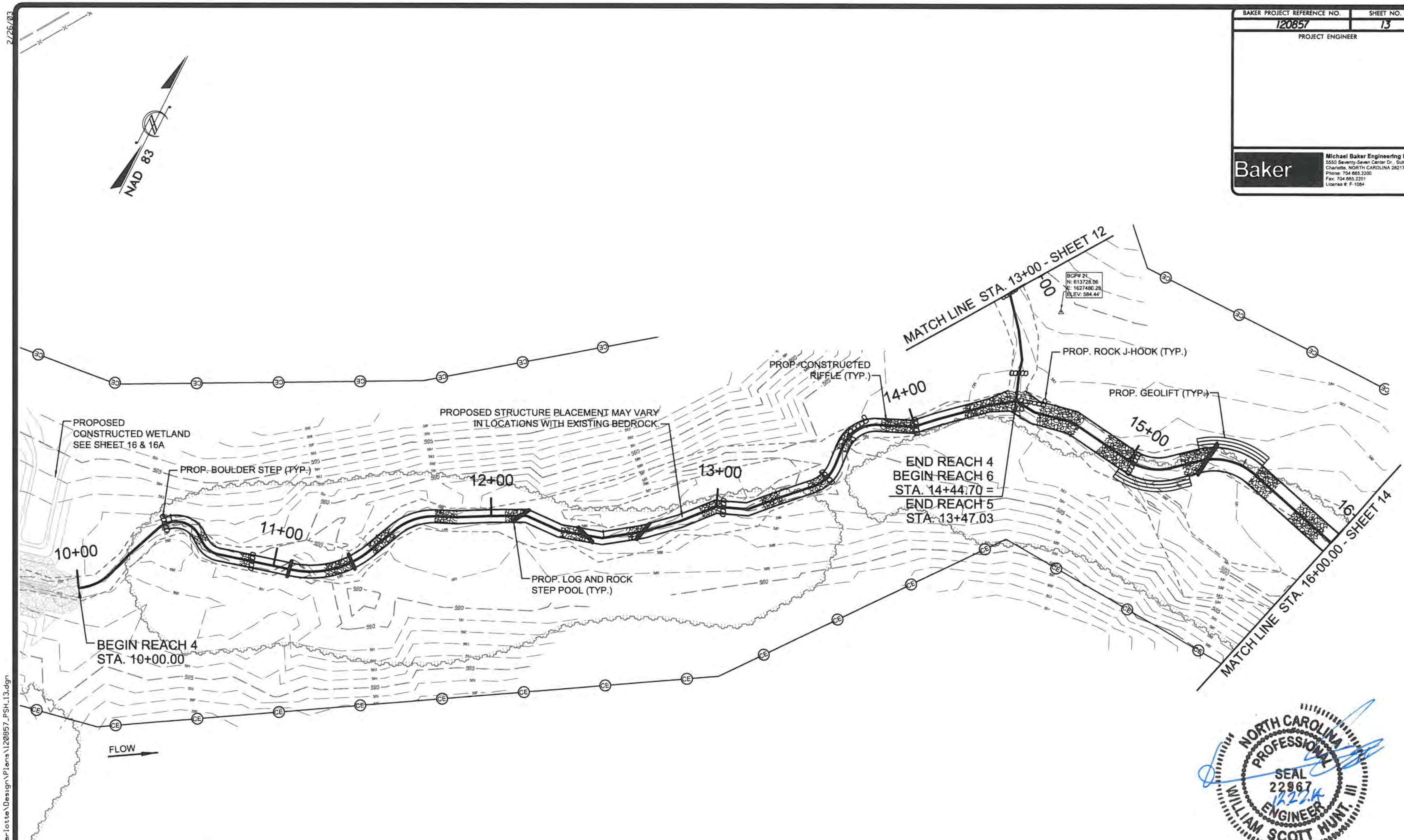

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

NOTES:

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WETLAND RESTORATION

WETLAND CREATION

UT TO TOWN CREEK
Reach 4, Reach 5 & Reach 6

20 0 20 40
SCALE (FT)

2/26/03

12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	14

PROJECT ENGINEER

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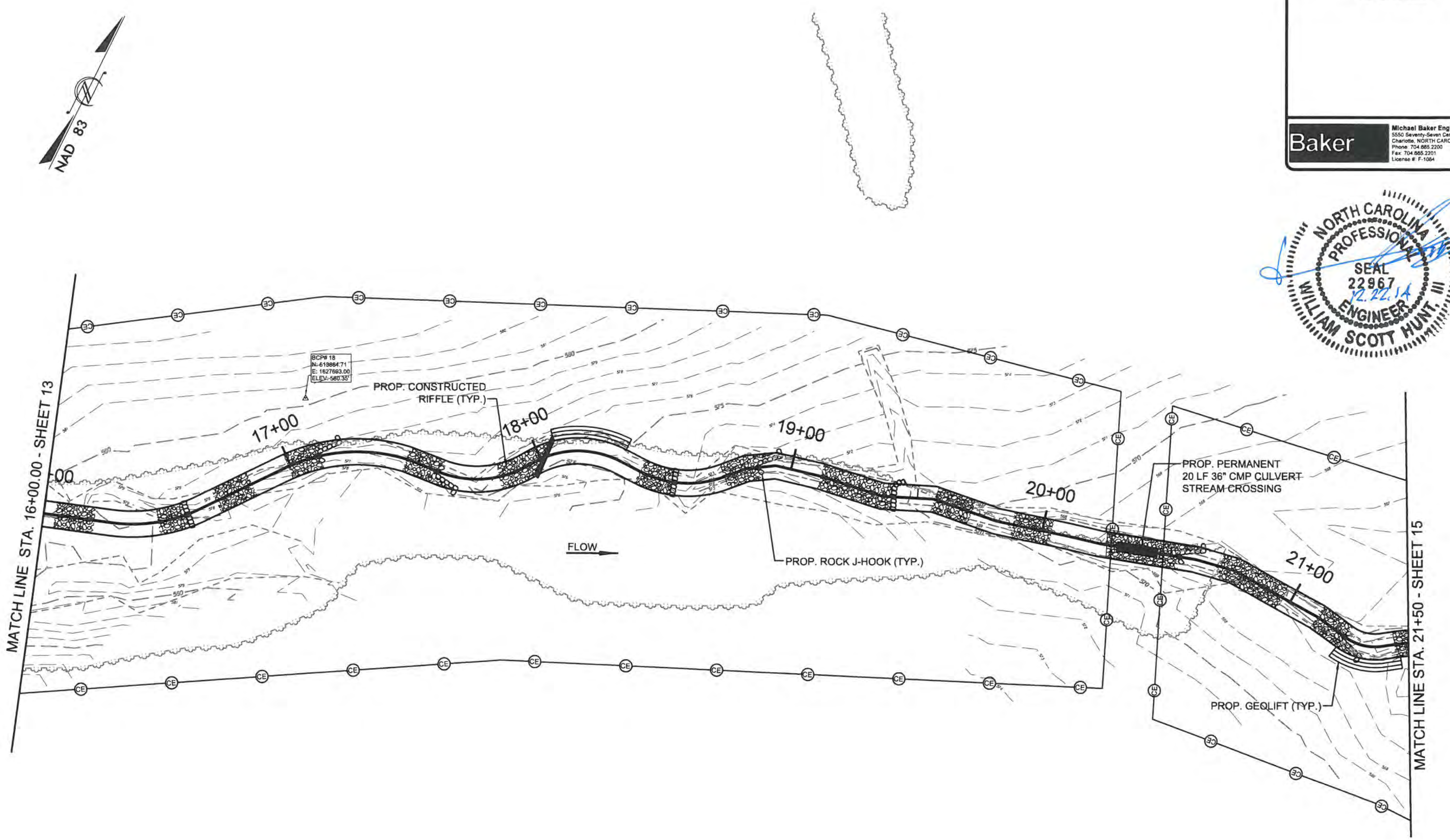

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WETLAND RESTORATION

WETLAND CREATION

UT TO TOWN CREEK
Reach 6

20 0 20 40
SCALE (FT)

2/26/03
12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	15

PROJECT ENGINEER

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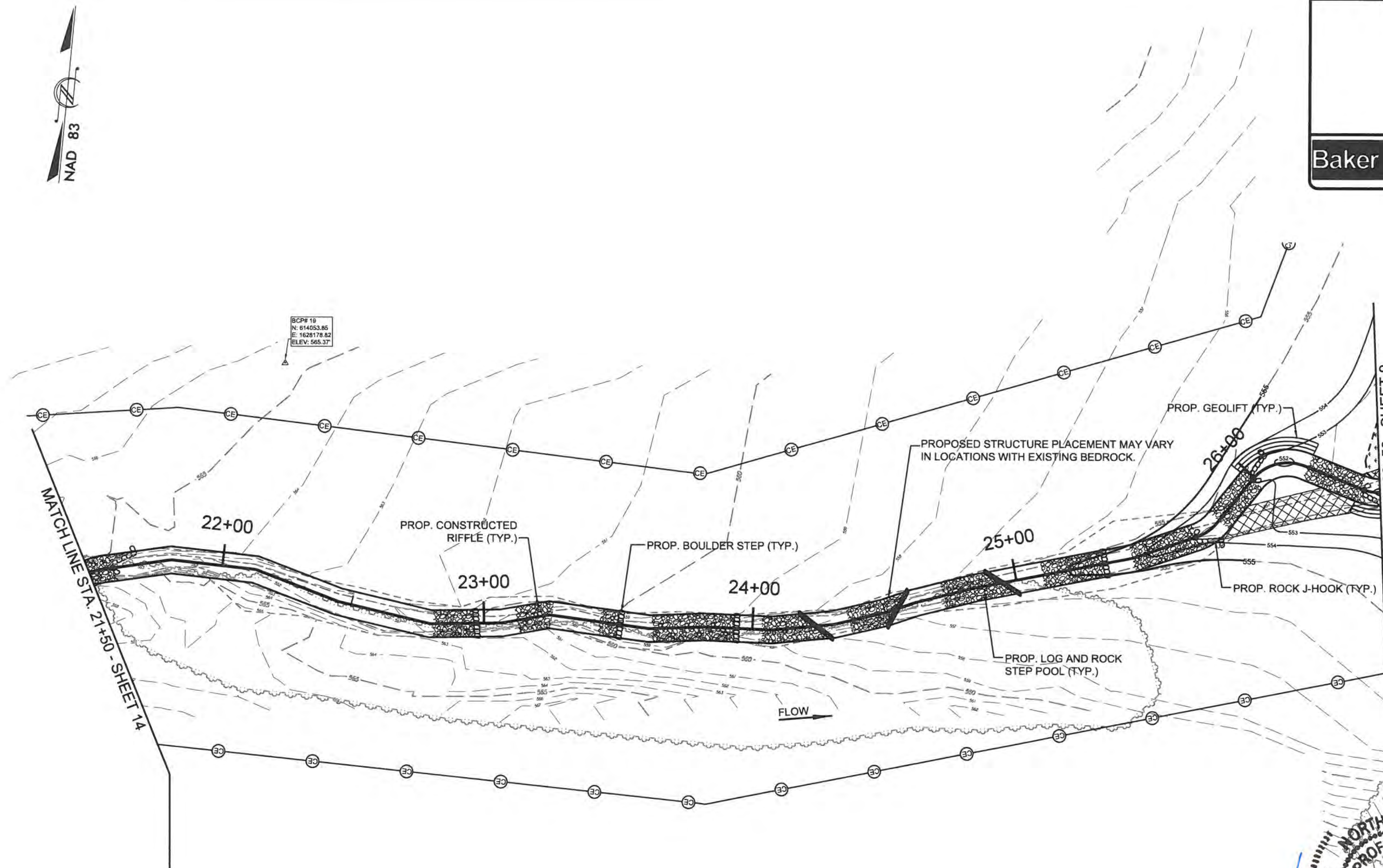

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

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WETLAND RESTORATION

WETLAND CREATION

UT TO TOWN CREEK
Reach 6

20 0 20 40
SCALE (FT)

2/26/03

12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	16

PROJECT ENGINEER

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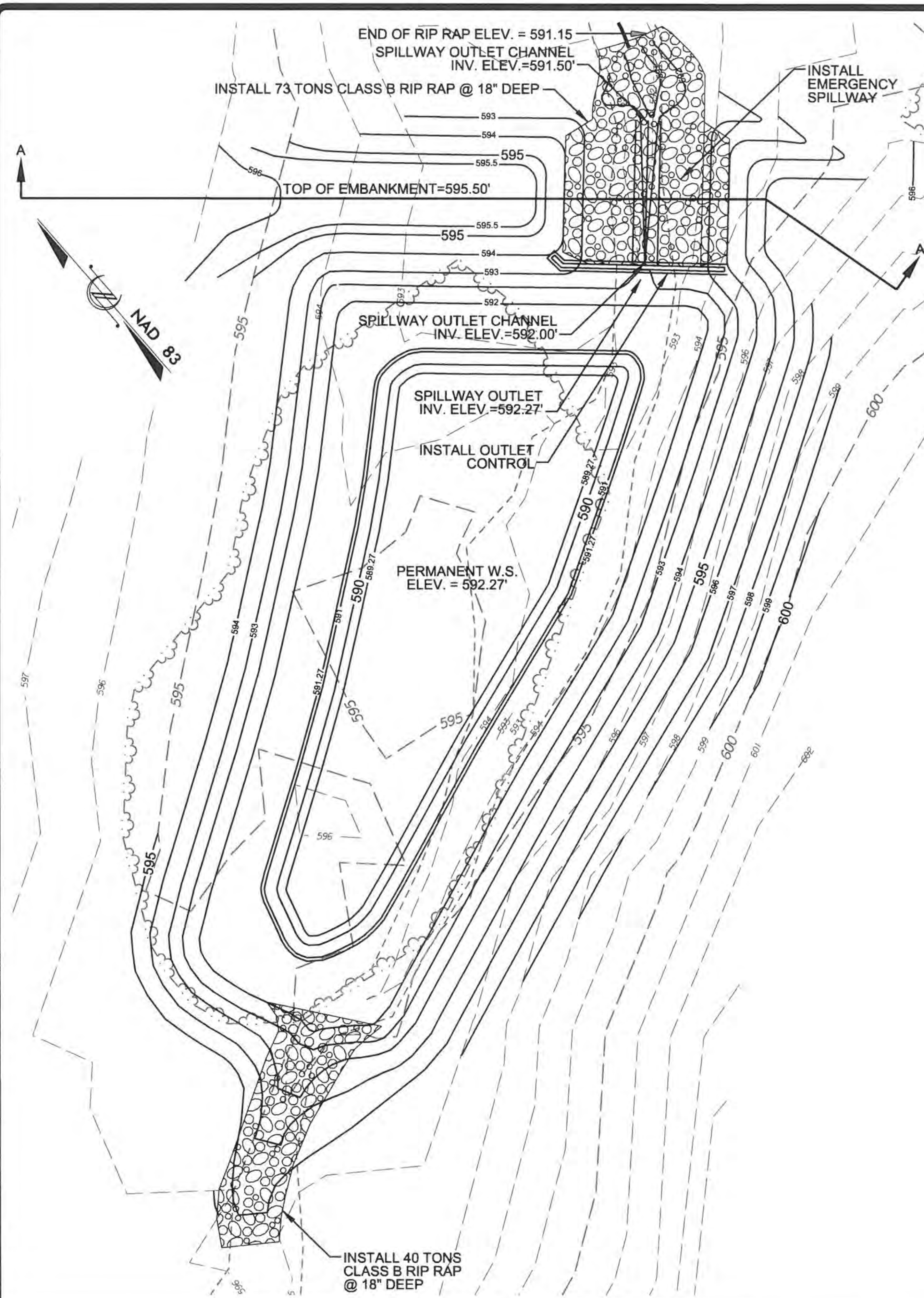
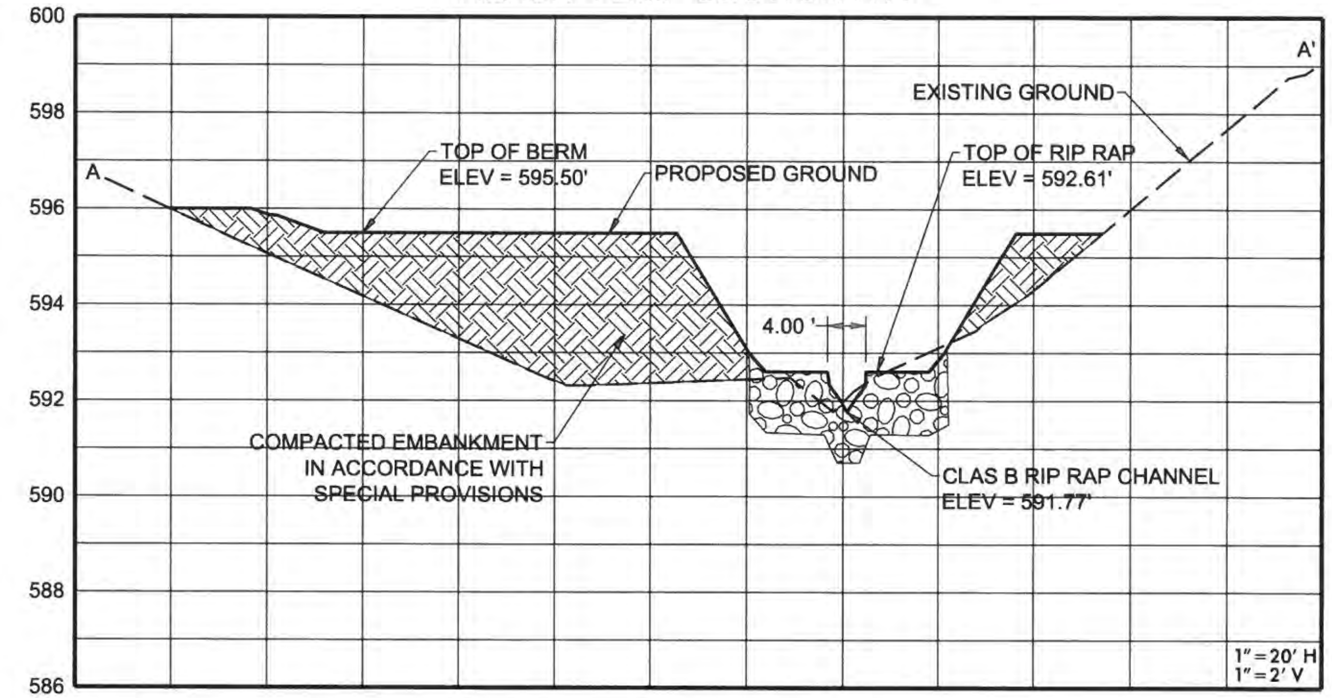


