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

REPLY TO
ATTENTION OF:

CESAW-RG/Tugwell 21 May, 2014

MEMORANDUM FOR RECORD

SUBJECT: Poplin Ridge- 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. Please note that this is the second review. Due to a change made to the project following the first review and plan approval, the site was reposted. Comments noted below also include those generated during the initial review of the project, as noted by the date of the comment, and they may have been addressed in the most recent version of the Mitigation Plan but they are provided here to provide a complete record of the comments generated during the review process.

NCEEP Project Name: Poplin Ridge Stream Mitigation Site, Union County, NC

USACE AID#: SAW-2012-01079
NCEEP #: 95359

30-Day Comment Deadline: 7 May, 2014

1. *Eric Kulz, NCDWR, 16 April, 2014*:

- The report states that utility (electric) easement crossings will be planted with shrub and herbaceous vegetation. In addition, these easements will be mowed or treated with herbicide periodically by the utility. As such, the streams within these corridors will never meet performance standards for vegetation, and will have degraded function (thermoregulation, nutrient input, LWD input). Credit should be adjusted for each of these stream segments to reflect the reduced functional uplift, as consistent with IRT/USACE adjustments on other similar sites.
- A utility enters the conservation easement and runs parallel to UT1-4. The width of the remaining area that will be forested is unclear in the plans. While buffer/conservation easement width was added on the opposite side of the stream, the functional uplift to this portion of the stream, and hence the credits, may be affected depending on the forested width.

30-Day Comment Deadline: 14 November, 2013 (These comments are from the initial review.)

1. *Paul Wiesner, NCEEP, 17 October, 2013:*

- I missed this in the initial review, but it needs to make it into the final document. The credit release schedule in document is incorrect. The Poplin Ridge project was instituted after Nov. 7, 2011. The final Poplin Ridge mitigation plan should utilize the credit release schedule for projects instituted after Nov. 7, 2011 per the most recent EEP template: NCEEP Mitigation Plan Template_version 2.2_adopted 8 June 2012

2. *Eric Kulz, NCDWR, 14 November, 2013*:

- 1) The report states that utility (electric) easement crossings will be planted with shrub and herbaceous vegetation. In addition, these easements will be mowed or treated with herbicide periodically by the utility. As such, the streams within these corridors will never meet performance standards for vegetation, and will have degraded function (thermoregulation, nutrient input, LWD input). Credit should be adjusted for each of these stream segments to reflect the reduced functional uplift, as consistent with IRT/USACE adjustments on other similar sites.
- 2) Figure 23 identifies the utility crossing over the northern portion of UT2-4 as a 30-foot ROW claimed by Union Power Cooperative. The crossing over the lower portion of UT2-4 is labeled as "Unknown right-of-way claimed by Union Power Cooperative". The width of the ROW should be verified by the utility company to ascertain that it is indeed a 30-foot easement and not a wider area which can be maintained.
- 3) A utility easement enters the conservation easement along UT1-4. The width of the remaining area that will be forested is unclear in the plans. While buffer/conservation easement width was added on the opposite side of the stream, the functional uplift to this portion of the stream may be affected depending on the forested width. Please provide the width from top of bank of the area to be planted in trees at this location.

3. *T. Crumbley and T. Tugwell, USACE, 14 November, 2013*:

- A brief discussion on impacts to existing wetlands is presented in the Draft plan, but any impacts (eg. filling, draining, converting) to current waters of the U.S. (streams, wetlands and open waters) must be accounted for and discussed in the Pre-Construction Notification (PCN) and the loss or conversion of those waters must be replaced on-site. (the conversion of ponds to stream is considered an impact, but the functional uplift provided allows for this conversion to be conducted under NWP 27. These impacts do, however need to be accounted for in the PCN).
- Please discuss in further detail any required maintenance of the diffuse flow structures shown on Design Drawing #s 12, 15, 23, and 24.
- Section 9, pg. 67. Performance Standards: It is stated that the Performance Standards will be consistent with published federal rules, but additional District/EEP guidance must also be adhered to. Specifically the “Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and Wetland Mitigation” Dated November 7, 2011. (Section IV C.) *All monitoring and performance standard

requirements need to comply with this EEP/District guidance unless the project was instituted prior to the release of this guidance*

- Under normal project review processes, a Jurisdictional Determination would have been submitted concurrently with the Draft mitigation plan. Since no determination was submitted, please be advised that linear footage and credit amounts may be subject to change, dependent upon the results of said determination.
- The upstream reach of UT1 and UT1-B are proposed for Preservation. In areas where work conducted will result in functional uplift (eg. wider buffers, stabilization, or invasive control) the mitigation plan should identify these areas as Enhancement at a 5:1 ratio. If none of these activities will occur then the Preservation ratio should be reduced, unless justification for Preservation at a 5:1 ratio, with consideration of factors mentioned in the District stream preservation guidance, is provided.

/s/
Todd Tugwell
Special Projects Manager
Regulatory Division

M E M O R A N D U M

WK DICKSON
community infrastructure consultants

720 Corporate Center Drive Raleigh, North Carolina 27607 919.782.0495 tel. 919.782.9672 fax

TO: **David Godley, EBX**

FROM: **Ward Marotti, WKD**

DATE: **May 28, 2014**

RE: **NCIRT Review of the Poplin Ridge Draft Mitigation Plan; EEP # 95359; Contract #004672**

Listed below are the comments provided by the NCIRT to NCEEP on November 15, 2013 and on May 21, 2013 regarding the Poplin Ridge Stream Restoration Project Mitigation Plan and WKD's responses.

1. *Eric Kulz, NCDWR, 16 April, 2014:*

- The report states that utility (electric) easement crossings will be planted with shrub and herbaceous vegetation. In addition, these easements will be mowed or treated with herbicide periodically by the utility. As such, the streams within these corridors will never meet performance standards for vegetation, and will have degraded function (thermoregulation, nutrient input, LWD input). Credit should be adjusted for each of these stream segments to reflect the reduced functional uplift, as consistent with IRT/USACE adjustments on other similar sites.

See #2-1 below. There are breaks in the conservation easement at the utility easement crossings. Therefore, the stream segments within these areas are not included in the conservation easement, and will not yield mitigation credits.

- A utility enters the conservation easement and runs parallel to UT1-4. The width of the remaining area that will be forested is unclear in the plans. While buffer/conservation easement width was added on the opposite side of the stream, the functional uplift to this portion of the stream, and hence the credits, may be affected depending on the forested width.

See #2-3 below. The buffer width ranges from 15 to 50 feet where the conservation easement is adjacent to the utility easement. The buffer on the opposite (right) bank has been widened up to 100 feet. As was discussed in the IRT on-site field meeting on July 11, 2012, the buffer width was increased to offset the power line easement encroachment; therefore, no adjustments were made to the proposed credit yield.

1. *Paul Wiesner, NCEEP, 17 October, 2013*:

- I missed this in the initial review, but it needs to make it into the final document. The credit release schedule in document is incorrect. The Poplin Ridge project was instituted after Nov. 7, 2011. The final Poplin Ridge mitigation plan should utilize the credit release schedule for projects instituted after Nov. 7, 2011 per the most recent EEP template: NCEEP Mitigation Plan Template_version 2.2_adopted 8 June 2012

Table 18 (Stream Credits) has been revised to reflect the most recent EEP Mitigation Plan template.

2. *Eric Kulz; NCDWR, 14 November, 2013:*
   - 1) The report states that utility (electric) easement crossings will be planted with shrub and herbaceous vegetation. In addition, these easements will be mowed or treated with herbicide periodically by the utility. As such, the streams within these corridors will never meet performance standards for vegetation, and will have degraded function (thermoregulation, nutrient input, LWD input). Credit should be adjusted for each of these stream segments to reflect the reduced functional uplift, as consistent with IRT/USACE adjustments on other similar sites.

There are breaks in the conservation easement at the utility easement crossings. Therefore, the stream segments within these areas are not included in the conservation easement, and will not yield mitigation credits.