REACH 4 BMP SECTION A-A'



NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III
12.22.14

UT TO TOWN CREEK
Constructed Wetland Reach 4

SCALE (FT)

2/26/03

12/22/2014
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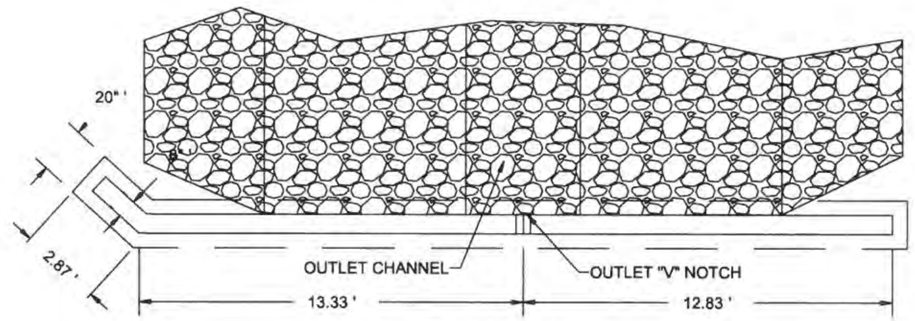
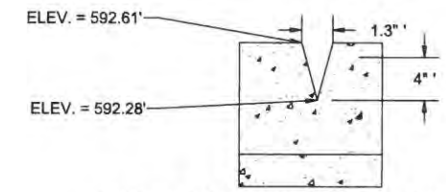
2/26/03

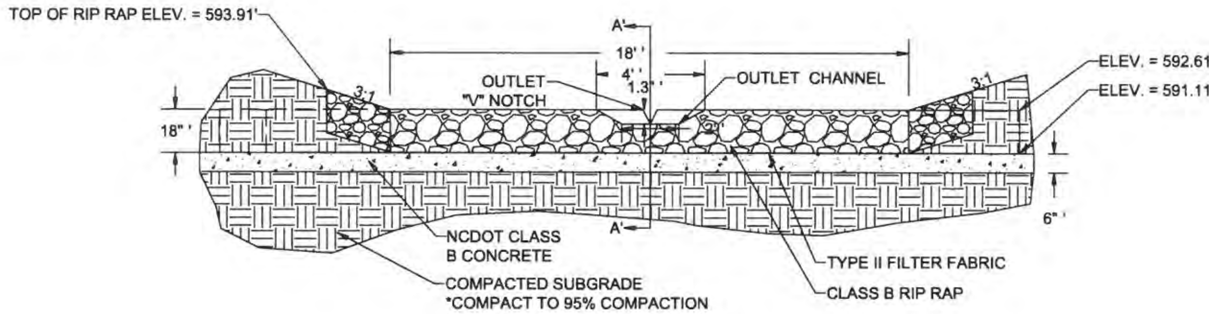
1 / D5 CONCRETE WEIR REACH 4
NTS



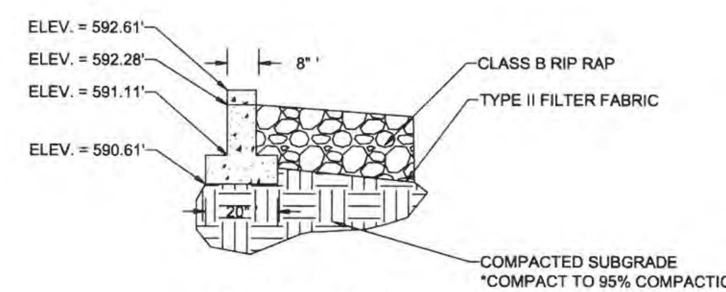
PLAN VIEW



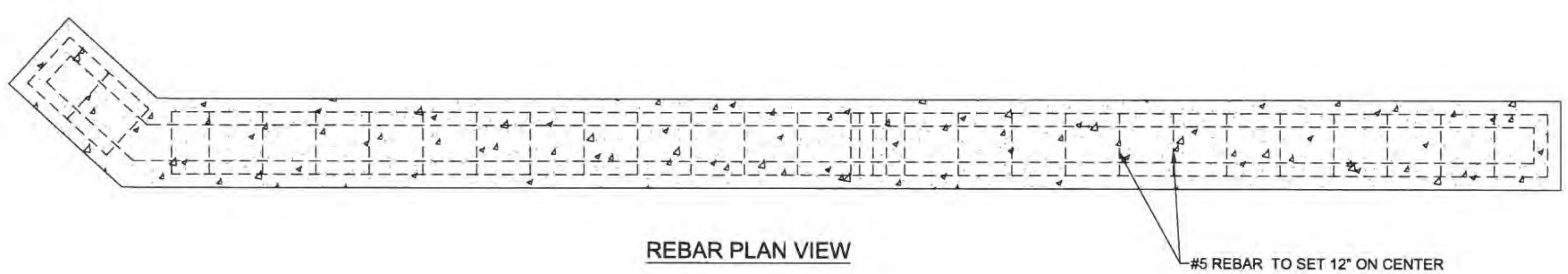
OUTLET WEIR NOTCH DETAIL



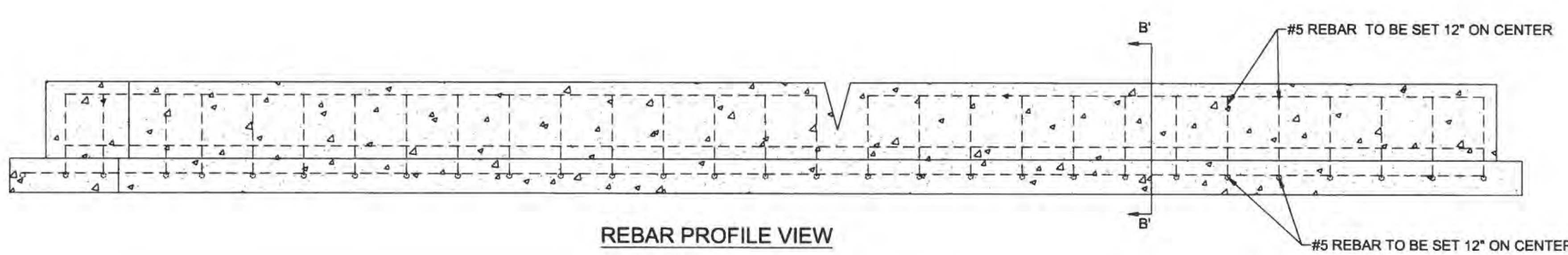
PROFILE VIEW



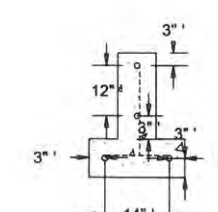
SECTION A' - A'



REBAR PLAN VIEW



REBAR PROFILE VIEW



SECTION B' - B'

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	16A

PROJECT ENGINEER

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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14

UT TO TOWN CREEK
Constructed Wetland Reach 4

10 0 10 20
SCALE (FT)

12/22/2014
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PROJECT ENGINEER

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5550 Seventy-Seven Center Dr., Suite 320
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Phone: 704.665.2200
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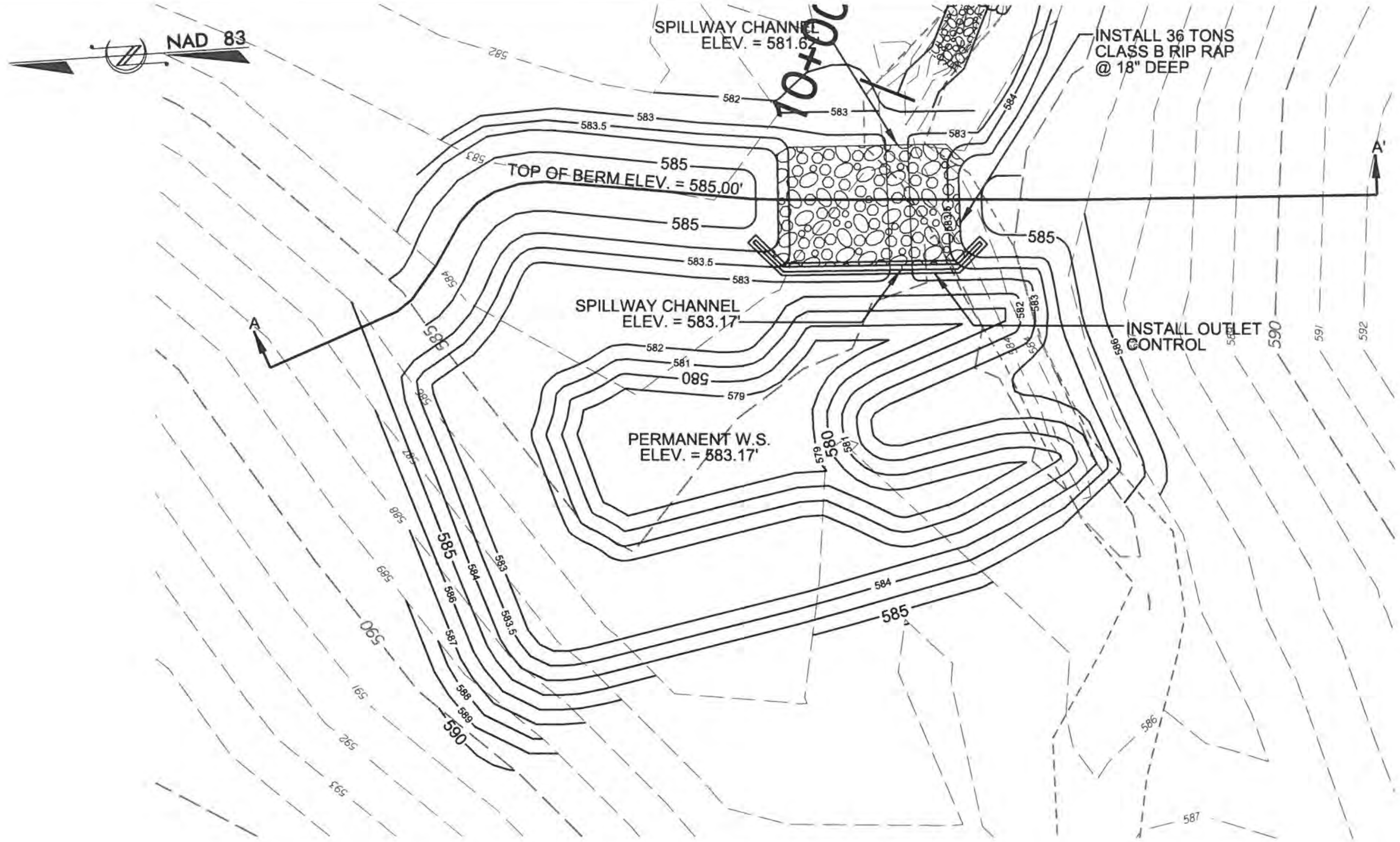
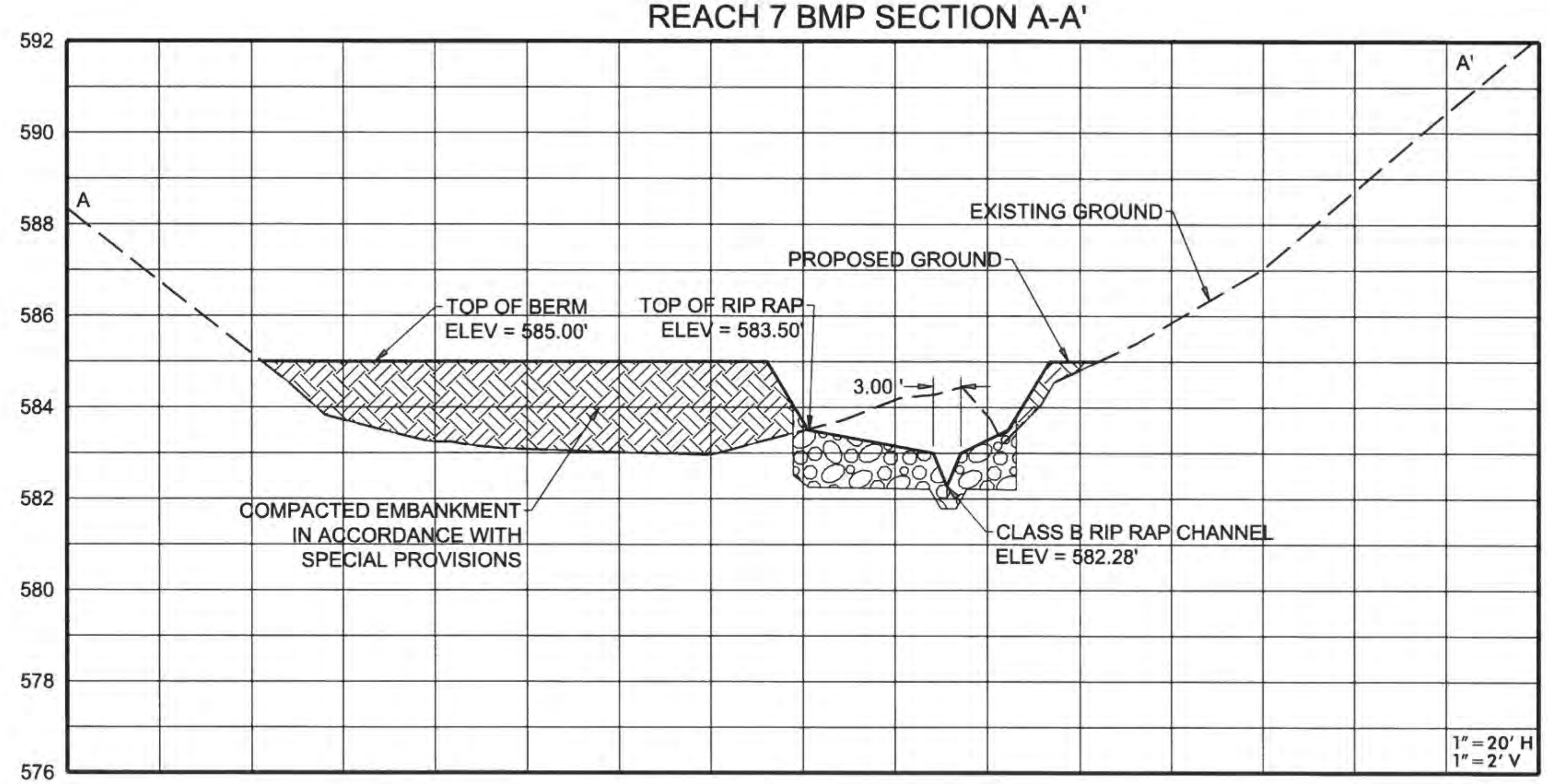
License #: F-1084

2/26/03



REACH 7 BMP SECTION A-A'



NORTH CAROLINA PROFESSIONAL ENGINEER
SEAL
22967
WILLIAM SCOTT HUNT, III
12.22.14

UT TO TOWN CREEK
Constructed Wetland Reach 7

10 0 10 20
SCALE (FT)

12/22/2014
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	17A

PROJECT ENGINEER

Baker

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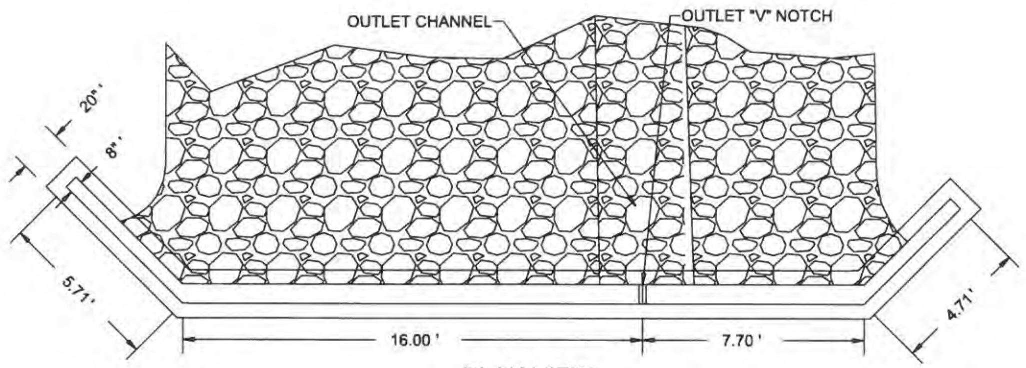
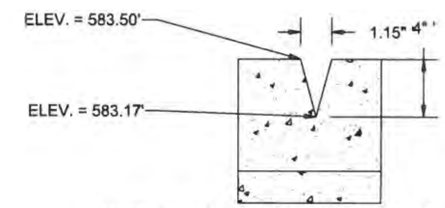
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

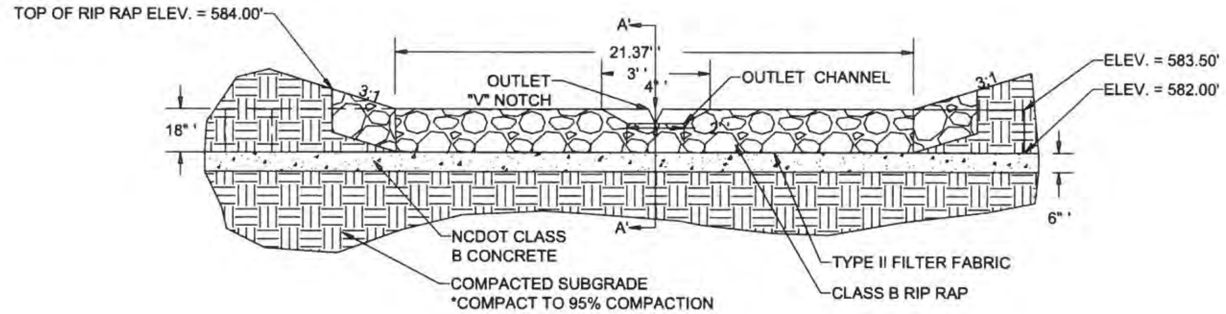
1 / D6 CONCRETE WEIR REACH 7
NTS



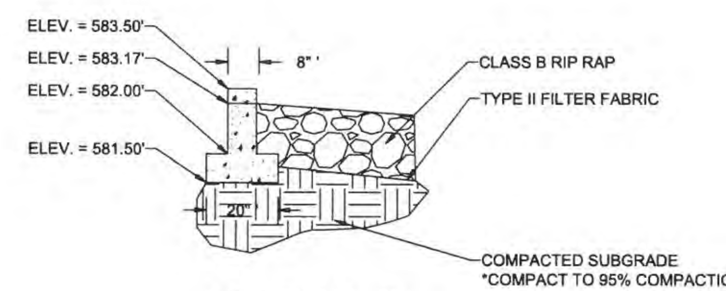
PLAN VIEW



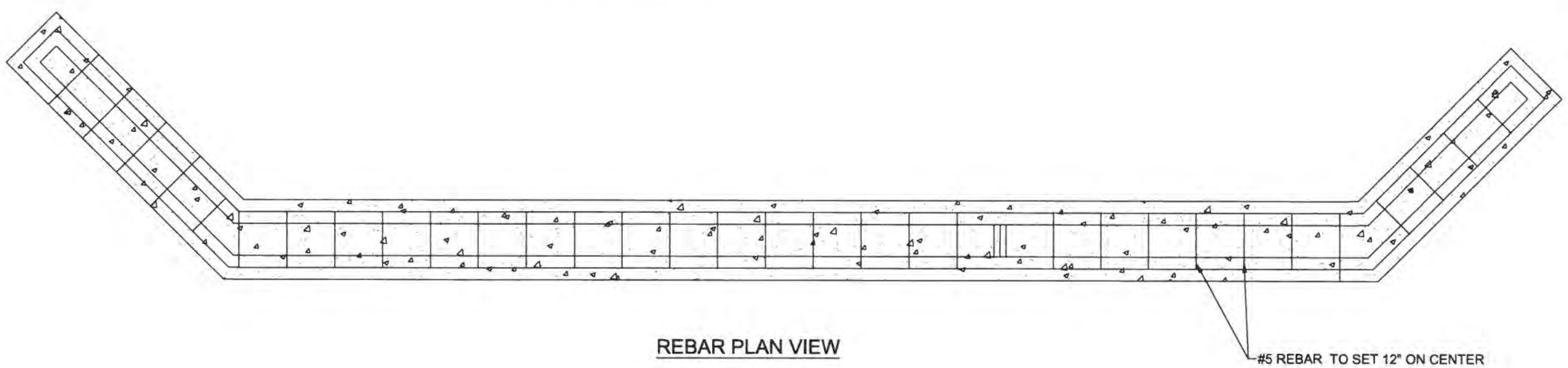
OUTLET WEIR NOTCH DETAIL



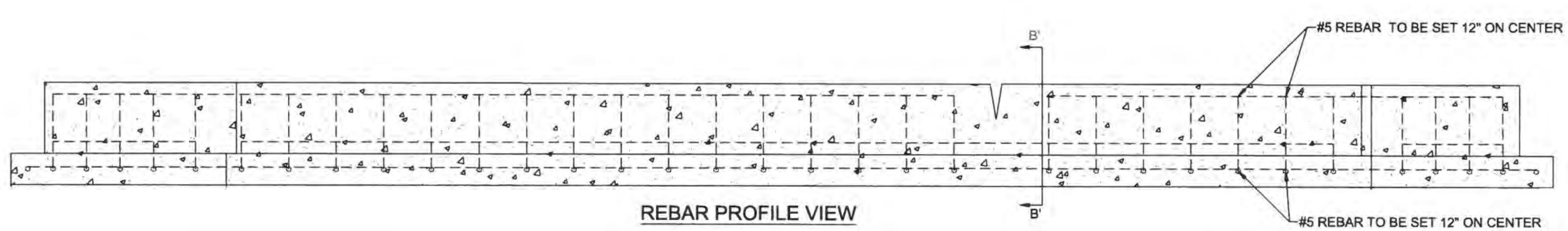
PROFILE VIEW



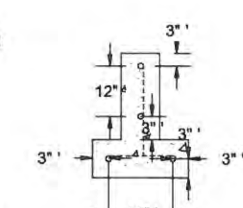
SECTION A' - A'



REBAR PLAN VIEW



REBAR PROFILE VIEW



SECTION B' - B'

UT TO TOWN CREEK
Constructed Wetland Reach 7

10 0 10 20
SCALE (FT)

12/23/2014
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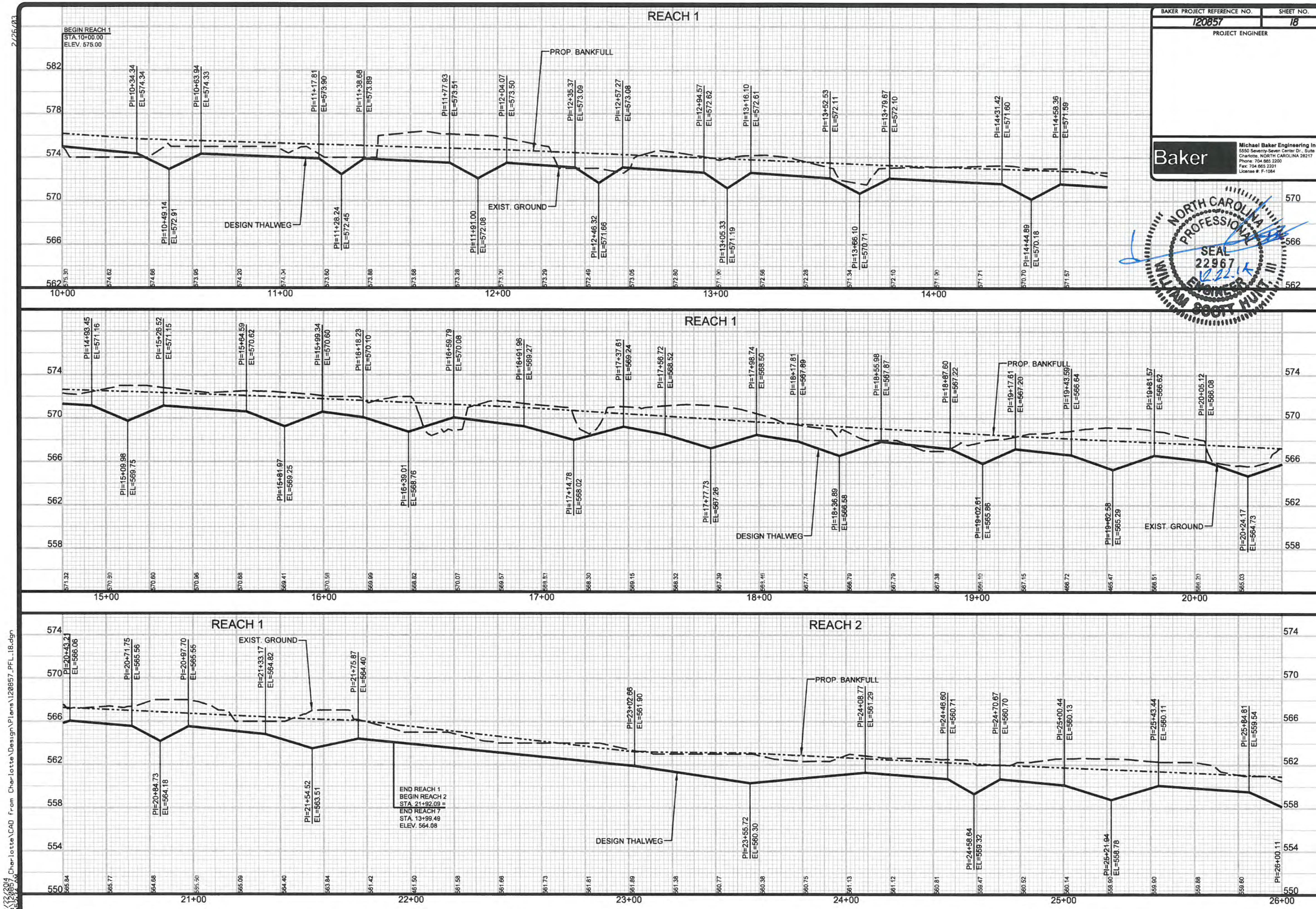
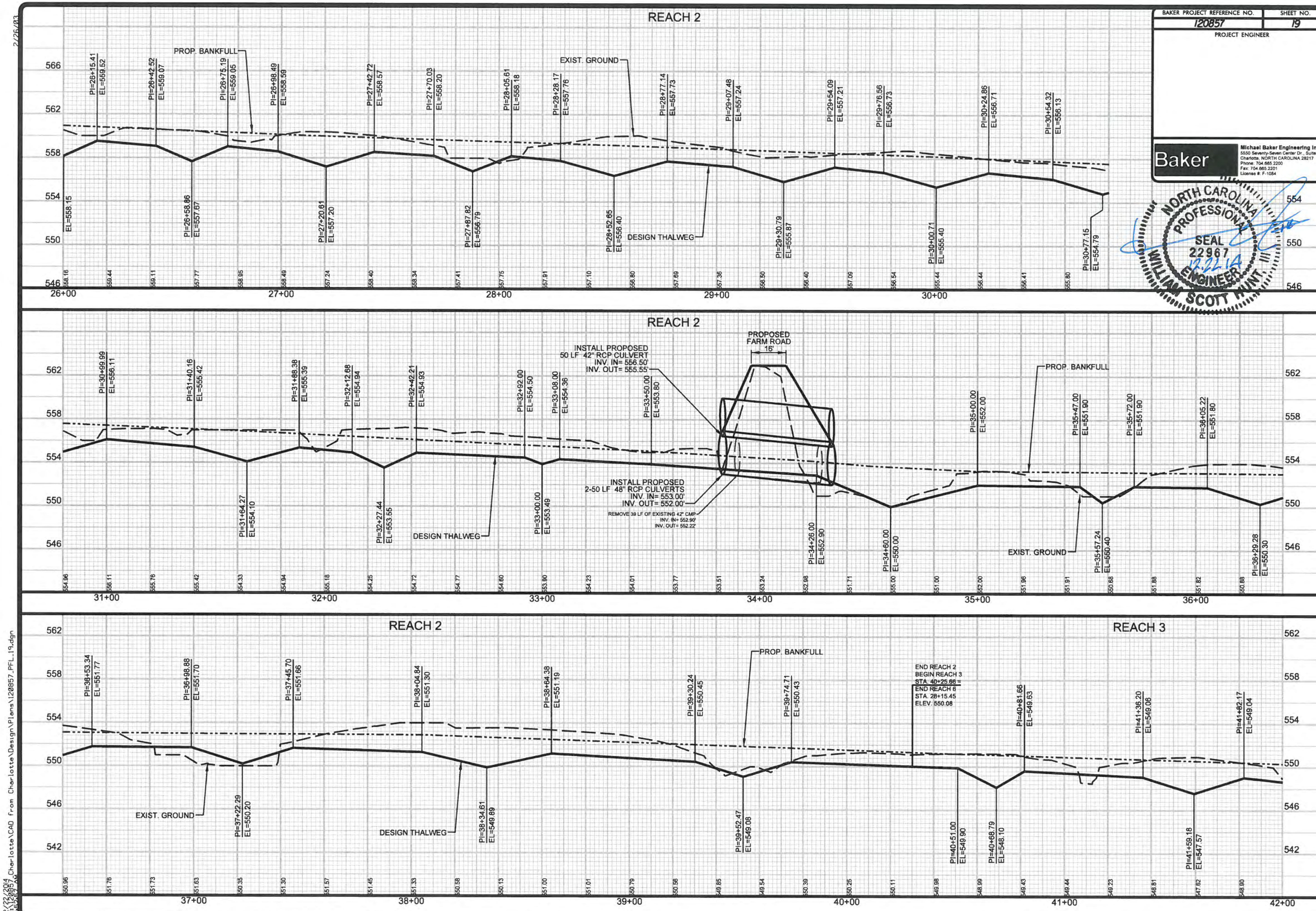

BAKER PROJECT REFERENCE NO. 120857
SHEET NO. 18
PROJECT ENGINEER
Baker
Michael Baker Engineering Inc.
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III
REACH 1
BEGIN REACH 1 STA. 10+00.00 ELEV. 575.00
PROP. BANKFULL
EXIST. GROUND
DESIGN THALWEG
REACH 2
END REACH 1 BEGIN REACH 2 STA. 21+92.09 = END REACH 7 STA. 13+99.49 ELEV. 564.08
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00



BAKER PROJECT REFERENCE NO.
120857
SHEET NO.
19
PROJECT ENGINEER
Baker
Michael Baker Engineering Inc.
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Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
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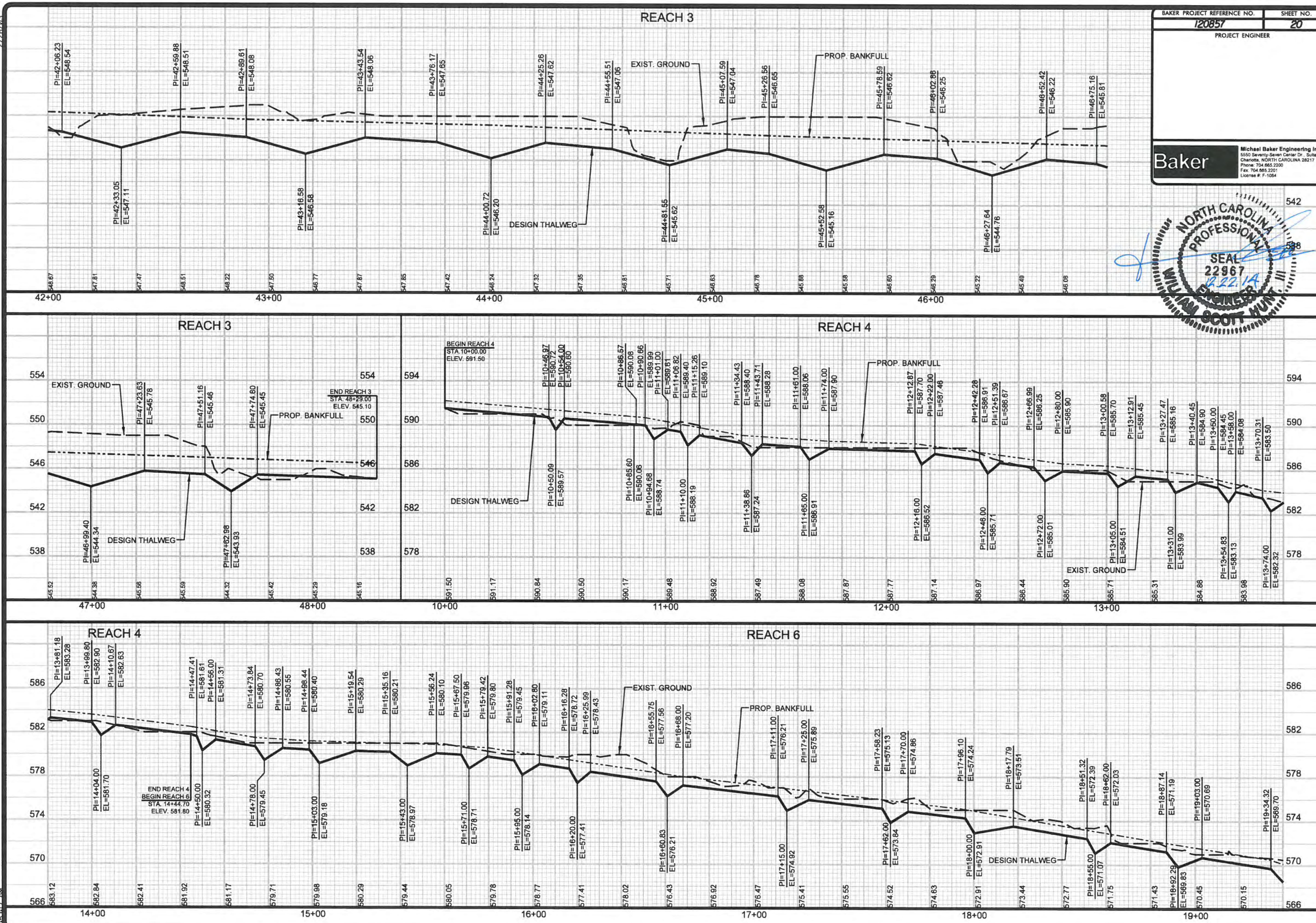
License #: F-1084
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT
12.22.14
REACH 2
PROP. BANKFULL
EXIST. GROUND
DESIGN THALWEG
26+00
27+00
28+00
29+00
30+00
INSTALL PROPOSED 50 LF 42" RCP CULVERT INV. IN= 556.50' INV. OUT= 555.55'
PROPOSED FARM ROAD
16'
INSTALL PROPOSED 2-50 LF 48" RCP CULVERTS INV. IN= 553.00' INV. OUT= 552.00'
REMOVE 38 LF OF EXISTING 42" CMP INV. IN= 552.90' INV. OUT= 552.22'
31+00
32+00
33+00
34+00
35+00
36+00
REACH 3
END REACH 2 BEGIN REACH 3 STA. 40+25.66 = END REACH 6 STA. 28+15.45 ELEV. 550.08
37+00
38+00
39+00
40+00
41+00
42+00