   - 2) Figure 23 identifies the utility crossing over the northern portion of UT2-4 as a 30-foot ROW claimed by Union Power Cooperative. The crossing over the lower portion of UT2-4 is labeled as "Unknown right-of-way claimed by Union Power Cooperative". The width of the ROW should be verified by the utility company to ascertain that it is indeed a 30-foot easement and not a wider area which can be maintained.

Union Power Cooperative has verbally confirmed that the easement in question is 30 feet wide.

   - 3) A utility easement enters the conservation easement along UT1-4. The width of the remaining area that will be forested is unclear in the plans. While buffer/conservation easement width was added on the opposite side of the stream, the functional uplift to this portion of the stream may be affected depending on the forested width. Please provide the width from top of bank of the area to be planted in trees at this location.

The buffer width ranges from 15 to 50 feet where the conservation easement is adjacent to the utility easement. The buffer on the opposite (right) bank has been widened up to 100 feet.

3. *T. Crumbley and T. Tugwell; USACE, 14 November, 2013*:
   - A brief discussion on impacts to existing wetlands is presented in the Draft plan, but any impacts (eg. filling, draining, converting) to current waters of the U.S. (streams, wetlands and open waters) must be accounted for and discussed in the Pre-Construction Notification (PCN) and the loss or conversion of those waters must be replaced on-site. (the conversion of ponds to stream is considered an impact, but the functional uplift provided allows for this

conversion to be conducted under NWP 27. These impacts do, however need to be accounted for in the PCN).

Impacts to current waters of the U.S. will be accounted for in the PCN.

- Please discuss in further detail any required maintenance of the diffuse flow structures shown on Design Drawing #s 12, 15, 23, and 24.

No further maintenance is required within the easement for the diffuse flow structures.

- Section 9, pg. 67. Performance Standards: It is stated that the Performance Standards will be consistent with published federal rules, but additional District/EEP guidance must also be adhered to. Specifically the "Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and Wetland Mitigation" Dated November 7, 2011. (Section IV C.) *All monitoring and performance standard requirements need to comply with this EEP/District guidance unless the project was instituted prior to the release of this guidance*

Section 9, p. 65 was amended to state that monitoring success criteria will be established in accordance with the Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and Wetland Mitigation (Section IV C) dated November 7, 2011.

- Under normal project review processes, a Jurisdictional Determination would have been submitted concurrently with the Draft mitigation plan. Since no determination was submitted, please be advised that linear footage and credit amounts may be subject to change, dependent upon the results of said determination.

We understand that linear footage and credit amounts may be subject to change, dependent upon the results of the Jurisdictional Determination.

- The upstream reach of UT1 and UT1-B are proposed for Preservation. In areas where work conducted will result in functional uplift (eg. wider buffers, stabilization, or invasive control) the mitigation plan should identify these areas as Enhancement at a 5:1 ratio. If none of these activities will occur then the Preservation ratio should be reduced, unless justification for Preservation at a 5:1 ratio, with consideration of factors mentioned in the District stream preservation guidance, is provided.

The mitigation plan was amended throughout to change the 'Preservation' stream segments to 'Stream Preservation and Buffer Enhancement' at a ratio of 5:1.

FINAL MITIGATION PLAN

POPLIN RIDGE STREAM RESTORATION PROJECT
UNION COUNTY, NORTH CAROLINA
EEP PROJECT # 95359
CONTRACT # 004672

Yadkin River Basin
HUC 03040105070050

Prepared for:

Ecosystem Enhancement PROGRAM

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

July 2014

FINAL MITIGATION PLAN

Poplin Ridge Stream Restoration Project
Union County, North Carolina
EEP Project # 95359
Contract # 004672

Yadkin River Basin
HUC 03040105070050

Prepared for:

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program
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March 2014

EXECUTIVE SUMMARY

"This mitigation plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDENR Ecosystem Enhancement Program In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern NCEEP operations and procedures for the delivery of compensatory mitigation."

The Poplin Ridge Stream Restoration Project (EEP Project #95359) is located within an agricultural watershed in Union County, North Carolina, approximately six miles north of Monroe. Many stream channels in the area have been heavily impacted by channelization and agricultural practices. The project will involve the restoration and protection of streams in the Stewarts Creek watershed. The purpose of this restoration project is to restore and enhance a stream complex located within the Yadkin River Basin.

The project lies within USGS Hydrologic Unit Code 03040105070050 (USGS, 1998) and within the North Carolina Division of Water Quality (NCDWQ) Yadkin River Subbasin 03-07-14 (NCDENR, 2002). The easement totals 27.17 acres, and is split into two tributary systems (UT1 and UT2). The western system (UT1) is divided into seven reaches along four unnamed tributaries to East Fork Stewarts Creek. The eastern system (UT2) is divided into five reaches, all unnamed tributaries of East Fork Stewarts Creek. UT1-Reach 1 has a drainage area of 0.21 square miles (136 acres); it begins at the start of the restoration project (STA 1+20) and extends southeast to STA 12+58. UT1-Reach 2 has a drainage area of 0.39 square miles (248 acres); it begins at STA 12+58 and extends to STA 24+89. UT1-Reach 3 has a drainage area of 0.60 square miles (384 acres); it begins at STA 24+89 and extends to STA 34+50. UT1-Reach 4 is the downstream section of UT1 (STA 34+50 to 46+60), and has a drainage area of 1.14 square miles (728 acres). Reach UT1-A has a drainage area of 0.14 square miles (88 acres) and flows south directly into UT1 at the break between Reaches 1 and 2. UT1-B has a drainage area of 0.19 square miles (120 acres) and flows south to the break between UT1 Reaches 2 and 3. UT1-C has a drainage area of 0.39 square miles (250 acres) and flows east to the break between UT1 Reaches 3 and 4 (**Figure 11a**). UT2-Reach 1 has a drainage area of 0.99 square miles (631 acres); it begins at the start of the UT2 portion of the restoration project (STA 0+00) and extends southwest to STA 4+90. UT2-Reach 2 has a drainage area of 1.13 square miles (726 acres); it begins at STA 4+90 and extends to STA 13+97. UT2-Reach 3 has a drainage area of 1.24 square miles (792 acres); it begins at STA 13+97 and extends to STA 19+18. UT2-Reach 4 has a drainage area of 1.35 square miles (861 acres); it begins at STA 19+18 and extends to STA 22+07. Reach UT2-A has a drainage area of 0.08 square miles (49 acres) and flows east into UT2 at the break between Reaches 2 and 3 (**Figure 11b**).

Land uses within and immediately adjacent to the project area include row crops, hay fields, pasture, concentrated animal feeding operations (CAFO), and wooded areas. The total easement area is 27.17 acres, approximately 4.69 acres of which are wooded and the remaining 22.48 acres is agricultural fields and pasture. Land use immediately surrounding the project consists of livestock grazing, row crops, and forestry. Current stream conditions along the project's proposed restoration reaches demonstrate significant habitat degradation as a result of impacts from livestock and channelization performed to promote agricultural activities. Additionally, the riparian buffer is in poor condition throughout most of the project area. Much of the riparian buffer is devoid of trees or shrubs, is active pasture and/or crops are present up to the edge of the existing channel. Little habitat is available to support aquatic life, and the channels are not maximizing their potential to filter nutrients because they are entrenched.

The goal for the Poplin Ridge Stream Restoration project is to restore the channelized streams based on reference reach conditions, enrich the aquatic ecosystem through stream restoration, riparian buffer habitat improvements and cattle exclusion, and provide ecological uplift within the Yadkin River Basin. The design will be based on reference conditions, USACE guidance (USACE, 2005), and criteria that are developed during this project to achieve success.

The objective for this restoration project is to design a natural waterway with appropriate cross-sectional dimension and slope that will provide function and meet the appropriate success criteria for the existing streams. Accomplishing this objective entails the restoration of natural stream characteristics, such as stable cross sections, planform, and in-stream habitat. The floodplain areas will be hydrologically reconnected to the channel to provide natural exchange and storage during flood events. Additional project objectives, including restoring the riparian buffer with native vegetation, ensuring hydraulic stability, and eradicating invasive species, are listed in **Section 1**.