BAKER PROJECT REFERENCE NO. 120857
SHEET NO. 20
PROJECT ENGINEER
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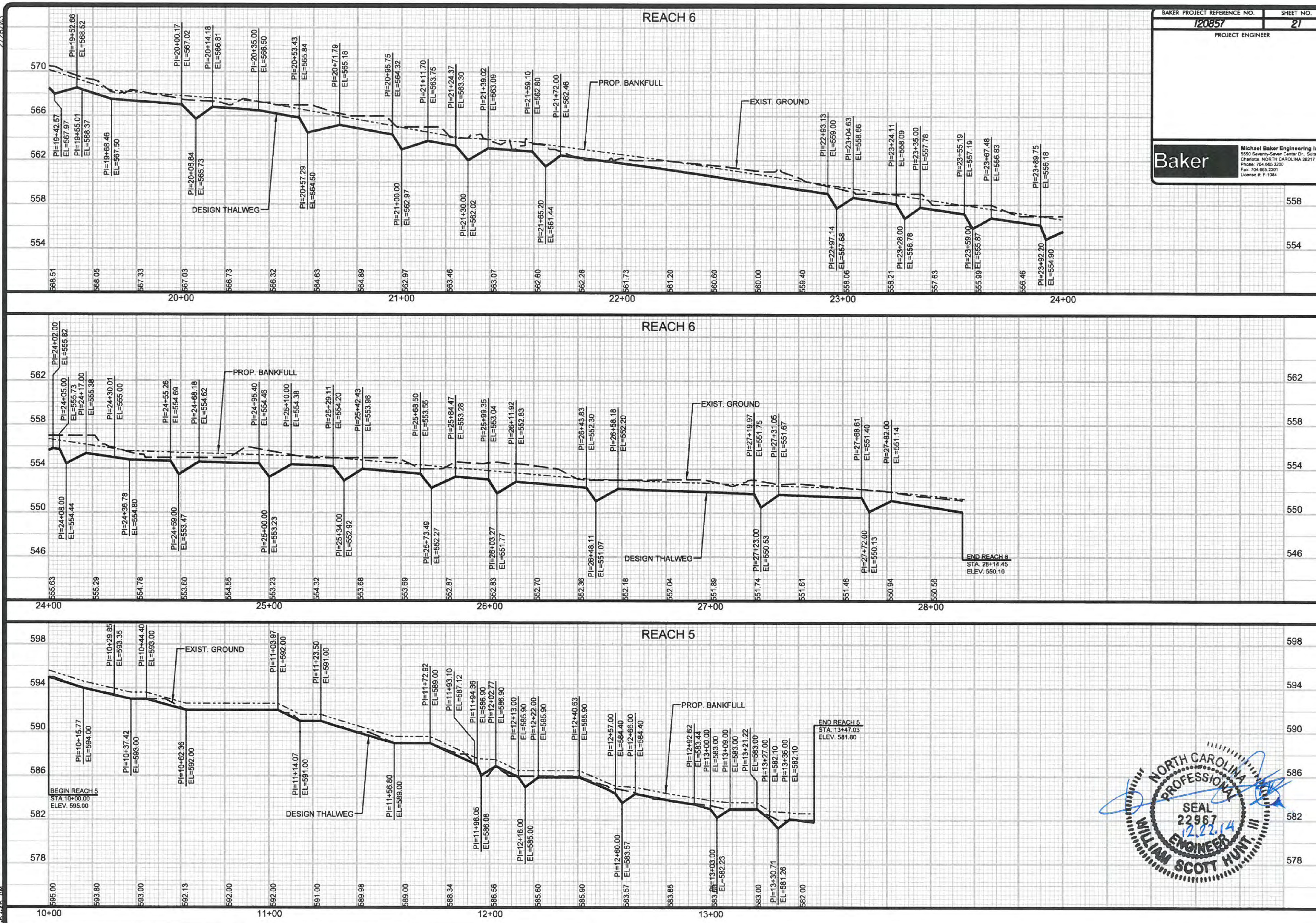
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT III
2.22.14
REACH 3
EXIST. GROUND
PROP. BANKFULL
DESIGN THALWEG
PI=42+06.23 EL=548.54
PI=42+33.05 EL=547.11
PI=42+59.88 EL=548.51
PI=42+89.61 EL=548.08
PI=43+16.58 EL=546.58
PI=43+43.54 EL=548.06
PI=43+76.17 EL=547.85
PI=44+00.72 EL=546.20
PI=44+25.26 EL=547.62
PI=44+55.51 EL=547.06
PI=44+81.55 EL=545.62
PI=45+07.59 EL=547.04
PI=45+26.56 EL=546.65
PI=45+52.58 EL=545.16
PI=45+78.59 EL=546.62
PI=46+02.86 EL=546.25
PI=46+27.64 EL=544.76
PI=46+52.42 EL=546.22
PI=46+75.16 EL=545.81
42+00
43+00
44+00
45+00
46+00
REACH 3
END REACH 3
STA. 48+29.00
ELEV. 545.10
PI=46+99.40 EL=544.34
PI=47+23.63 EL=545.78
PI=47+51.16 EL=545.46
PI=47+62.98 EL=543.93
PI=47+74.80 EL=545.45
47+00
48+00
REACH 4
BEGIN REACH 4
STA. 10+00.00
ELEV. 591.50
10+00
11+00
12+00
13+00
REACH 4
REACH 6
END REACH 4
BEGIN REACH 6
STA. 14+44.70
ELEV. 581.80
14+00
15+00
16+00
17+00
18+00
19+00


BAKER PROJECT REFERENCE NO. 120857
SHEET NO. 21
PROJECT ENGINEER
Baker
Michael Baker Engineering Inc.
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Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084
REACH 6
PROP. BANKFULL
EXIST. GROUND
DESIGN THALWEG
REACH 6
END REACH 6
STA. 28+14.45
ELEV. 550.10
REACH 5
BEGIN REACH 5
STA.10+00.00
ELEV. 595.00
END REACH 5
STA. 13+47.03
ELEV. 581.80
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14
12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	22

PROJECT ENGINEER

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Phone: 704.665.2200
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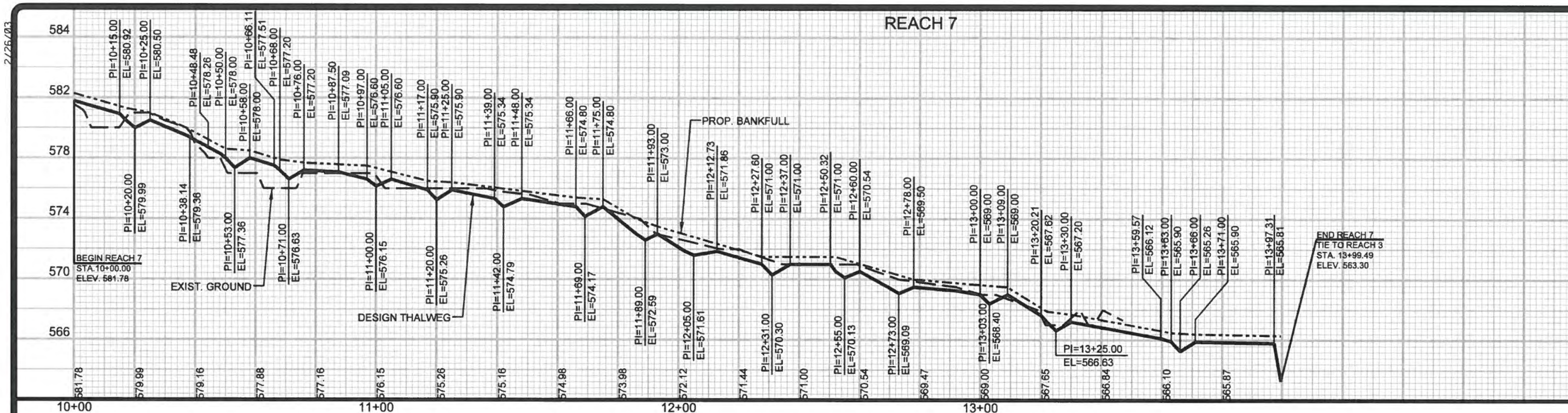
REACH 7



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

2/26/03

12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	23

PROJECT ENGINEER

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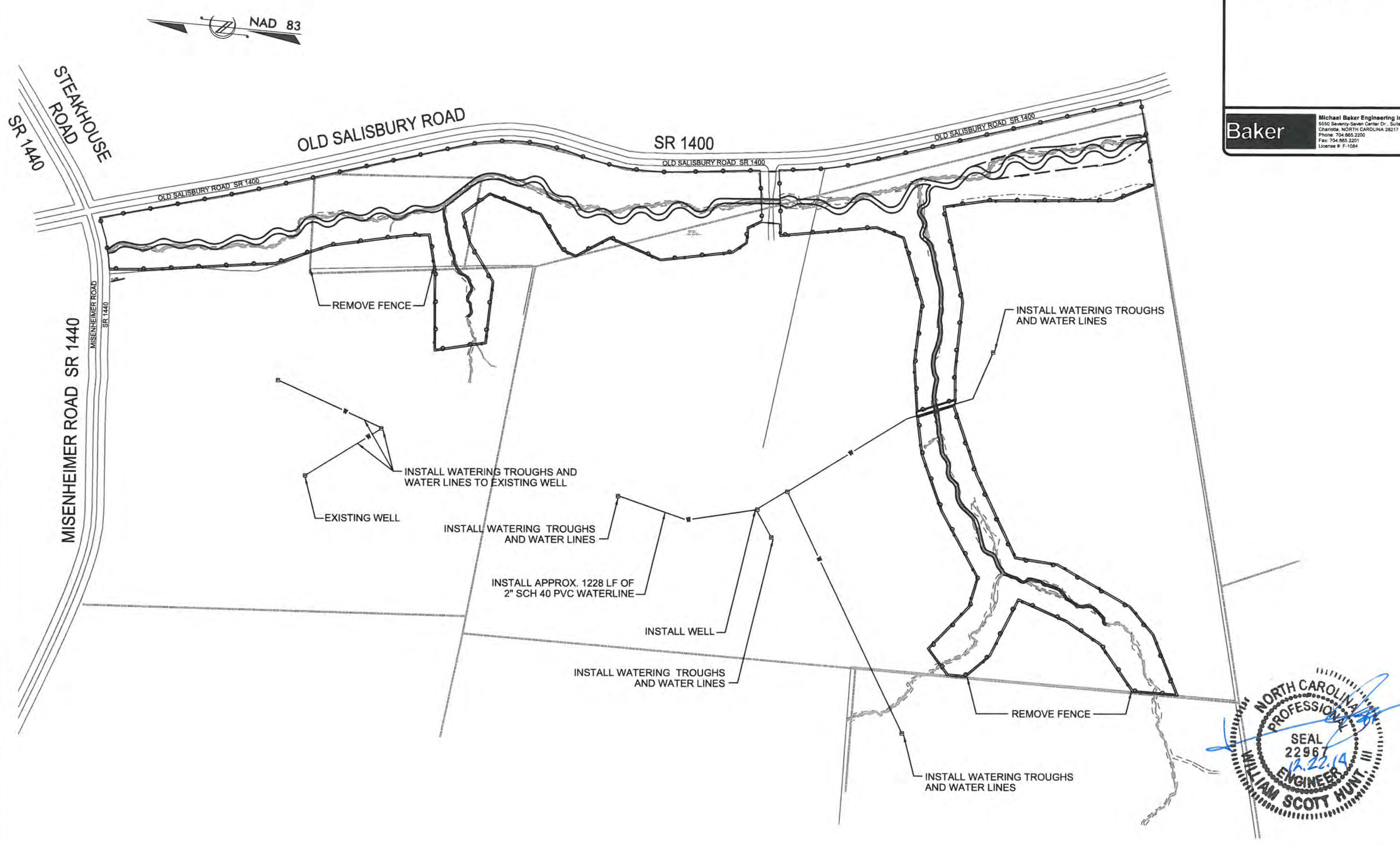
Fax: 704.665.2201
License #: F-1084



UT TO TOWN CREEK FENCING /CATTLE EXCLUSION OVERVIEW MAP

150 0 150 300
SCALE (FT)

2/26/03

12/22/2014
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BAKER PROJECT REFERENCE NO. 120857 | SHEET NO. 24

PROJECT ENGINEER

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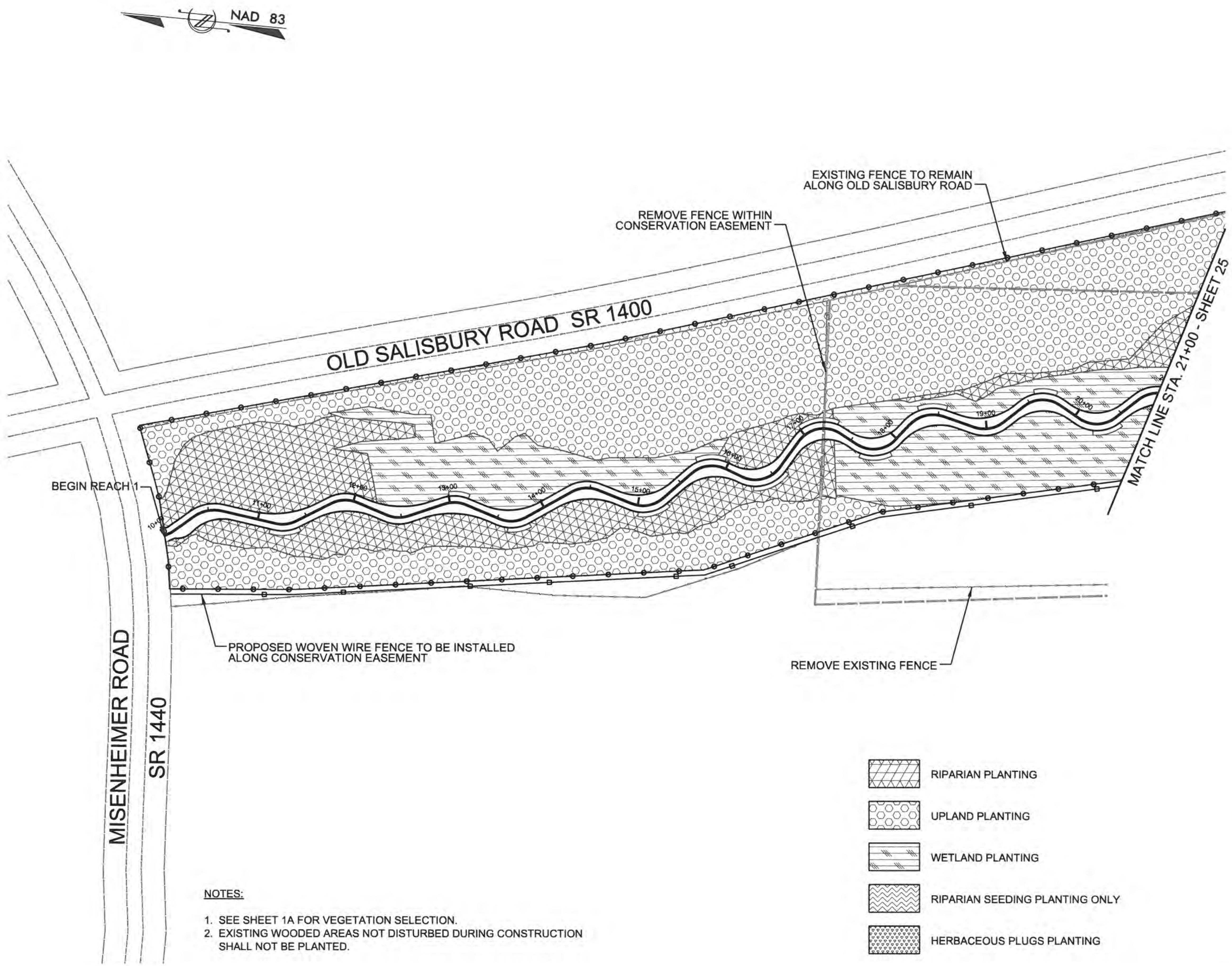

NOTES:

1. SEE SHEET 1A FOR VEGETATION SELECTION.
2. EXISTING WOODED AREAS NOT DISTURBED DURING CONSTRUCTION SHALL NOT BE PLANTED.