The design approach for Poplin Ridge is to combine the analog method of natural channel design with analytical methods to evaluate stream flows and hydraulic performance of the channel and floodplain. The analog method involves the use of a "template" stream adjacent to, nearby, or previously in the same location as the design reach. The template parameters of the analog reach are replicated to create the features of the design reach. The analog approach is useful when watershed and boundary conditions are similar between the design and analog reaches (Skidmore, et al., 2001). Hydraulic geometry was developed using analytical methods in an effort to identify the design discharge.

The Poplin Ridge Site will include Priority Level I stream restoration, stream Enhancement Levels I and II, and Stream Preservation and Buffer Enhancement. Priority Level I stream restoration will incorporate the design of a single-thread meandering channel, with parameters based on data taken from a reference site, published empirical relationships, NC Rural Piedmont Regional Curves, and hydrologic and hydraulic analyses. Approximately 3,697 linear feet of stream channel will be reconstructed. Enhancement Level I will be applied to 3,305 linear feet of channel that requires stabilization bank improvements, and buffer restoration. Enhancement Level II will be applied to an additional 953 linear feet of channel that requires buffer enhancement and/or minimal bank and habitat improvements. Additionally, Stream Preservation and Buffer Enhancement is proposed on 1,192 feet of channel.

The stream and adjacent riparian areas will be protected by a minimum 50-foot permanent conservation easement, which will be fenced as needed to exclude livestock. However, an approximately 100-foot section along the east side of Reach UT1-R4 is proposed where the minimum 50-foot conservation easement cannot be met due to a Union Power Cooperative 100-foot right-of-way. At this location, the conservation easement will be extended to a width of 75- to 100-feet along the west side of the channel to offset the loss of easement on the opposite side. Additionally, areas within the power easement that fall within the 50-foot buffer will be planted with herbaceous/shrub vegetation. No loss in stream credit is expected at this location since the buffer width will be increased along the west side to offset the encroachment of the powerline easement as was discussed with the IRT on July 11, 2012.

Throughout the project area, there will be several breaks within the conservation easement where stream credits will not be generated to account either for 60-foot farm crossings or for existing Union Power overhead utility crossings. Along UT1, one existing crossing will be moved outside of the project, one new culvert crossing will be installed, and three culvert crossings will be upgraded. Along UT2, the existing culvert crossing will be upgraded, and there will be one 30-foot easement break associated with an existing Union Power easement. These two easement breaks will be planted with herbaceous/shrub vegetation within the 50-foot buffer.

After completion of all construction and planting activities, the site will be monitored on a regular basis. A physical inspection of the site will be conducted a minimum of twice per year throughout the seven year post-construction monitoring period, or until performance standards are met. These site inspections will identify site components and features that require routine maintenance. The measure of stream restoration success will be documented bankfull flows and no change in stream channel classification. The measure of vegetative success for the site will be the survival of at least 210 trees per acre at the end of Year 7 of the monitoring period. Annual monitoring data will be reported using the EEP monitoring template.

Upon approval for closeout by the Interagency Review Team (IRT), the site will be transferred to the State of North Carolina (State). The State shall be responsible for periodic inspection of the site to ensure that restrictions required in the conservation easement or the deed restriction document(s) are upheld.

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1. RESTORATION PROJECT GOALS AND OBJECTIVES

The Poplin Ridge Stream Restoration Project is located in the Lake Twitty-Stewarts Creek Watershed (http://portal.ncdenr.org/web/eep/priorities-map). This 14-digit Hydrologic Unit Code (HUC 03040105070050) is identified as a Targeted Local Watershed (TLW) in the Lower Yadkin Pee-Dee Basin Restoration Priority (RBRP).

The North Carolina Ecosystem Enhancement Program (EEP) develops River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's 54 cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These TLWs receive priority for EEP planning and restoration project funds. Currently, no Local Watershed Plan (LWP) is available for the project area.

The watershed is characterized by approximately 60 percent agricultural land use area with over 30 animal operations. The Poplin Ridge Mitigation Site drains into Stewarts Creek. The 2012 NC 303(d) List rates Stewart Creek as Impaired for aquatic life because of ecological and biological integrity of benthos. From 0.4 miles downstream of Stumplick Branch to Lake Twitty, Stewart's Creek is a Water Supply III watershed that services the City of Monroe. Lake Twitty is impaired for aquatic life because of low dissolved oxygen, copper, and chlorophyll a. This suburban stream is likely affected by both low flows and nonpoint runoff from its urban/suburban watershed. (BAU Memo B-060928; Appendix A-Use Support Ratings-Rocky River)

The 2009 Lower Yadkin Pee-Dee RBRP identified water quality, point and non-point source runoff, and animal operations as major stressors within this TLW. The Poplin Ridge Stream and Wetland Restoration Project was identified as a Stream and Wetland opportunity to improve water quality, habitat, and hydrology within the TLW.

The project goals address stressors identified in the TLW, and include the following:

- Nutrient removal,
- Sediment removal,
- Reducing runoff from animal operations,
- Filtration of runoff, and
- Improved aquatic and terrestrial habitat.

The project goals will be addressed through the following project objectives:

- Establishing riparian buffer areas adjacent to CAFOs,
- Converting active farm fields to forested buffers,
- Stabilization of eroding stream banks,
- Reduction in stream bank slope,
- Restoration of riparian buffer bottomland hardwood habitats, and
- Construction of in-stream structures designed to improve bedform diversity and trap detritus.

2. SITE SELECTION

2.1 Directions to Site

The Poplin Ridge Stream Mitigation Site (Site) is located in Union County approximately six miles north of Monroe, NC (**Figure 1**). To access the Site from the city of Monroe, travel west on West Roosevelt Boulevard, then turn north onto Secrest Short Cut Road. To access UT1, travel 3.6 miles on Secrest Short Cut Road, then turn right onto a gravel farm road and drive approximately 0.6 miles. To access UT2, travel north on Secrest Short Cut Road for 2.8 miles, then turn right onto Roanoke Church Road. After 0.8 miles, turn left onto a gravel farm road. This private road will split just past the pond on the left. At the split, stay to the left and travel approximately 800 feet to access the downstream end of UT2.

2.2 Site Selection

2.2.1 USGS Hydrologic Unit Code and NC DWQ River Basin

The project is located within the Yadkin River Basin (8-digit USGS HUC 03040105, 14-digit USGS HUC 03040105070050) (USGS, 1998) and the NCDWQ Yadkin 03-07-14 sub-basin (NCDWQ, 2002) (**Figure 2**).

2.2.2 Project Components

The project area is comprised of two perennial drainage features that flow from north to south towards their confluence with Stewarts Creek (**Figure 4**). UT1 has three smaller tributaries, one of which is intermittent. A small intermittent tributary (UT2-A) enters UT2 from the west, and an impoundment is located on the UT2 stream channel near the upper end of the project. Each drainage feature was assessed using the NCDWQ Stream Identification Form (Version 4.11). The stream mitigation project components are summarized in **Table 1**.

US Fish and Wildlife Service National Wetland Inventory (NWI) mapping depicts four wetlands within the project site area (**Figure 6**). Three of these wetlands are small ponds classified as PUBHh (Palustrine Unconsolidated Bottom Permanently Flooded Diked/Impounded). These small ponds are adjacent to the stream channels; one is in the proposed buffer on UT2 and will be filled, one is within the project limits on UT2, and the third, at the head of UT1, is classified a PFO1 (Palustrine Forested Broad-Leaved Deciduous Temporarily Flooded). This NWI wetland was field verified and found not to be present or within the proposed project area.