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

UT TO TOWN CREEK REVEGETATION AND FENCING PLAN

50 0 50 100

SCALE (FT)

2/26/03

12/23/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	25

PROJECT ENGINEER

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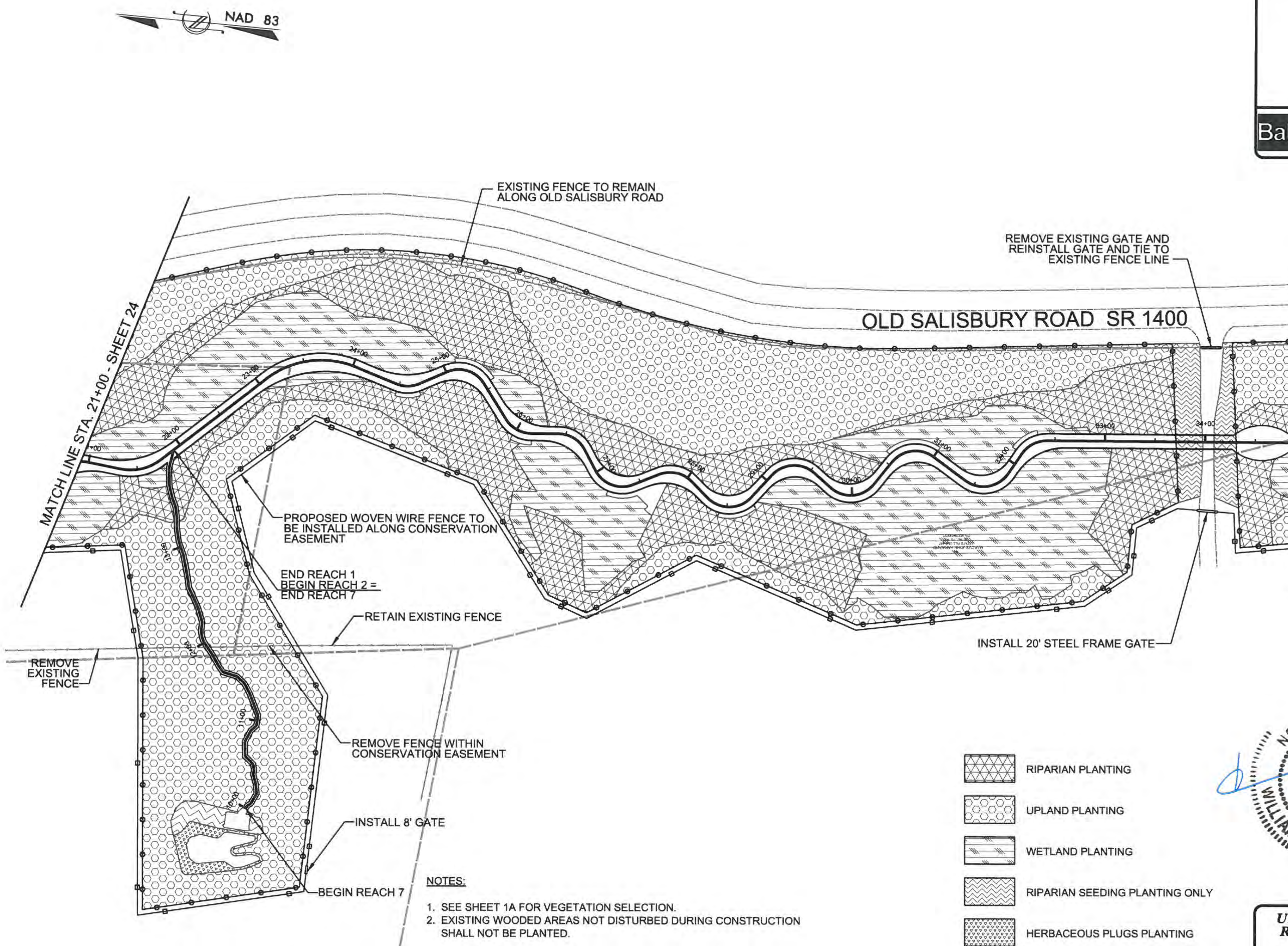

NOTES:

1. SEE SHEET 1A FOR VEGETATION SELECTION.
2. EXISTING WOODED AREAS NOT DISTURBED DURING CONSTRUCTION SHALL NOT BE PLANTED.

RIPARIAN PLANTING

UPLAND PLANTING

WETLAND PLANTING

RIPARIAN SEEDING PLANTING ONLY

HERBACEOUS PLUGS PLANTING

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

UT TO TOWN CREEK REVEGETATION AND FENCING PLAN

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SCALE (FT)

2/26/03

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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	26

PROJECT ENGINEER

Baker

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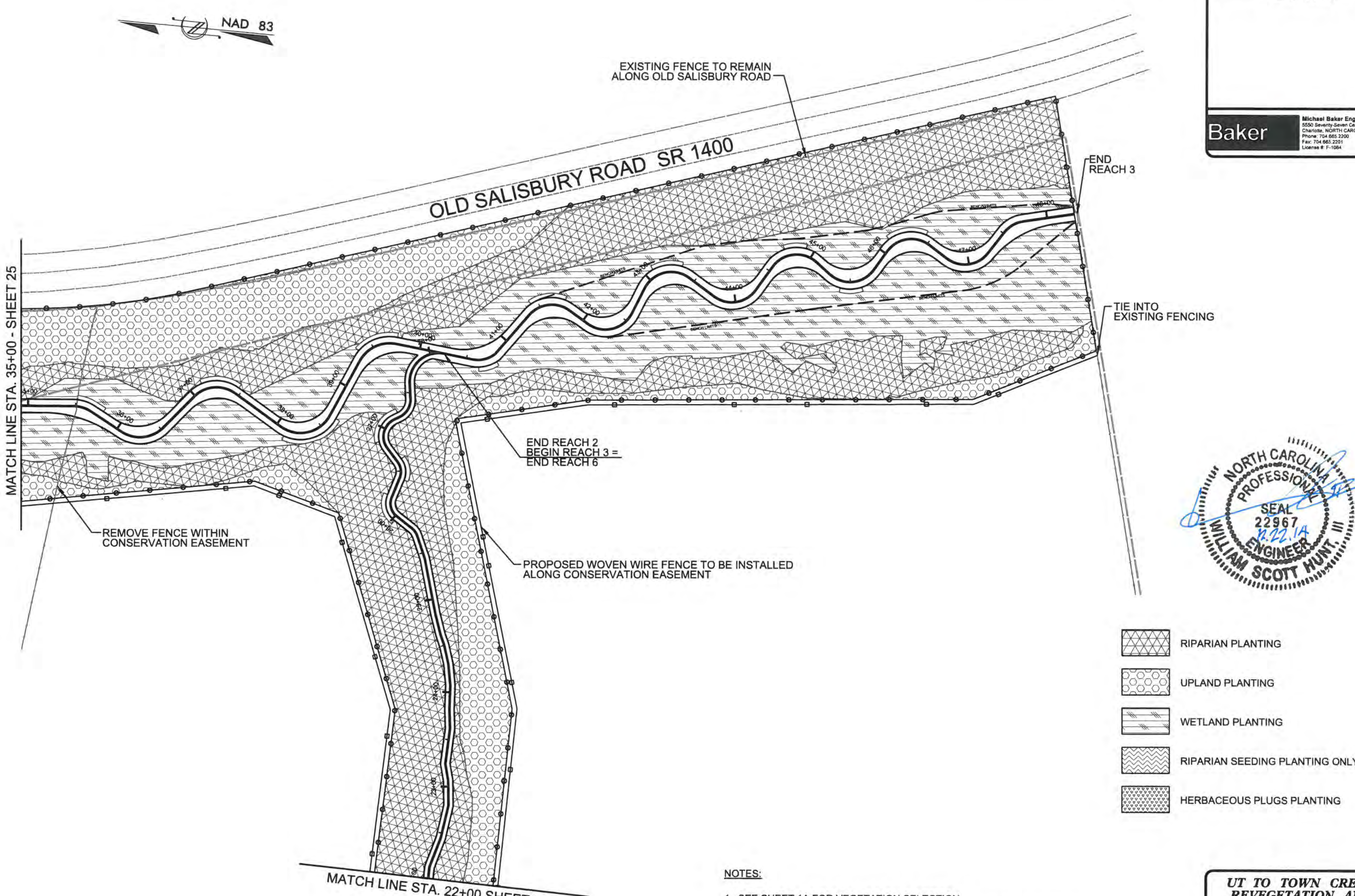

RIPARIAN PLANTING

UPLAND PLANTING

WETLAND PLANTING

RIPARIAN SEEDING PLANTING ONLY

HERBACEOUS PLUGS PLANTING

NOTES:

1. SEE SHEET 1A FOR VEGETATION SELECTION.
2. EXISTING WOODED AREAS NOT DISTURBED DURING CONSTRUCTION SHALL NOT BE PLANTED.

UT TO TOWN CREEK REVEGETATION AND FENCING PLAN

50 0 50 100
SCALE (FT)

2/26/03

12/22/2014 R:\120857_Charlotte\CAD from Charlotte\Design\Plans\120857_PSH_26.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	27

PROJECT ENGINEER

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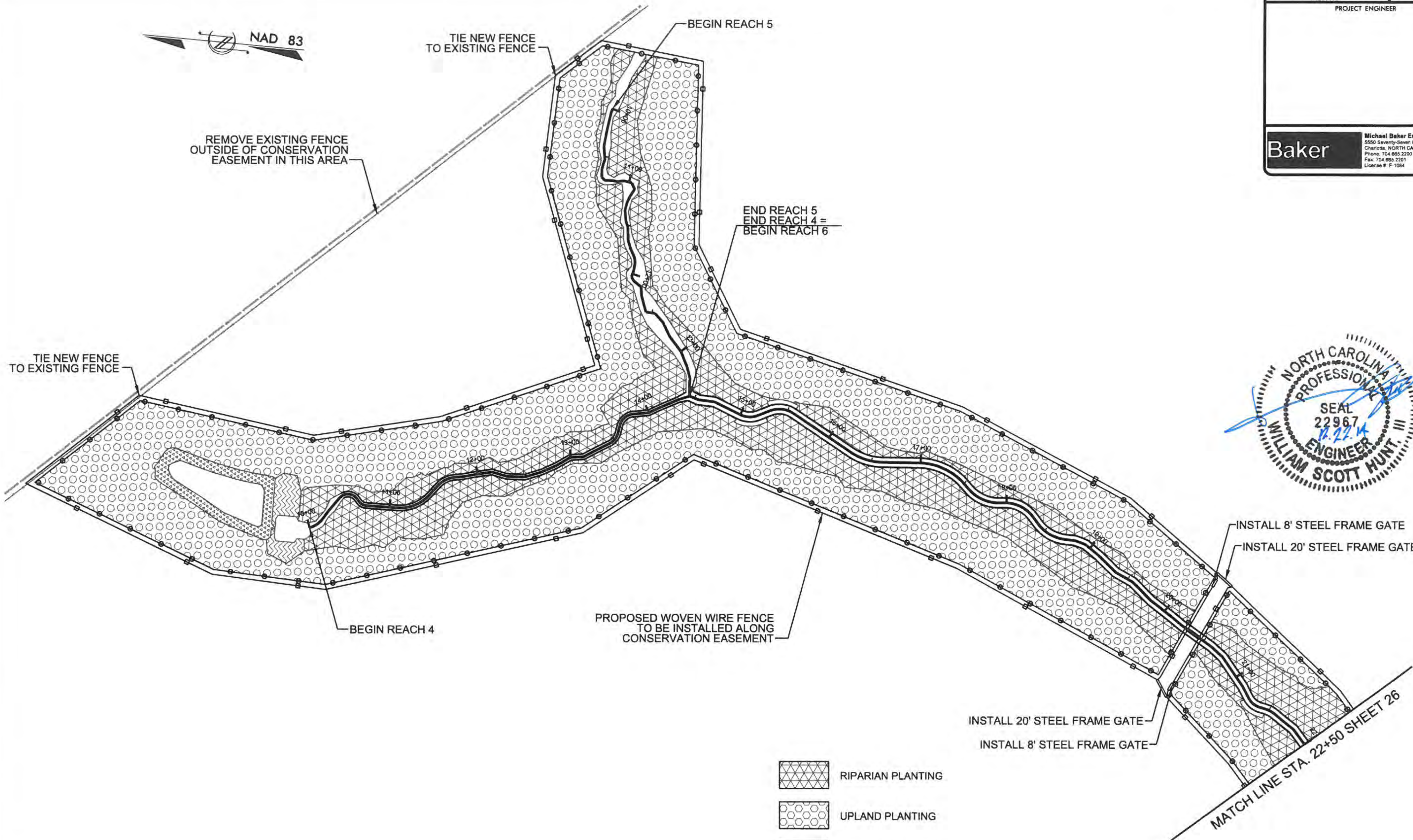
Fax: 704.665.2201
License #: F-1084



RIPARIAN PLANTING

UPLAND PLANTING

WETLAND PLANTING

RIPARIAN SEEDING PLANTING ONLY

HERBACEOUS PLUGS PLANTING

NOTES:

1. SEE SHEET 1A FOR VEGETATION SELECTION.
2. EXISTING WOODED AREAS NOT DISTURBED DURING CONSTRUCTION SHALL NOT BE PLANTED.

UT TO TOWN CREEK REVEGETATION AND FENCING PLAN

50 0 50 100

SCALE (FT)

12/22/2014
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STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	120857	EC1	8

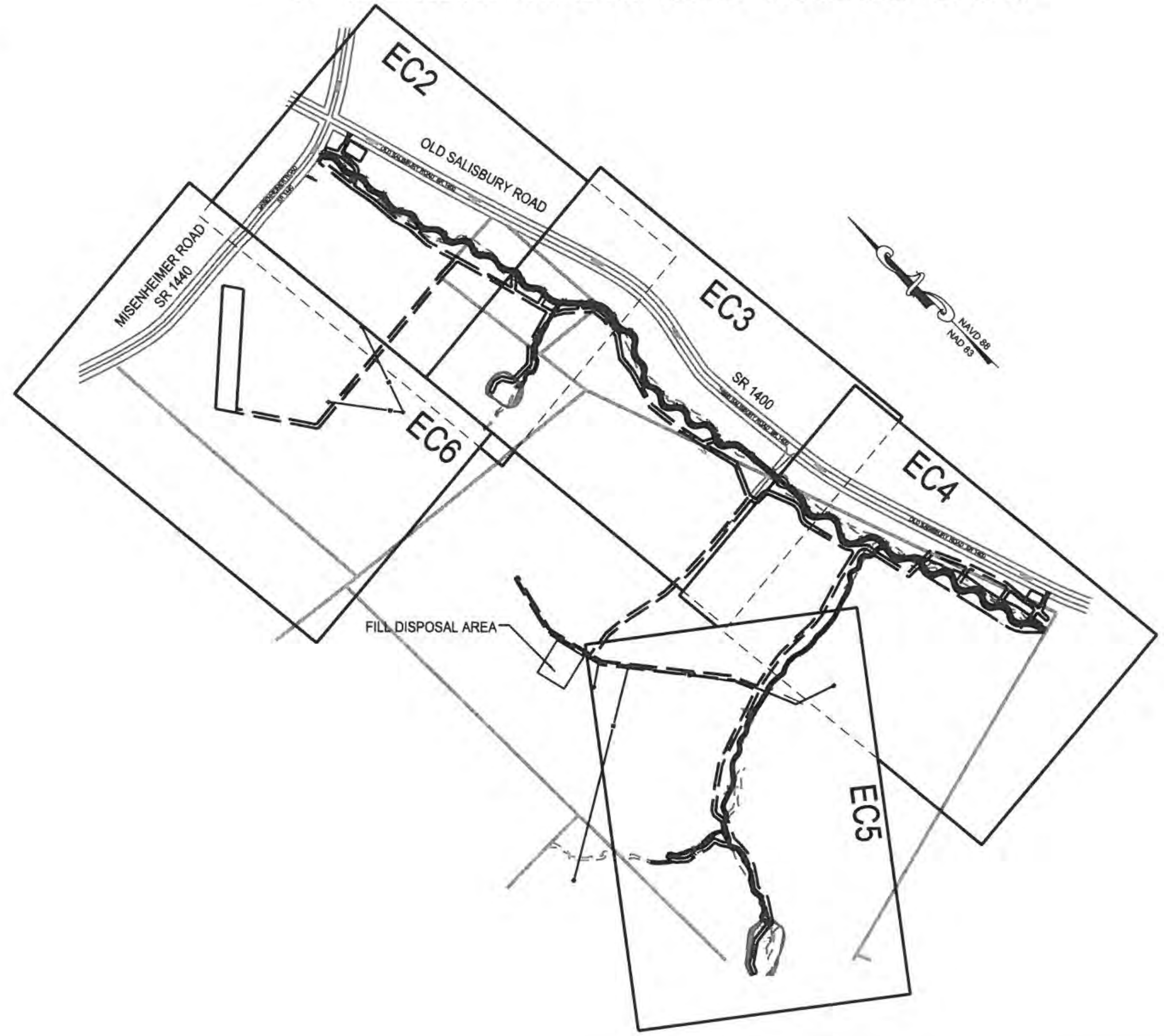
NC ECOSYSTEM ENHANCEMENT PROGRAM

EROSION CONTROL PLAN

LOCATION: APPROXIMATELY 9 MILES NORTH OF ALBEMARLE, NC - NEAR THE INTERSECTION OF MISENHEIMER ROAD AND OLD SALISBURY ROAD

TYPE OF WORK: STREAM RESTORATION & ENHANCEMENT - WETLAND RESTORATION & CREATION CONSTRUCTED WETLAND BMP'S

STD. NO.	DESCRIPTION	SYMBOL
6.06	TEMPORARY GRAVEL CONSTRUCTION ACCESS	
6.60	TEMPORARY SEDIMENT TRAP	
6.62	SILT FENCE	
6.63	TEMPORARY ROCK DAM	
6.70	TEMPORARY STREAM CROSSING	
	TEMPORARY WETLAND CROSSING	
	HAUL ROAD	
	LIMITS OF DISTURBANCE	



UNNAMED TRIBUTARY TO TOWN CREEK

PROJECT: 120857

GRAPHIC SCALES

40 0 40 80

PLANS

THIS PROJECT CONTAINS EROSION CONTROL PLANS FOR ALL PHASES OF CONSTRUCTION.

TOTAL DISTURBED AREA = 19.2 Acres

PROJECT STANDARDS

THE FOLLOWING STANDARDS AS THEY APPEAR IN THE "NC EROSION CONTROL PLANNING AND DESIGN MANUAL" AND ARE APPLICABLE TO THIS PROJECT AND BY REFERENCE HEREBY ARE CONSIDERED PART OF THE PLANS.

6.06 TEMPORARY GRAVEL CONSTRUCTION ACCESS
6.60 TEMPORARY SEDIMENT TRAP
6.62 SILT FENCE
6.63 TEMPORARY ROCK DAM
6.70 TEMPORARY STREAM CROSSING

PREPARED IN THE OFFICE OF:

Baker

Michael Baker Engineering Inc.
5550 Seventy-Seven Center Dr., Suite 320
Charlotte, NORTH CAROLINA 28217
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

LETTING DATE:

KRISTI SUGGS
PROJECT MANAGER

WILLIAM SCOTT HUNT III, PE
PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

12.22.14

SIGNATURE: P.E.

PROJECT ENGINEER

Baker
Michael Baker Engineering Inc.
5550 Seventy-Seven Center Dr., Suite 320
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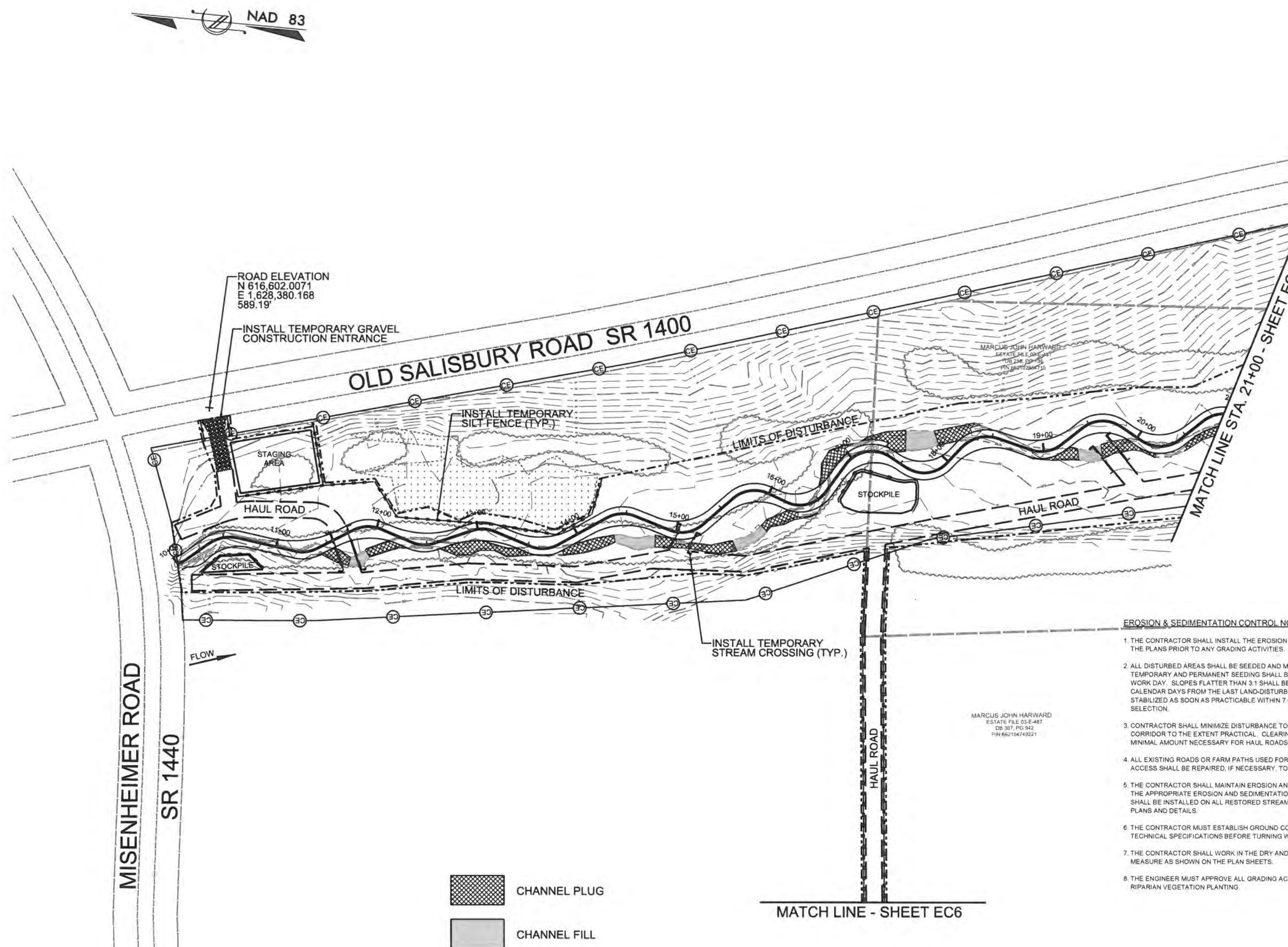
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14

2/26/03



EROSION & SEDIMENTATION CONTROL NOTES:

1. THE CONTRACTOR SHALL INSTALL THE EROSION AND SEDIMENTATION CONTROL MEASURES AS SHOWN ON THE PLANS PRIOR TO ANY GRADING ACTIVITIES. SEE SHEET 3 FOR GENERAL CONSTRUCTION SEQUENCE.
2. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED PER THE PLANS AND TECHNICAL SPECIFICATIONS. TEMPORARY AND PERMANENT SEEDING SHALL BE PLACED ON ALL DISTURBED AREAS BY THE END OF EACH WORK DAY. SLOPES FLATTER THAN 3:1 SHALL BE STABILIZED WITH GROUND COVER WITHIN FOURTEEN (14) CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY. ALL SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED AS SOON AS PRACTICABLE WITHIN 7 CALENDAR DAYS. SEE SHEET 1A FOR VEGETATION SELECTION.
3. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING BUFFER VEGETATION AND CONSTRUCTION CORRIDOR TO THE EXTENT PRACTICAL. CLEARING AND GRUBBING ACTIVITIES SHALL BE LIMITED TO THE MINIMAL AMOUNT NECESSARY FOR HAUL ROADS, CHANNEL RELOCATIONS, AND STOCKPILE AREAS.
4. ALL EXISTING ROADS OR FARM PATHS USED FOR CONSTRUCTION ACTIVITES SUCH AS HAUL ROADS AND SITE ACCESS SHALL BE REPAIRED, IF NECESSARY, TO THE PRE-CONSTRUCTION CONDITION OR BETTER.
5. THE CONTRACTOR SHALL MAINTAIN EROSION AND SEDIMENTATION CONTROL DEVICES IN ACCORDANCE WITH THE APPROPRIATE EROSION AND SEDIMENTATION CONTROL ORDINANCES. EROSION CONTROL MATTING SHALL BE INSTALLED ON ALL RESTORED STREAMBANKS AND SIDE SLOPES STEEPER THAN AS SHOWN IN THE PLANS AND DETAILS.
6. THE CONTRACTOR MUST ESTABLISH GROUND COVER VEGETATION IN ACCORDANCE WITH THE PLANS AND TECHNICAL SPECIFICATIONS BEFORE TURNING WATER INTO THE NEW STREAM CHANNEL SEGMENTS.
7. THE CONTRACTOR SHALL WORK IN THE DRY AND UTILIZE A PUMP-AROUND OPERATION OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLAN SHEETS.
8. THE ENGINEER MUST APPROVE ALL GRADING ACTIVITIES AND GROUNDCOVER STABILIZATION PRIOR TO RIPARIAN VEGETATION PLANTING.

UT TO TOWN CREEK EROSION CONTROL PLAN

50 0 50 100
SCALE (FT)

12/22/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	EC3

PROJECT ENGINEER

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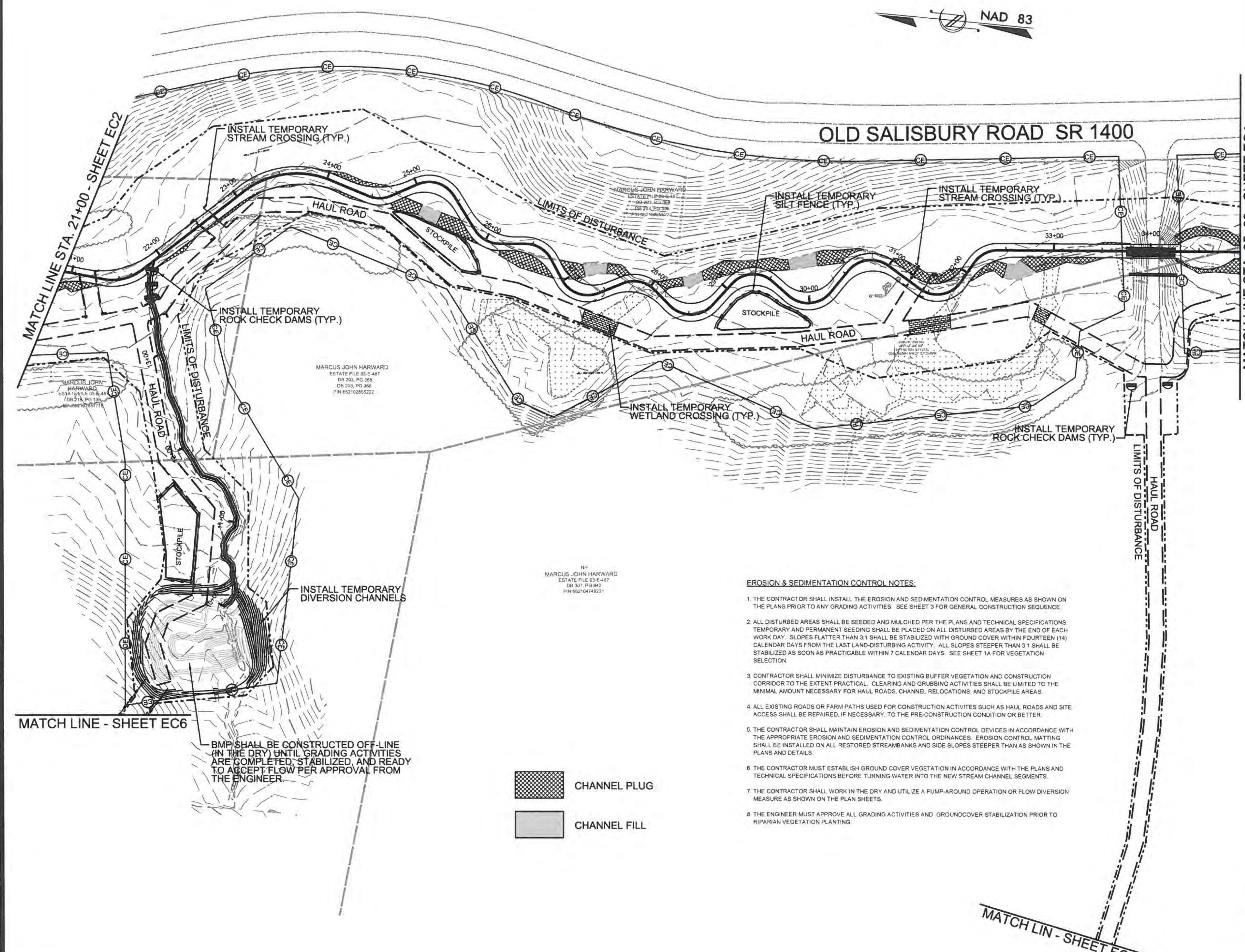
License #: F-1084



EROSION & SEDIMENTATION CONTROL NOTES:

1. THE CONTRACTOR SHALL INSTALL THE EROSION AND SEDIMENTATION CONTROL MEASURES AS SHOWN ON THE PLANS PRIOR TO ANY GRADING ACTIVITIES. SEE SHEET 3 FOR GENERAL CONSTRUCTION SEQUENCE.
2. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED PER THE PLANS AND TECHNICAL SPECIFICATIONS. TEMPORARY AND PERMANENT SEEDING SHALL BE PLACED ON ALL DISTURBED AREAS BY THE END OF EACH WORK DAY. SLOPES FLATTER THAN 3:1 SHALL BE STABILIZED WITH GROUND COVER WITHIN FOURTEEN (14) CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY. ALL SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED AS SOON AS PRACTICABLE WITHIN 7 CALENDAR DAYS. SEE SHEET 1A FOR VEGETATION SELECTION.
3. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING BUFFER VEGETATION AND CONSTRUCTION CORRIDOR TO THE EXTENT PRACTICAL. CLEARING AND GRUBBING ACTIVITIES SHALL BE LIMITED TO THE MINIMAL AMOUNT NECESSARY FOR HAUL ROADS, CHANNEL RELOCATIONS, AND STOCKPILE AREAS.
4. ALL EXISTING ROADS OR FARM PATHS USED FOR CONSTRUCTION ACTIVITES SUCH AS HAUL ROADS AND SITE ACCESS SHALL BE REPAIRED, IF NECESSARY, TO THE PRE-CONSTRUCTION CONDITION OR BETTER.
5. THE CONTRACTOR SHALL MAINTAIN EROSION AND SEDIMENTATION CONTROL DEVICES IN ACCORDANCE WITH THE APPROPRIATE EROSION AND SEDIMENTATION CONTROL ORDINANCES. EROSION CONTROL MATTING SHALL BE INSTALLED ON ALL RESTORED STREAMBANKS AND SIDE SLOPES STEEPER THAN AS SHOWN IN THE PLANS AND DETAILS.
6. THE CONTRACTOR MUST ESTABLISH GROUND COVER VEGETATION IN ACCORDANCE WITH THE PLANS AND TECHNICAL SPECIFICATIONS BEFORE TURNING WATER INTO THE NEW STREAM CHANNEL SEGMENTS.
7. THE CONTRACTOR SHALL WORK IN THE DRY AND UTILIZE A PUMP-AROUND OPERATION OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLAN SHEETS.
8. THE ENGINEER MUST APPROVE ALL GRADING ACTIVITIES AND GROUNDCOVER STABILIZATION PRIOR TO RIPARIAN VEGETATION PLANTING.