Table 1. Poplin Ridge Site Project Components – Stream Mitigation

Reach	Mitigation Type[1]	Stationing (Proposed)			Existing Length[2] (LF)	Proposed Length[2] (LF)	Mitigation Ratio[3]	SMUs[2]
UT1-1	SP&BE	1+20	to	6+92	572	572	1 : 5.0	114
UT1-1	Enhancement I	6+92	to	12+58	566	566	1 : 1.5	377
UT1-2	P1 Restoration	12+58	to	24+89	1,284	1,171	1 : 1.0	1,171
UT1-3	P1 Restoration	24+89	to	34+50	916	901	1 : 1.0	901
UT1-4	Enhancement I	34+50	to	46+60	1,210	1,210	1 : 1.5	807
UT1-A	Enhancement I	0+65	to	2+82	197	217	1 : 1.5	145
UT1-B	SP&BE	0+09	to	6+29	620	620	1 : 5.0	124
UT1-B	Enhancement I	6+29	to	11+46	512	455	1 : 1.5	303
UT1-C	Enhancement I	1+21	to	9+78	883	857	1 : 1.5	571
UT2-1	Enhancement II	0+00	to	4+90	490	490	1 : 2.5	196
UT2-2	P1 Restoration	4+90	to	13+97	875	847	1 : 1.0	847
UT2-3	P1 Restoration	13+97	to	19+18	495	521	1 : 1.5	347
UT2-4	P1 Restoration	19+18	to	22+07	251	257	1 : 1.0	257
UT2-A	Enhancement II	0+65	to	5+28	365	463	1 : 2.5	185
		Total			**9,236**	**9,147**		**6,345**

1) P1 = Priority 1; SP&BE = Stream Preservation and Buffer Enhancement
2) The calculations for existing and proposed lengths and SMUs do not include stream segments associated with existing culverts or breaks in the proposed conservation easement associated with culvert or utility crossings.
3) Reach UT2-3 has a lower mitigation ratio of 1:1.5 due to previous impacts from the landowner. The proposed lower ratio is based on coordination with USACE.
4) See Figures 11A and 11B for reach locations.

2.2.3 Historical Land Use and Development Trends

2.3 Historical condition

Aerial imagery and information provided by the property owners indicate that the subject site has been used extensively for agricultural purposes. The locations of the streams have not changed in over 50 years (**Figure 5**). From 1961 to present, the land has been primarily used for agricultural crop production. Portions of forested buffers along UT1 and UT1-C were cleared between 1969 and 1976. By 1976, one poultry house was constructed along both UT1 and UT2. Between 1976 and 1983, two CAFOs (poultry houses) were added to the UT1 site and three additional houses were added along UT2. A pond on the eastern UT2 site (UT2-R2) was also constructed between 1976 and 1983. Between 1983 and 1993, three additional poultry houses were added, for a total of six along the UT1 site. No noticeable changes occurred along UT2 site. The 1998 aerial photography shows the forested area above UT2-R2 (pond) was cleared and converted into agriculture fields between 1993 and 1998. No other changes to land use are noticeable at that time. Since 1998 little development has occurred at the project site or adjacent property. The area remains in an agricultural use, with some neighboring forested property. As detailed in this section, several watershed characteristics, including groundwater, vegetation, surface drainage, and soils,

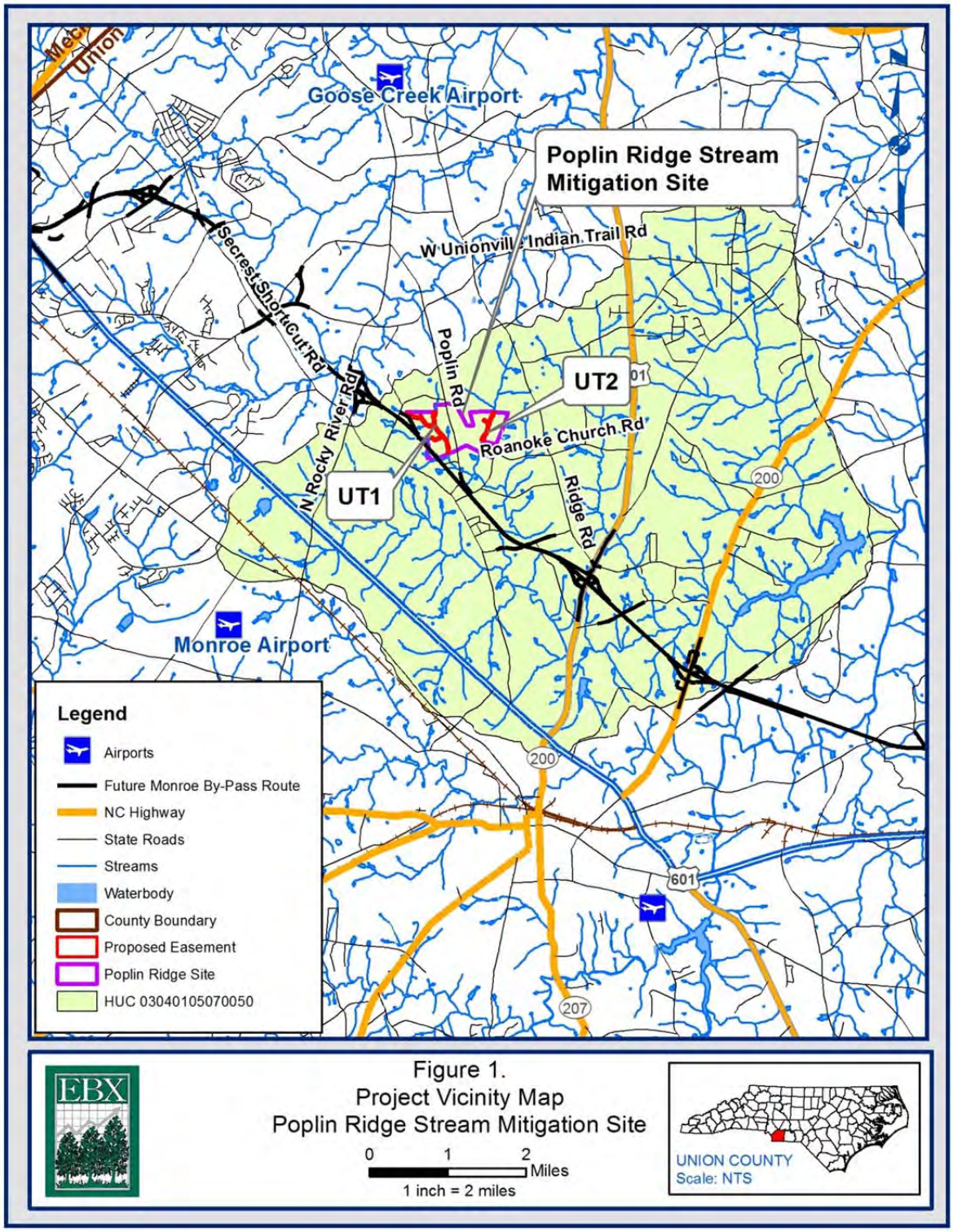
have been modified. Soil structure and surface texture have been altered from intensive agricultural operations. Historical land use development trends for the Site are summarized in **Table 2**. **Figure 5** shows 1976 aerial photography for the Site; additional historical aerial photographs from 1961, 1969, 1976, 1983, 1993, and 1998 are included in the Environmental Data Resources, Inc (EDR) report in **Appendix B**.

Table 2. Historical Land Use and Development Trends

Date	Land Use and Development Observations*
1961	Agricultural fields throughout the project area. UT1 Reach 3 and 4 were forested on the left bank. UT1-C also had a forested buffer on both banks. No evidence of CAFO (poultry houses) on either UT1 or UT2 sites.
1969	Little change.
1976	The forested corridor where UT1-R3, UT1-R4, and UT1-C are proposed has been logged and converted into agricultural fields. One CAFO (poultry house) had been added to the western UT1 site. On the eastern UT2 site, one CAFO and a few buildings have been added.
1983	Two CAFO (poultry houses) have been added to the UT1 site. Three additional CAFO (poultry houses) have been added to the UT2 site. UT2-R2 (pond) is present.
1993	On the western UT1 farm operation, three additional poultry houses have been added for a total of six houses. The eastern UT2 farm has not changed.
1998	The forested area above UT2-R2 (pond) has been logged and converted into agricultural fields. No other changes to land use are noticeable.
2010	Depicts current site conditions.

* Observations based on aerial imagery

2.3.1 Project Site Vicinity Map



2.3.2 Project Site Watershed Map

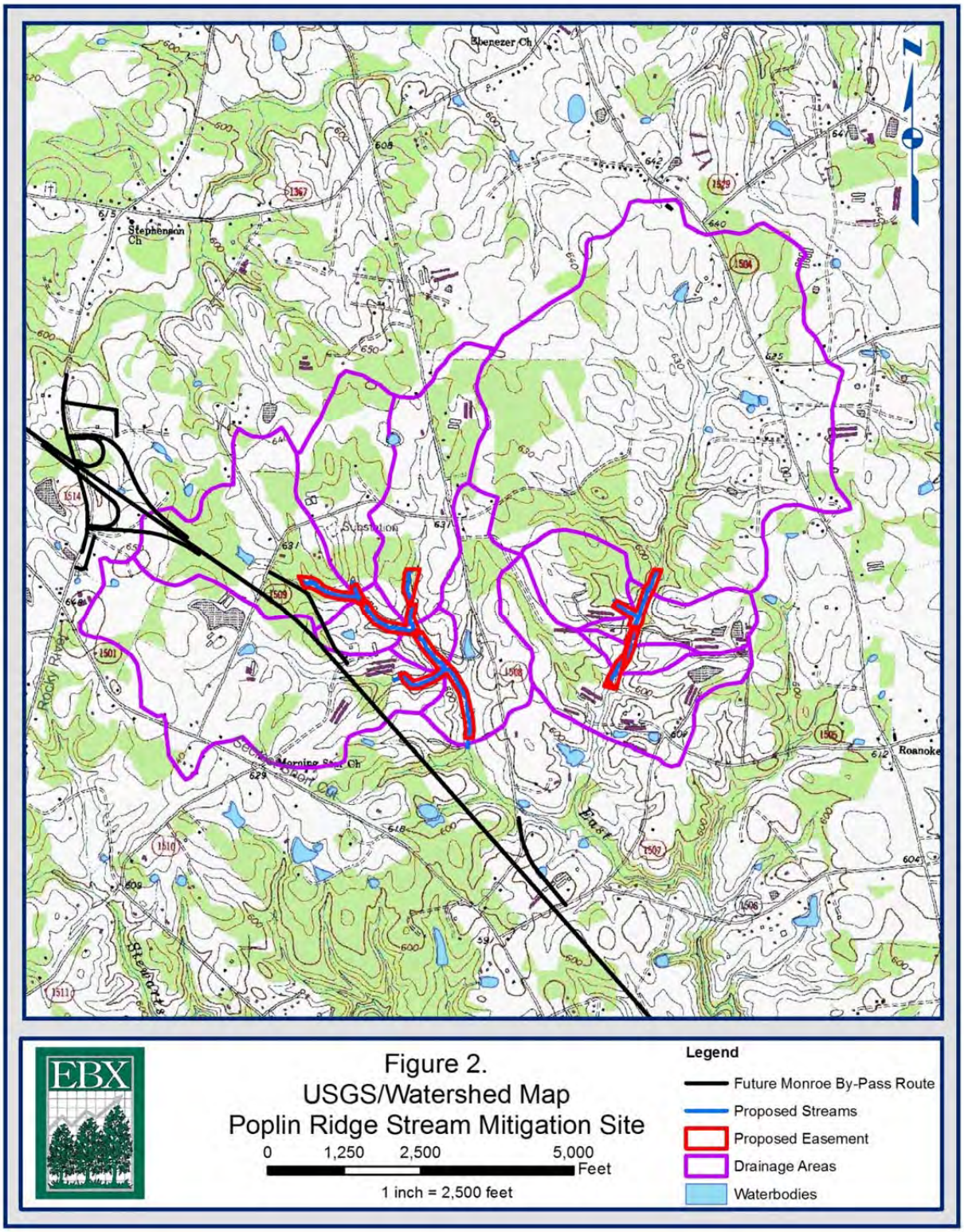


Figure 2.
USGS/Watershed Map
Poplin Ridge Stream Mitigation Site

2.4 Soil Survey

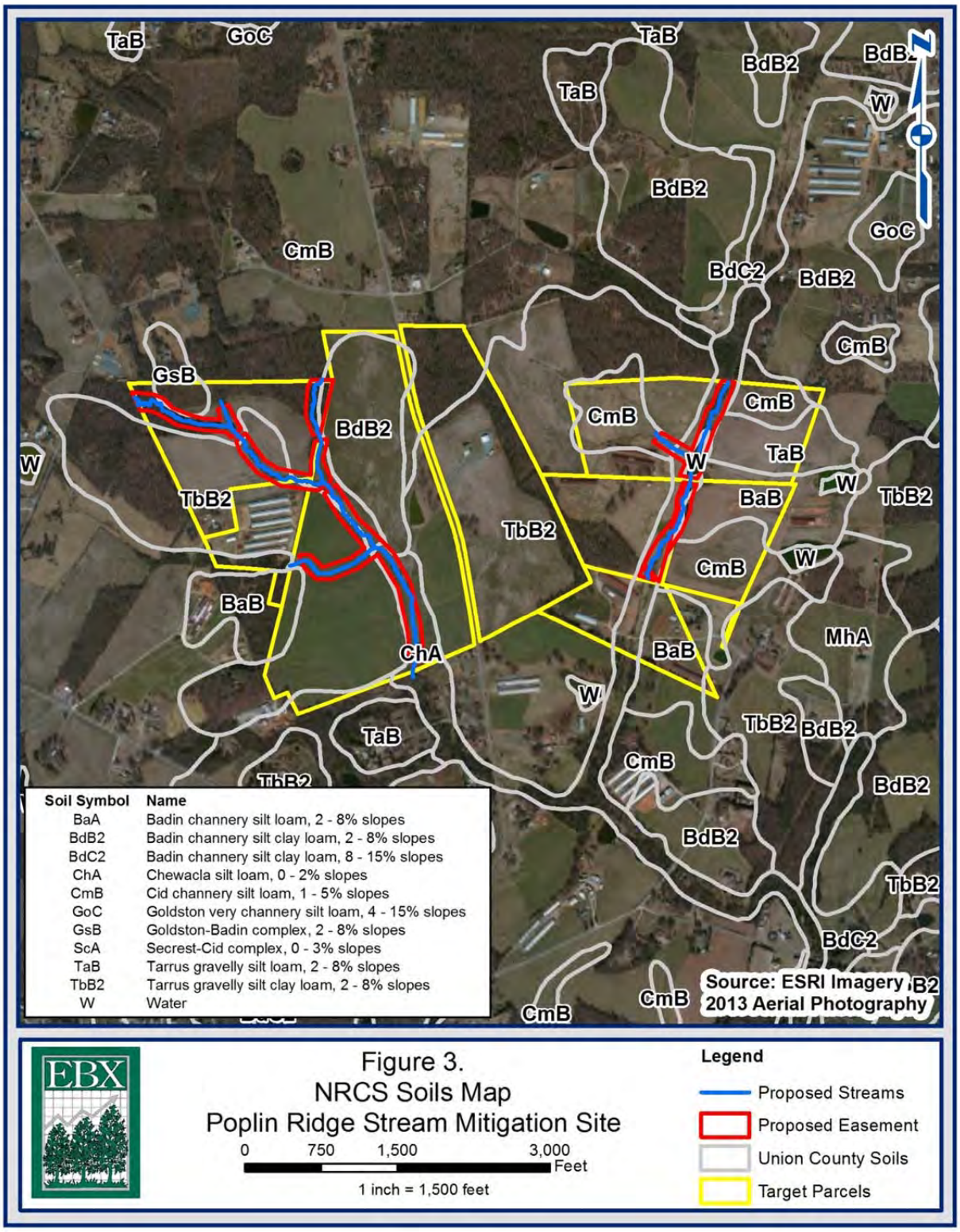
The Poplin Ridge site is located in the Southern Piedmont Physiographic Province. The watershed is underlain by a fractured bedrock aquifer. Groundwater in the area is from aquifers that are local in nature (recharged generally from surrounding high topographic areas; generally within one mile). Aquifers are part of the Piedmont regolith-fractured bedrock groundwater system. Bored wells tap the regolith (saprolite) part of the system and drilled wells tap the bedrock fractures. Fractured-rock aquifers may not always convey or store large quantities of water. The water generally is suitable for drinking and other uses, but iron, manganese, and sulfate locally occur in objectionable concentrations. The water from these aquifers is mostly a calcium bicarbonate type and is considered too hard.