UT TO TOWN CREEK
EROSION CONTROL PLAN

50 0 50 100
SCALE (FT)

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	EC4

PROJECT ENGINEER

Baker

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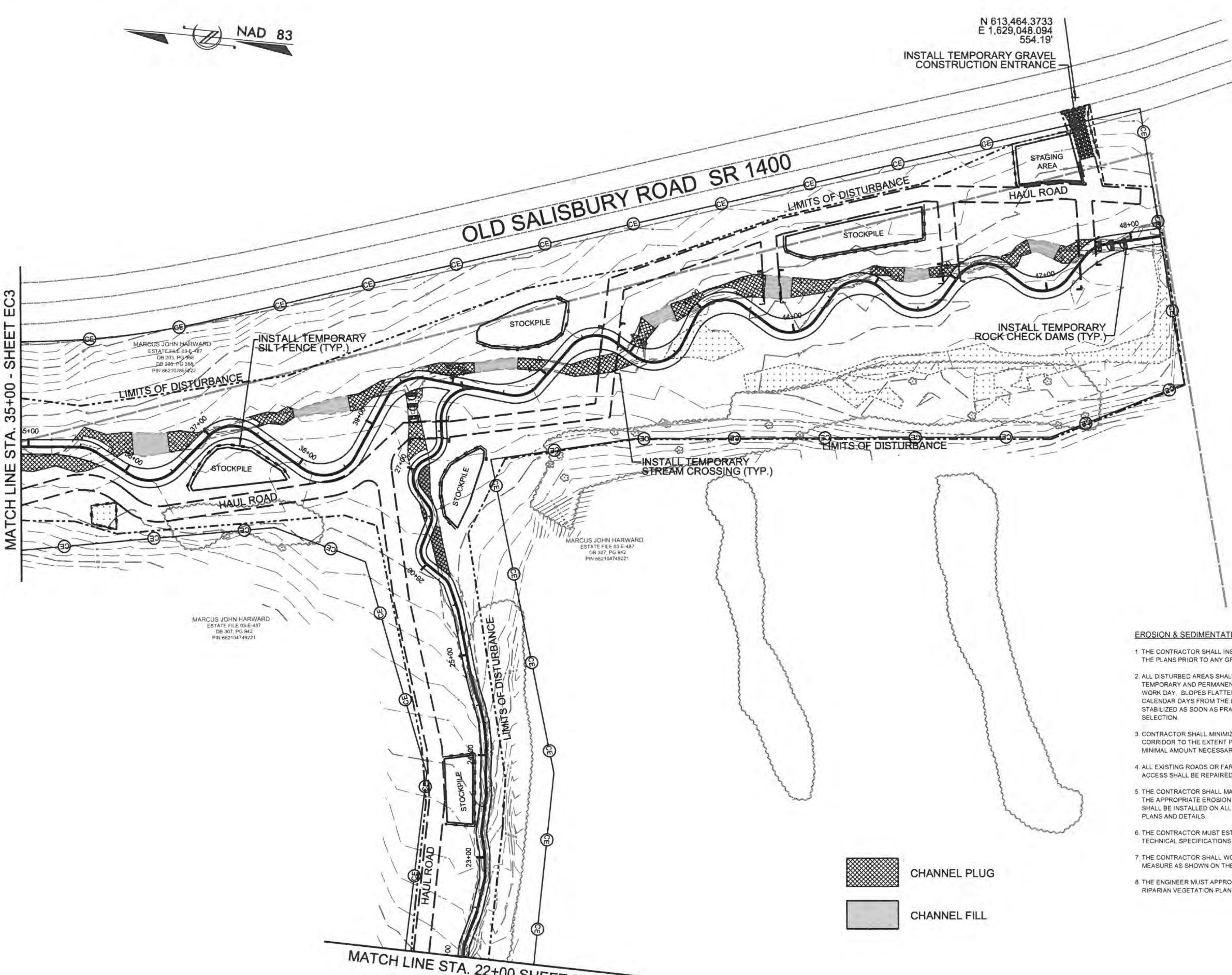
License #: F-1084

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III
12.22.14



CHANNEL PLUG

CHANNEL FILL

EROSION & SEDIMENTATION CONTROL NOTES:

1. THE CONTRACTOR SHALL INSTALL THE EROSION AND SEDIMENTATION CONTROL MEASURES AS SHOWN ON THE PLANS PRIOR TO ANY GRADING ACTIVITIES. SEE SHEET 3 FOR GENERAL CONSTRUCTION SEQUENCE.
2. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED PER THE PLANS AND TECHNICAL SPECIFICATIONS. TEMPORARY AND PERMANENT SEEDING SHALL BE PLACED ON ALL DISTURBED AREAS BY THE END OF EACH WORK DAY. SLOPES FLATTER THAN 3:1 SHALL BE STABILIZED WITH GROUND COVER WITHIN FOURTEEN (14) CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY. ALL SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED AS SOON AS PRACTICABLE WITHIN 7 CALENDAR DAYS. SEE SHEET 1A FOR VEGETATION SELECTION.
3. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING BUFFER VEGETATION AND CONSTRUCTION CORRIDOR TO THE EXTENT PRACTICAL. CLEARING AND GRUBBING ACTIVITIES SHALL BE LIMITED TO THE MINIMAL AMOUNT NECESSARY FOR HAUL ROADS, CHANNEL RELOCATIONS, AND STOCKPILE AREAS.
4. ALL EXISTING ROADS OR FARM PATHS USED FOR CONSTRUCTION ACTIVITES SUCH AS HAUL ROADS AND SITE ACCESS SHALL BE REPAIRED, IF NECESSARY, TO THE PRE-CONSTRUCTION CONDITION OR BETTER.
5. THE CONTRACTOR SHALL MAINTAIN EROSION AND SEDIMENTATION CONTROL DEVICES IN ACCORDANCE WITH THE APPROPRIATE EROSION AND SEDIMENTATION CONTROL ORDINANCES. EROSION CONTROL MATTING SHALL BE INSTALLED ON ALL RESTORED STREAMBANKS AND SIDE SLOPES STEEPER THAN AS SHOWN IN THE PLANS AND DETAILS.
6. THE CONTRACTOR MUST ESTABLISH GROUND COVER VEGETATION IN ACCORDANCE WITH THE PLANS AND TECHNICAL SPECIFICATIONS BEFORE TURNING WATER INTO THE NEW STREAM CHANNEL SEGMENTS.
7. THE CONTRACTOR SHALL WORK IN THE DRY AND UTILIZE A PUMP-AROUND OPERATION OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLAN SHEETS.
8. THE ENGINEER MUST APPROVE ALL GRADING ACTIVITIES AND GROUNDCOVER STABILIZATION PRIOR TO RIPARIAN VEGETATION PLANTING.

UT TO TOWN CREEK EROSION CONTROL PLAN

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SCALE (FT)

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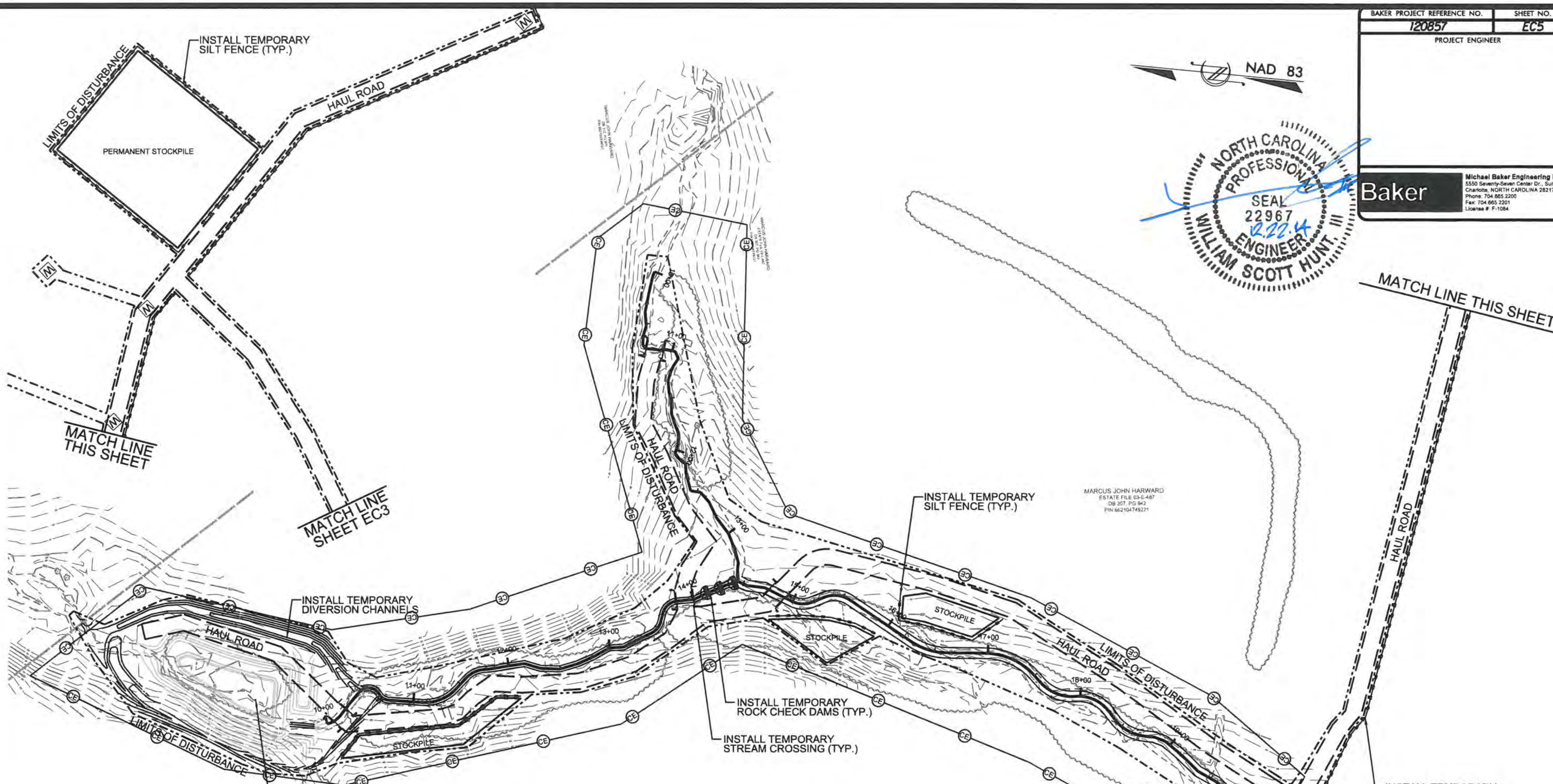
PROJECT ENGINEER



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CHANNEL PLUG

CHANNEL FILL

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UT TO TOWN CREEK EROSION CONTROL PLAN

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BAKER PROJECT REFERENCE NO.	SHEET NO.
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PROJECT ENGINEER

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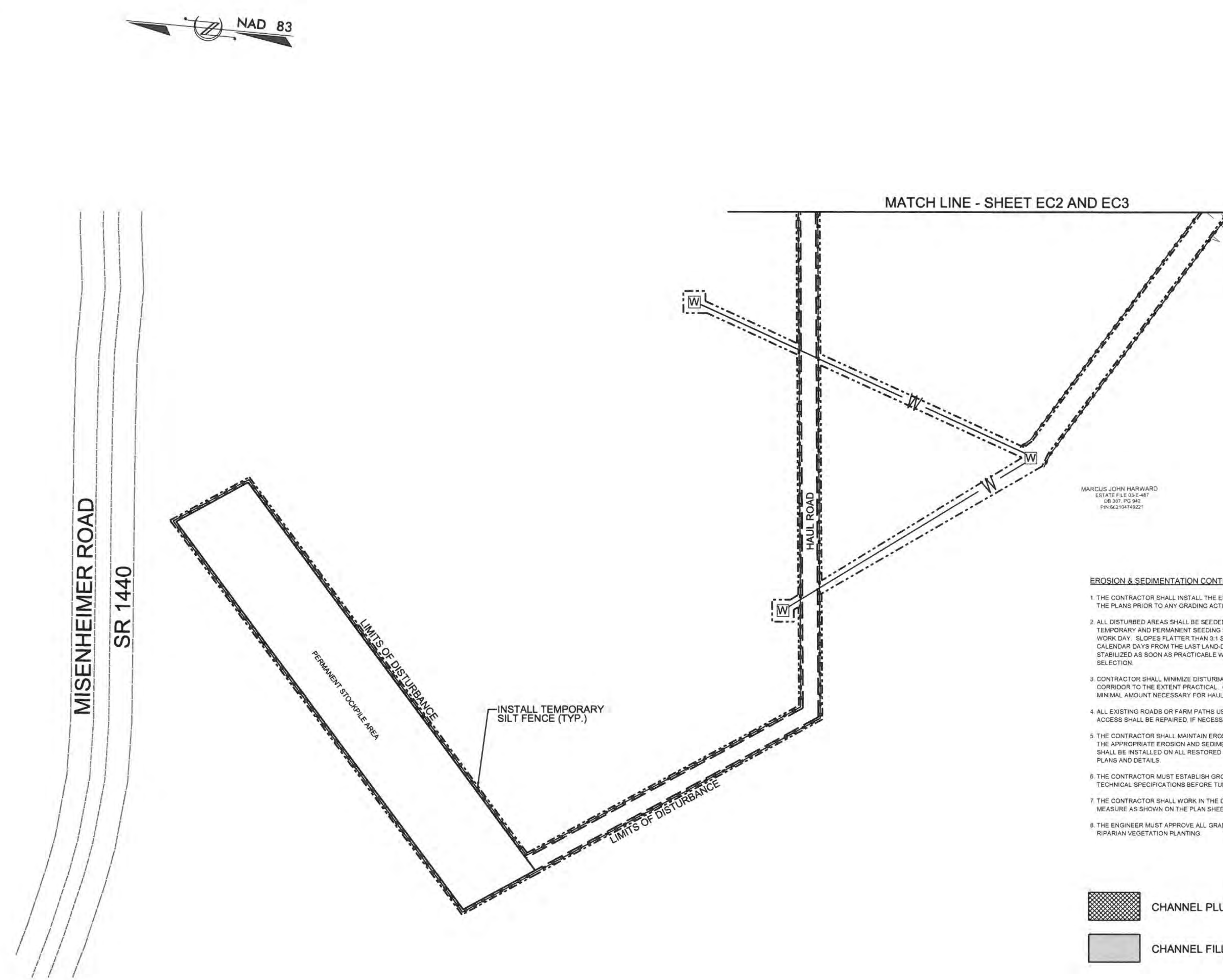

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III
12.22.14

ERROSION & SEDIMENTATION CONTROL NOTES:

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CHANNEL PLUG

CHANNEL FILL

UT TO TOWN CREEK
EROSION CONTROL PLAN

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BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	EC7

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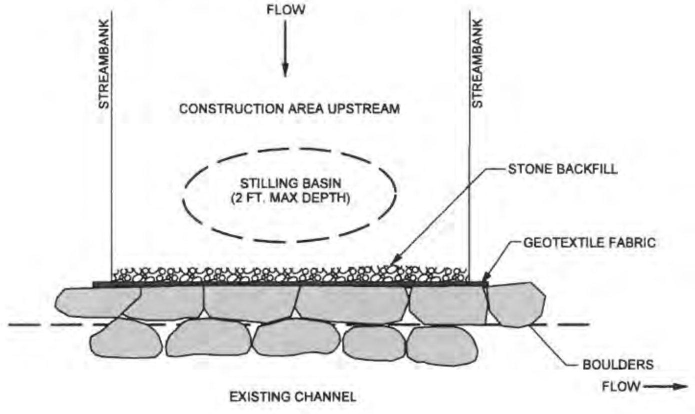
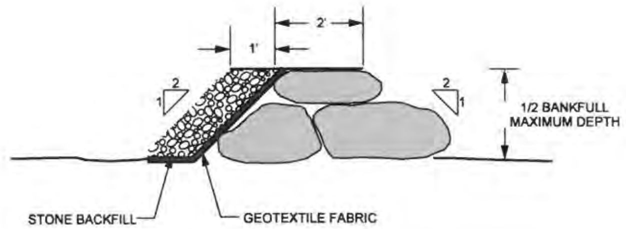
TEMPORARY ROCK DAM



PLAN VIEW

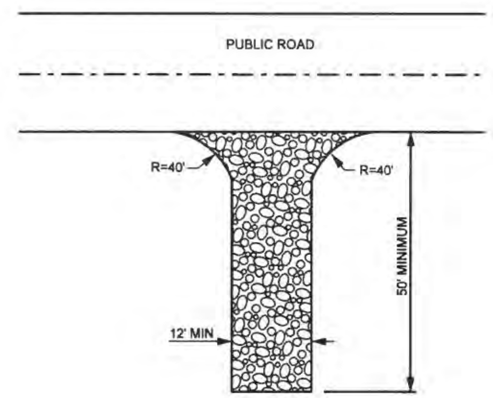


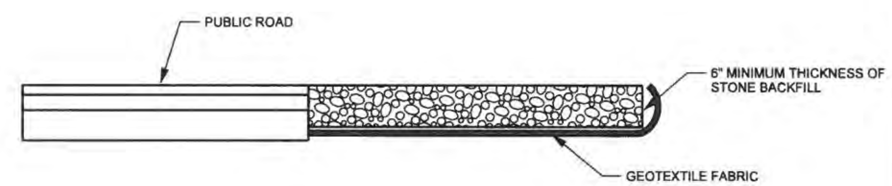
CROSS SECTION

NOTES:

CLEAN OUT STILLING BASIN OF TRAPPED SEDIMENT PRIOR TO REMOVAL.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

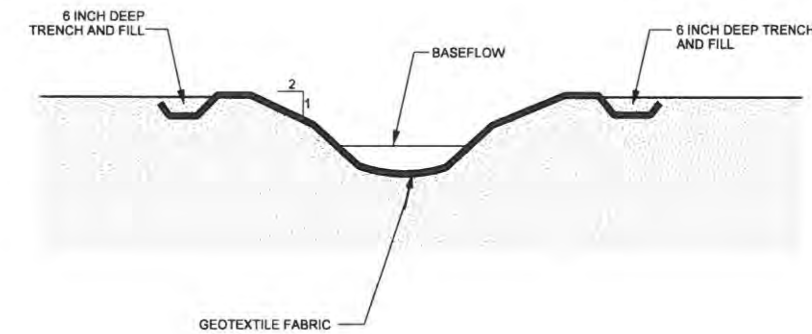




NOTES:

SPECIFICATION NO. 6.06 - CONSTRUCTION ACCESS "N.C. EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL MARCH 2009"

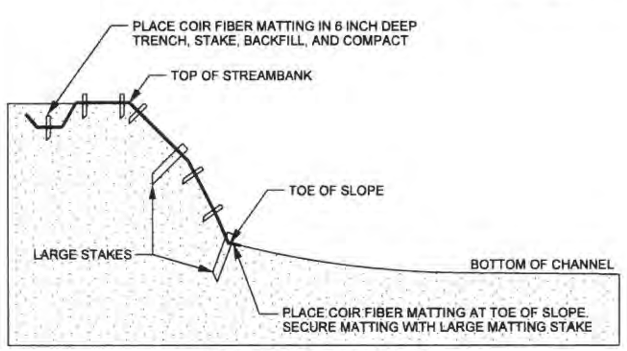
TEMPORARY DIVERSION CHANNEL



NOTES:

1. DIMENSIONS OF DIVERSION CHANNEL MAY BE ALTERED TO FIT SLOPE CONDITIONS.
2. ALIGN SEAMS OF FILTER FABRIC TO OVERLAP IN THE DIRECTION OF FLOW.
3. MAX SIDE SLOPE 2:1.
4. SEE TECHNICAL SPECIFICATIONS FOR FILTER FABRIC MATERIAL.