The project area falls within the Badin-Cid-Goldston-Tatum soil association. The landscape where this association is found includes wide ridges with upland depressions and narrow ridges with convex side slopes along the major streams. Much of the area is shallow to fractured slate bedrock. The Union County Soil Survey depicts a limited number of soil types within the project area (**Figure 3**). The map units present are Badin channery silt loam, Chewacla silt loam, Cid channery silt loam, Goldston-Badin complex, Tarrus gravelly silt loam, and Tarrus gravelly silty clay loam, moderately eroded. Of the six mapped soil series that occur throughout the project, the majority consists of Chewacla and Tarrus. The loamy Chewacla soil is derived from alluvium of the fine-grained rocks found in the local upland watersheds. The remaining soils as well as the upland soils in the watershed formed in residuum weathered from schist, argillite or other fine-grained metavolcanic rocks of the Carolina Slate Belt.

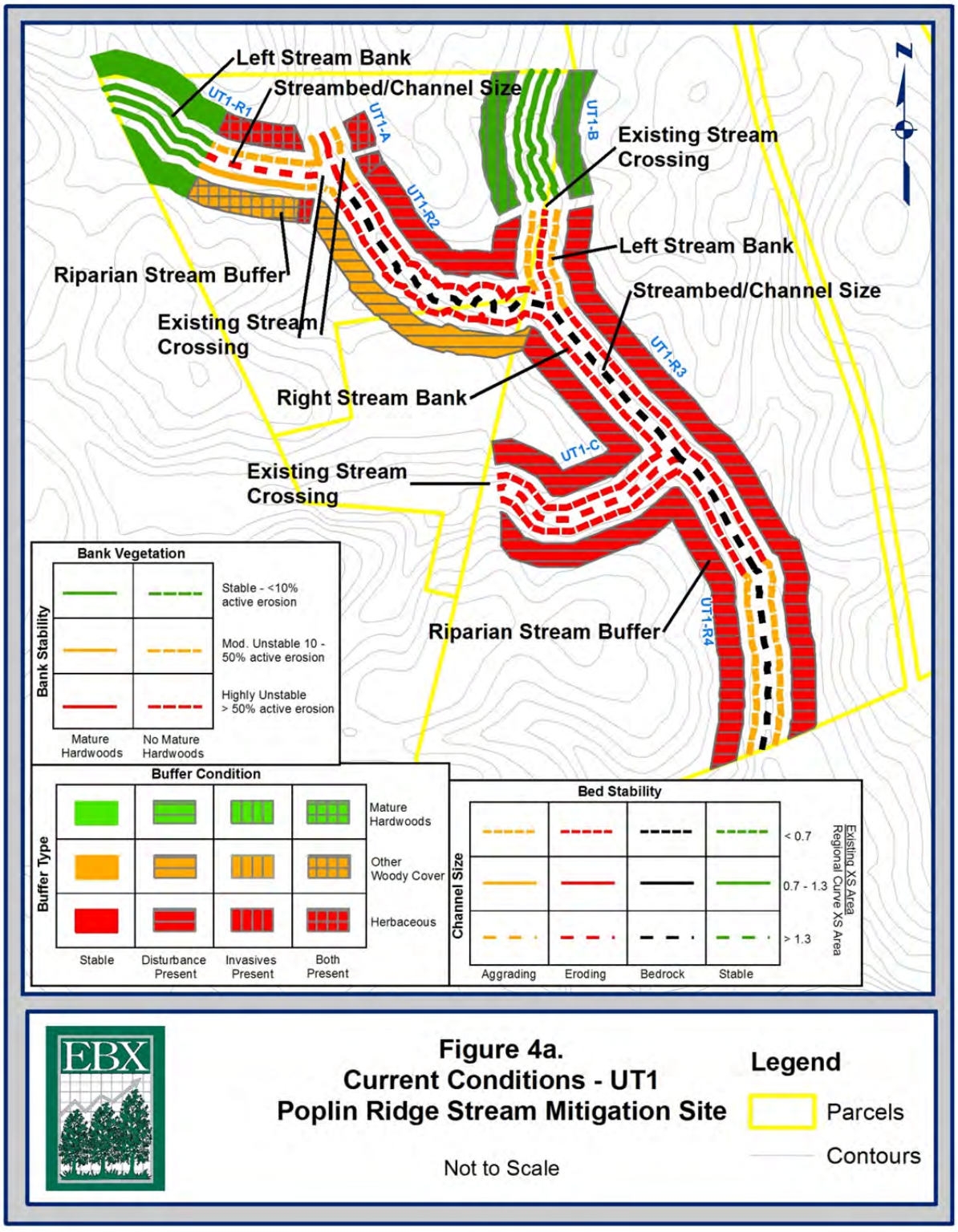
Badin channery silt loam is moderately deep, well-drained soil and has moderate permeability with medium to rapid runoff. The seasonal high water table is greater than 80 inches below the surface. Chewlaca silt loam is a somewhat poorly drained soil. It has moderate permeability with very slow runoff and typically floods frequently for brief periods. The seasonally high water table ranges from 6 to 18 inches below the surface. Cid channery silt loam is moderately well or somewhat poorly drained soil. It has up to 35 percent rock fragment. Permeability is slow and runoff is slow to moderate. The seasonally perched water table ranges from 12 to 30 inches below the surface in the winter and spring. The Goldston-Badin complex consists of two soils that cannot be shown separately on the maps. This unit is a well-drained soil found on hill slopes on ridges. Permeability ranges from very low to high with a seasonal high water table greater than 80 inches below the surface. Tarrus gravelly silty clay loam is moderately eroded. This soil is well drained and has moderate permeability with low to very rapid runoff and a seasonal high water table greater than 80 inches below the surface. Rock fragments of quartz or other fine-grained rock range up to 40 percent.

The Chewacla soil has bedrock at five to ten feet deep and the remaining soils found at the project site are shallow to weathered and hard fractured slate bedrock. These soils are typically used as cropland, pasture, or woodland. The Chewacla and Tarrus gravelly silt loam are considered prime farmland. The Chewacla series is considered to have small areas of hydric inclusions. The Badin and Cid soils are considered farmland of statewide importance. These soils are shallow to weathered bedrock, typically 20 to 40 inches for Badin and Cid, and 40 to 80 inches for Goldston-Badin complex soils and Tarrus.

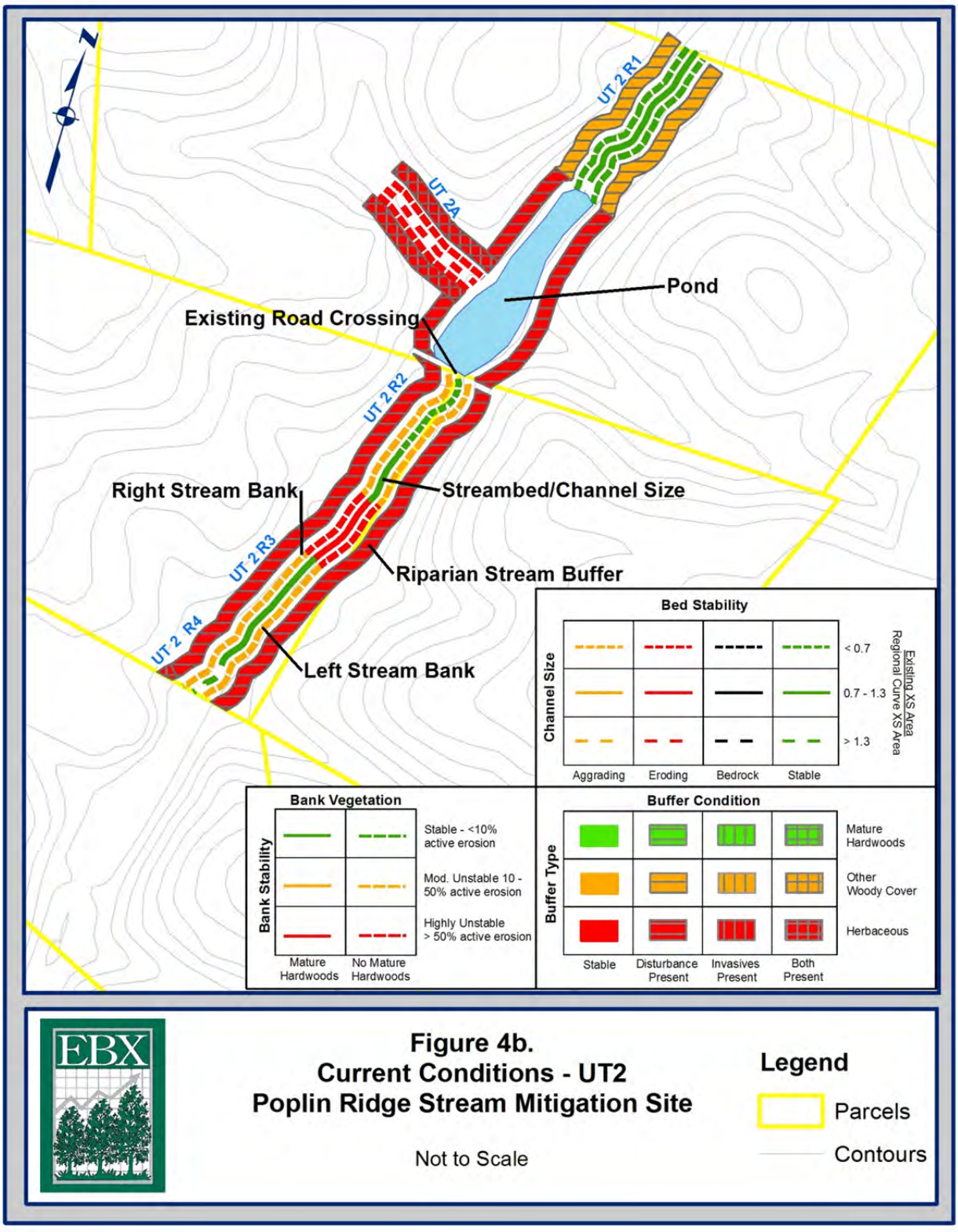
2.4.1 Project Site NRCS Soil Survey Map



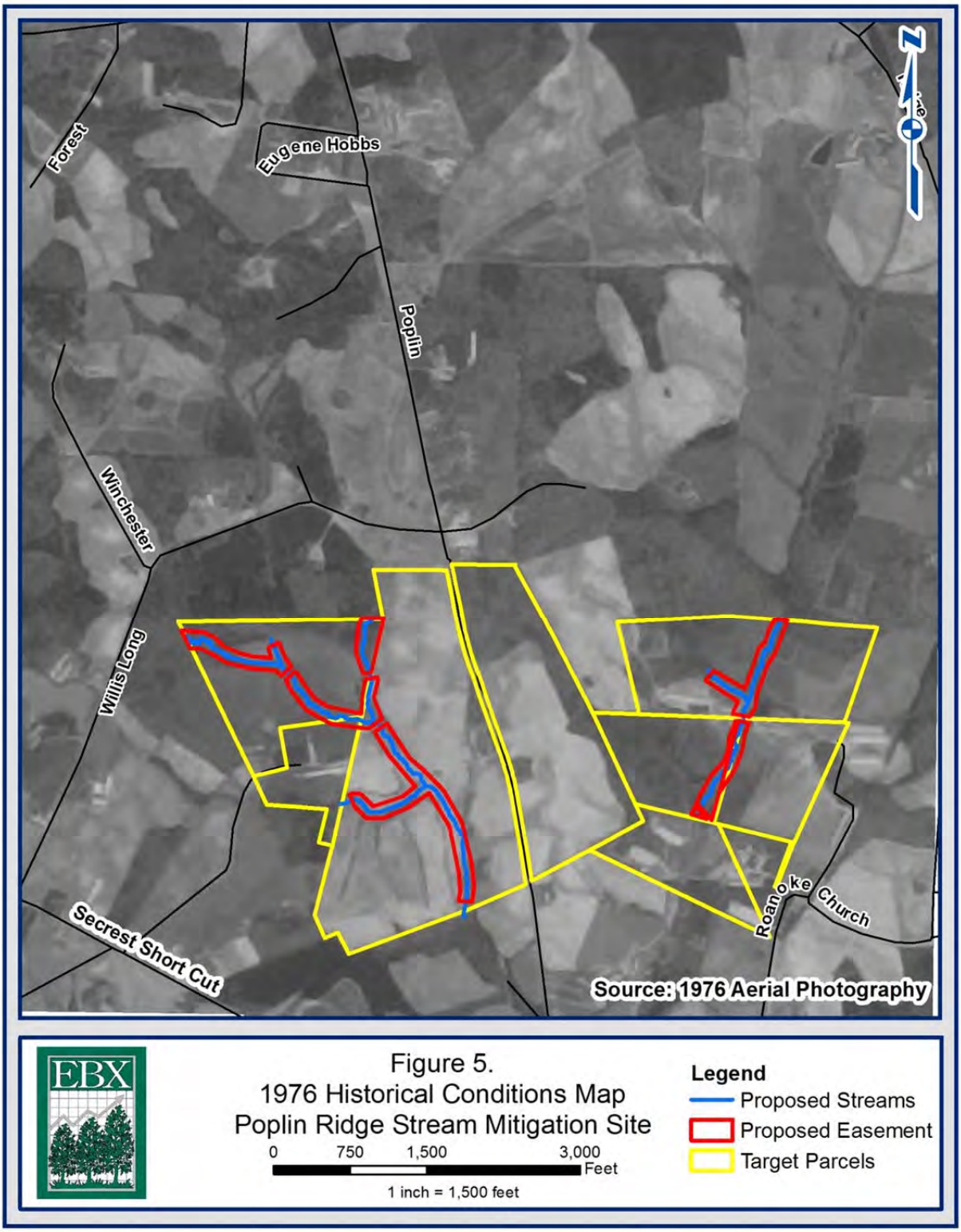
2.4.2 Project Site Current Condition Plan View



2.4.3 Project Site Current Condition Plan View (cont.)



2.4.4 Project Site Historical Condition Plan View



2.5 Site Photographs

Facing downstream on UT1-R1 (Stream Preservation and Buffer Enhancement section). 12/11/12

Facing downstream on UT1-R1 (Enhancement I section).
12/11/12

Facing downstream on UT1-R2 (P1 Restoration).
12/11/12

Facing upstream on UT1-R3 (P1 Restoration).
1/9/13

Facing upstream on UT1-R4 (Enhancement I).
1/9/13

Facing upstream on UT1-A (Enhancement I) (Enhancement I).
12/11/12

Facing upstream on UT1-B (Enhancement I section).
1/9/13

Facing upstream on UT1-C (Enhancement I).
1/9/13

Facing downstream on UT2-R1 (Enhancement II).
12/11/12

Facing upstream on UT2-R3 (P1 Restoration).
12/11/12

Facing upstream on UT2-R4 (P1 Restoration).
12/11/12

Facing downstream on UT2-A (Enhancement II).
12/11/12

Reference reach.
12/18/12

Reference reach.
12/18/12

3. SITE PROTECTION INSTRUMENT

3.1 Site Protection Instrument(s) Summary Information

The land required for the construction, management, and stewardship of this mitigation project includes portions of the following parcels. A copy of the land protection instrument(s) is included in the appendices.