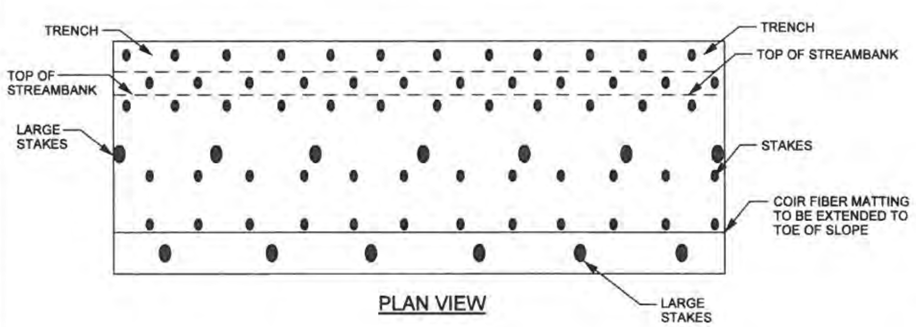
EROSION CONTROL MATTING



CROSS SECTION VIEW

TYPICAL LARGE MATTING STAKE

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



PLAN VIEW

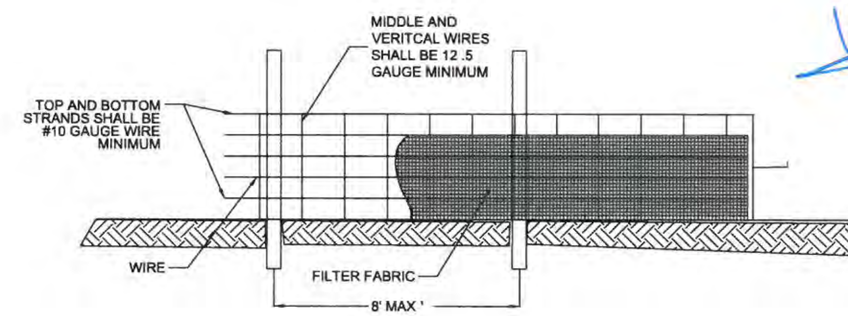
TYPICAL SMALL MATTING STAKE

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

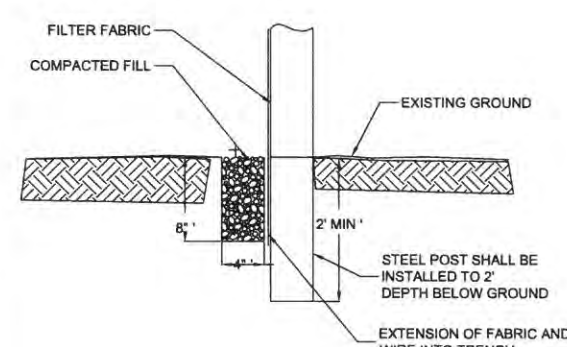
NOTES:

1. BANKS SHOULD BE SEEDED PRIOR TO PLACEMENT OF MATTING.
2. USE COIR FIBER MATTING.
3. LARGE STAKES SHOULD NOT BE SPACED FURTHER THAN 36" APART.
4. PLACE LARGE STAKES ALONG ALL SEAMS, IN THE CENTER OF BANK, AND TOE OF SLOPE.

TEMPORARY SILT FENCE



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
12.22.14



TEMPORARY SILT FENCE NOTES:

1. WIRE SHALL BE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.
2. FILTER FABRIC SHALL BE A MINIMUM OF 36" IN WIDTH AND FASTENED ADEQUATELY TO THE WIRE AS DIRECTED BY THE ENGINEER.
3. FILTER FABRIC SHOULD EXTEND INTO TRENCH.
4. 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE SHALL BE PROVIDED.
5. REFER TO STANDARD DRAWING NO. 1605.1"NCDOT ROADWAY STANDARD DRAWINGS," 2002.
6. INSTALL POSTS WITH THE NIPPLES FACING AWAY FROM THE SILT FENCE.
7. ATTACH THE FABRIC TO EACH POST WITH THREE TIES WITH THE TOP TIE WITHIN 8" OF THE TOP OF THE FABRIC.
8. WRAP APPROXIMATELY 6 INCHES OF FABRIC AROUND THE END POSTS AND SECURE WITH 3 TIES.
9. CONSTRUCT THE FILTER FABRIC FROM A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID JOINTS. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FILTER CLOTH ONLY AT A SUPPORT POST WITH 4 FEET MINIMUM OVERLAP TO THE NEXT POST.

MAINTENANCE NOTES

1. INSPECT SEDIMENT FENCES AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. MAKER ANY REQUIRED REPAIRS IMMEDIATELY.
2. SHOULD THE FABRIC OF A SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.
3. REMOVE SEDIMENT DEPOSITS AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING THE FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AND BRING THE AREA TO GRADE AND STABILIZE IT AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

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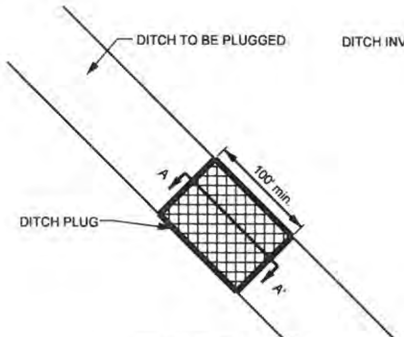
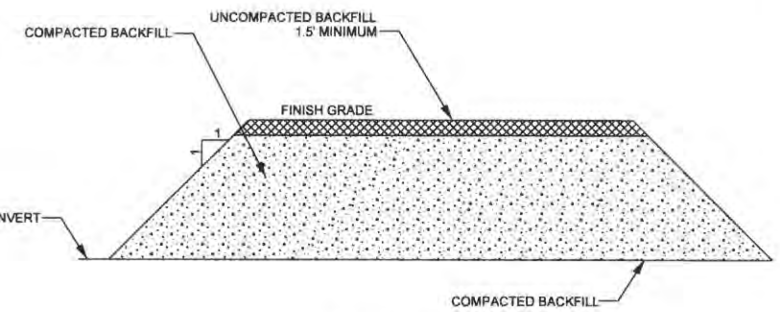
DITCH PLUG



PLAN VIEW

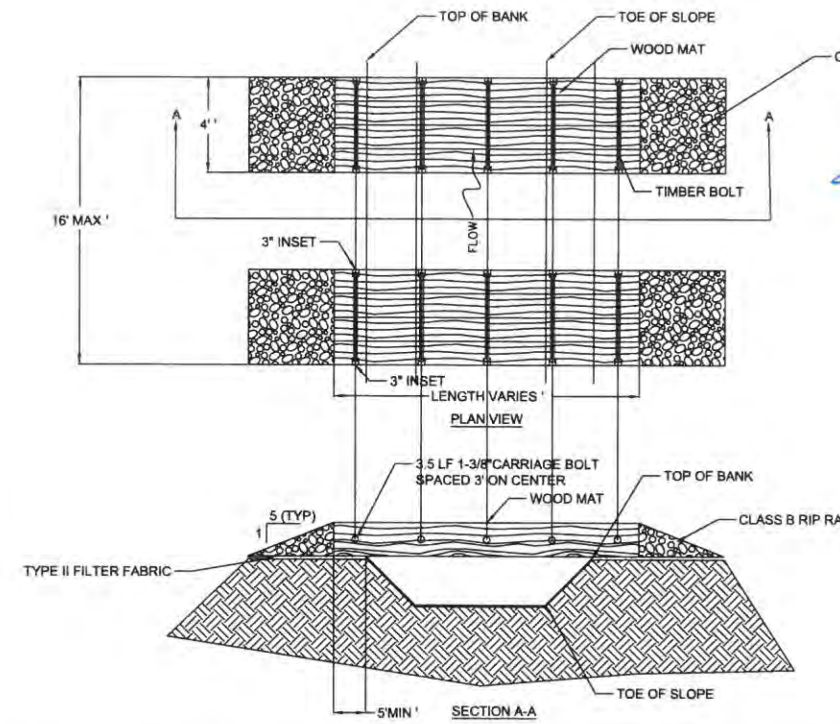


SECTION A - A'

NOTES:

1. COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.
2. FILL DITCH TO TOP OF BANKS OR AS DIRECTED BY ENGINEER.

TEMPORARY STREAM / WETLAND CROSSING



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
1/22/14

BAKER PROJECT REFERENCE NO.	SHEET NO.
120857	EC8

PROJECT ENGINEER

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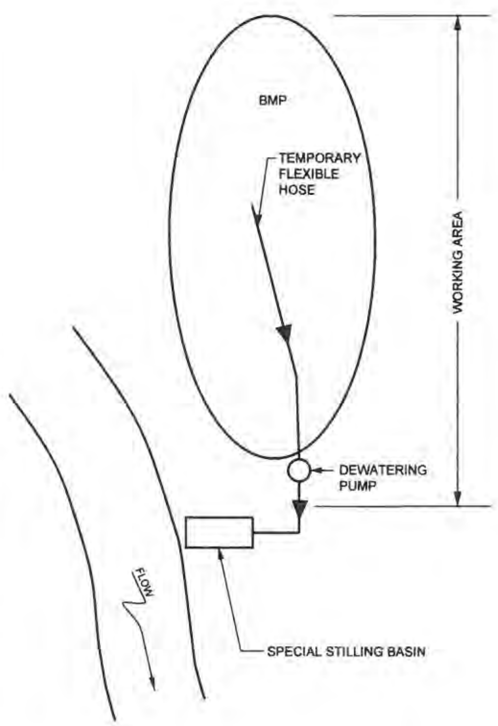
TEMPORARY STREAM CROSSING STRUCTURE NOTES:

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.
4. LINE STREAMBANK AND ACCESS RAMP AREA WITH NON-WOVEN FILTER FABRIC.
5. INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUDMAT.
8. THE MUD MAT SHALL BE OF SUFFICIENT SIZE AND WIDTH TO SUPPORT THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED, RECOMMENDED AT A 5:1 SLOPE.

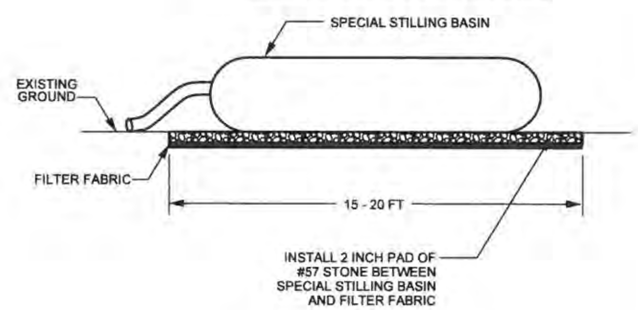
TEMPORARY STREAM CROSSING MAINTENANCE NOTES:

1. INSPECT TEMPORARY STREAM CROSSINGS AFTER RUN-OFF PRODUCING RAINS TO CHECK FOR BLOCKAGE IN CHANNEL, EROSION OF ABUTMENTS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING. MAKE ALL REPAIRS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.

DEWATERING PUMP



SPECIAL STILLING BASIN

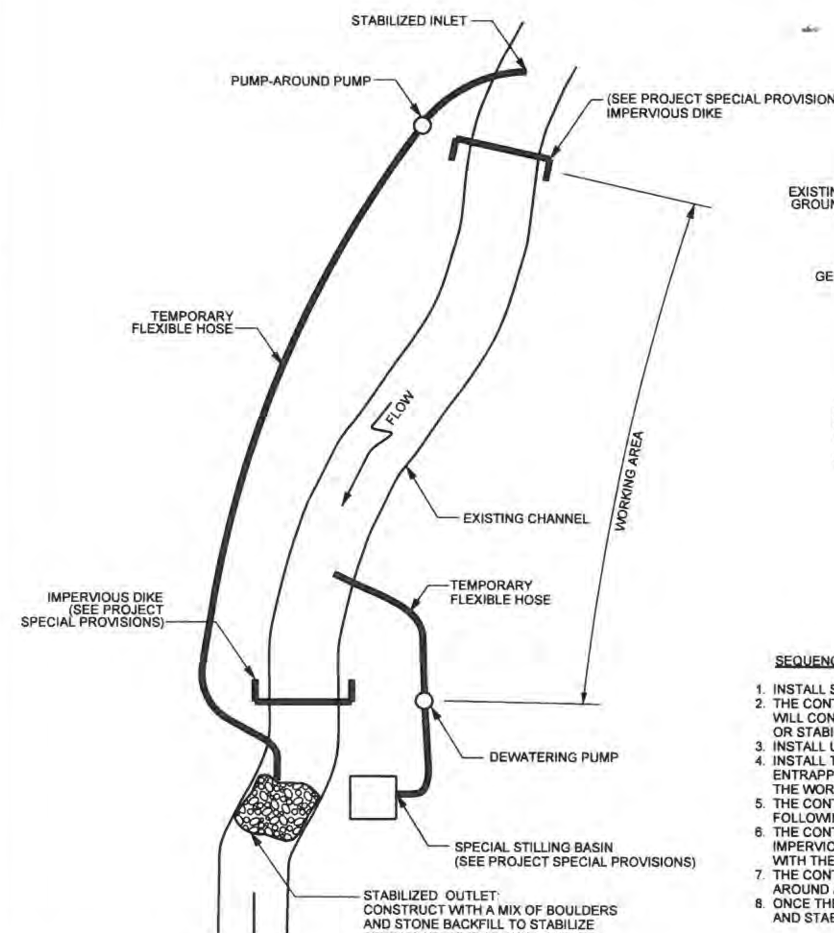


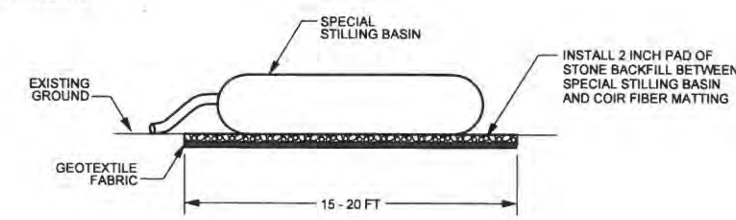
1. INSTALL SPECIAL SILLING BASIN OUTSIDE OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE DEWATERING PUMP AND THE TEMPORARY FLEXIBLE HOSE THAT WILL CONVEY THE WATER IN THE BMP TO THE SPECIAL STILLING BASIN OR STABILIZED OUTLET.
3. THE CONTRACTOR WILL PERFORM WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
4. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SILT, REMOVE PUMPS, AND TEMPORARY FLEXIBLE HOSE.
5. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE SPECIAL STILLING BASIN AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.

SEQUENCE OF CONSTRUCTION FOR DEWATERING PUMP

1. WHEN NECESSARY, INSTALL THE PUMPING APPARATUS TO DEWATER THE BMP WORK AREA. THE PUMP AND HOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE BMP WITHIN 24 HOURS. THE WATER SHALL BE PUMPED FROM THE BMP TO THE SPECIAL STILLING BASIN.
2. THE CONTRACTOR MAY THEN FINISH GRADE AND PLANT THE BMP IN ACCORDANCE WITH THE PLAN AND THE GENERAL CONSTRUCTION SEQUENCE.
3. ONCE GRADING AND PLANTING ARE COMPLETE, REMOVE PUMP AND HOSE.
4. STABILIZE DISTURBED AREAS WITH TEMPORARY SEED AND MULCH.

TYPICAL PUMP AROUND OPERATION





NOTES:

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. THE PUMP-AROUND PUMP SHOULD ADEQUATELY CONVEY 1 CFS (450 GALLONS PER MINUTE).

SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL STABILIZED OUTLET AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY FLEXIBLE HOSE THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE TO THE SPECIAL STILLING BASIN OR STABILIZED OUTLET.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL FLOW INTO A SPECIAL STILLING BASIN.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. THE CONTRACTOR WILL COMPLETE ALL GRADING AND STABILIZATION IN ONE DAY WITHIN THE PUMP AROUND AREA BETWEEN THE IMPERVIOUS DIKES.
8. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE SPECIAL STILLING BASIN AND STABILIZED OUTLET AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.