Table 3. Project Parcel and Landowner Information

	Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage Protected
Parcel A	POPLIN THOMAS RAY & JUDY H	8273001	Union			10.18
Parcel B	SIMPSON DON SCOTT	8273007	Union			4.44
Parcel C	AYCOTH BILLY F SR TRUSTEE	8303014	Union			8.80
Parcel D	HAMILTON KAREN S	08273006A	Union			2.17
Parcel E	BAUCOM TAMMY RENEE S	08273006B	Union			1.35
Parcel F	PHUNG FRANK & SYLVIA	08303014C	Union			0.23
					TOTAL	**27.17**

When available, the recorded document(s) will be provided. If the recorded document(s) are not available, the template documents will be provided.

All site protection instruments require 60-day advance notification to the Corps and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

3.2 Site Protection Instrument Figure

Site protection instrument figures will be provided as easement plats become available.

4. BASELINE INFORMATION

Table 4. Project Information

Project Name	Poplin Ridge Stream Restoration Project
County	Union
Project Area (acres)	27.17
Project Coordinates (latitude and longitude)	UT1: 35° 03' 15.97" N 80° 34' 21.64" W UT2: 35° 03' 17.99" N 80° 33' 46.77" W

4.1 Watershed Summary Information

4.1.1 Drainage Area

The easement totals 27.17 acres and is split into two tributary systems (UT1 and UT2). The western system (UT1) is divided into seven reaches along four unnamed tributaries to East Fork Stewarts Creek. The eastern system (UT2) is divided into five reaches, all unnamed tributaries of East Fork Stewarts Creek. UT1-Reach 1 has a drainage area of 0.21 square miles (136 acres); it begins at the start of the restoration project (STA 0+00) and extends southeast to STA 12+58. UT1-Reach 2 has a drainage area of 0.39 square miles (248 acres); it begins at STA 12+58 and extends to STA 24+89. UT1-Reach 3 has a drainage area of 0.60 square miles (384 acres); it begins at STA 24+89 and extends to STA 34+50. UT1-Reach 4 is the downstream section of UT1 (STA 34+50 to 46+60), and has a drainage area of 1.14 square miles (728 acres). Reach UT1-A has a drainage area of 0.14 square miles (88 acres) and flows south directly into UT1 at the break between Reaches 1 and 2. UT1-B has a drainage area of 0.19 square miles (120 acres) and flows south to the break between UT1 Reaches 2 and 3. UT1-C has a drainage area of 1.35 square miles (861 acres) and flows east to the break between UT1 Reaches 3 and 4 (**Figure 11a**). UT2-Reach 1 has a drainage area of 0.99 square miles (631 acres); it begins at the start of the UT2 portion of the restoration project (STA 0+00) and extends southwest to STA 4+90. UT2-Reach 2 has a drainage area of 1.13 square miles (726 acres); it begins at STA 4+90 and extends to STA 13+95. UT2-Reach 3 has a drainage area of 1.24 square miles (792 acres); it begins at STA 13+95 and extends to STA 18+90. UT2-Reach 4 has a drainage area of 1.35 square miles (861 acres); it begins at STA 18+90 and extends to STA 29+59. Reach UT2-A has a drainage area of 0.08 square miles (49 acres) and flows east into UT2 at the break between Reaches 2 and 3 (**Figure 11b**).

The land use in the project watershed is approximately 68 percent managed herbaceous and cultivated crops, 26 percent deciduous and evergreen forest, and six percent developed (mix of low, medium and high densities) and water bodies. Current land use around the project is primarily agricultural and forestry. Land use immediately surrounding the project consists of livestock grazing, row crops, and forestry. Future land use is projected to become more developed in the future due to the proximity to the Charlotte area. The Lower Yadkin Pee-Dee River Basin Restoration Plan (RBRP) indicates that urban land use may increase by over 350 percent with a population growth of 184 percent in Union County by the year 2030.

4.1.2 Surface Water Classification

Pursuant to 15A NCAC 02B .0301, because none of the streams within the project area are individually classified, they all carry "the same classification as that assigned to the stream segment to which it is tributary." UT1 is one of two main stems of the project which, after leaving the project area, confluences directly with East Fork to Stewarts Creek. UT2 is a section of East Fork to Stewarts Creek and has a NCDWQ classification of WS-III. Class WS-III waters are typically in low to moderately developed watersheds. These waters are used for drinking, food processing purposes and where WS-I or II are not feasible. WS-III waters are also protected for Class C uses. Class C waters are suitable for aquatic life, secondary recreation, and agricultural usage.

Table 5. Project Watershed Summary Information

Physiographic Province	Piedmont
River Basin	Yadkin
USGS Hydrologic Unit 8-digit	03040105
USGS Hydrologic Unit 14-digit	03040105070050
DWQ Sub-basin	03-07-14
Project Drainage Area (acres)	UT1: 1.14 square miles (728 acres) UT2: 1.35 square miles (861 acres)
Project Drainage Area Percentage of Impervious Area	UT1: 8% UT2: 5%
CGIA Land Use Classification	developed (open space, low density, med. density, high density), cultivated crops, pasture/hay, deciduous forest, evergreen forest

4.1.3 Endangered/Threatened Species

Plants and animals with a federal classification of endangered or threatened are protected under provisions of sections 7 and 9 of the Endangered Species Act of 1973, as amended. Rare and protected species listed for Union County, and any likely impacts to the species as a result of the project construction, are discussed in the following sections.

The US Fish and Wildlife Service (USFWS) database (updated 22 September 2010) lists three endangered species for Union County, North Carolina: Carolina heelsplitter (*Lasmigona decorate*), Schweinitz's sunflower (*Helianthus schweinitzii*), and Michaux's sumac (*Rhus michauxii*). The Georgia aster (*Symphyotrichum georgianum*) is listed as a Candidate species that is under consideration for official listing in the future, but is not currently protected. No protected species or potential habitat for protected species was observed during preliminary site evaluations. Designated Critical Habitat for the Carolina Heel splitter in Union County is north of the project watershed in Goose Creek and drains directly to the Rocky River. There is no critical habitat in the Stewarts Creek watershed, which drain into Richardson Creek before entering the Rocky River. The project will not affect the Designated Critical Habitat.

In addition to the USFWS database, the NC Natural Heritage Program (NHP) GIS database was consulted to determine whether previously cataloged protected species "element occurrences" had been mapped within one mile of the project site. Results from NHP indicated that there are no element occurrences within one mile of the project area. Based on initial site investigations, no impacts to federally protected species are anticipated as a result of the proposed project.

WK Dickson submitted a request to USFWS and North Carolina Wildlife Resources Commission (NCWRC) for review and comments on the proposed Poplin Ridge Stream Restoration Project on June 7, 2012 in regards to any potential impacts to threatened and endangered species. No response was received within a 30-day period from the USFWS; therefore, it is assumed that the initial determination of no effect to endangered and threatened species will result from the proposed project. In a letter dated June 20, 2012 (**Appendix B**), the NCWRC stated that their biologists had "reviewed the subject information" and recommended establishing native, forested buffers in the riparian areas to protect water quality, improve terrestrial habitat, and a travel corridor for wildlife species.

The proposed project offers some potential to improve or create suitable habitat for several Federal Species of Concern. Habitat may be improved or created for species that require riverine habitat by improving water quality, in-stream and near-stream forage, and providing stable conditions not subject to regular maintenance or disturbance. Improved bottomland habitat may benefit dwarf aster (Eurybia mirabilis) and Georgia aster (Symphyotrichum georgianum). Improved stream habitat may benefit Virginia quillwort (Isoetes virginica), American eel (Anguilla rostrata), and Carolina darter (Etheostoma collis collis). The environmental screening phase of the project will include USFWS coordination to confirm these findings.

4.1.4 Cultural Resources

Cultural resources include historic and archeological resources located in or near the project area. WK Dickson completed a preliminary survey of cultural resources to determine potential project impacts. No architectural structures or archeological artifacts have been observed or noted during surveys of the site for restoration purposes. In addition, the majority of the site has historically been disturbed due to agricultural practices and channel modifications.

WK Dickson submitted a request to the NC State Historic Preservation Office (SHPO) to search records to determine the presence of any areas of architectural, historic, or archaeological significance that may be affected by the Poplin Ridge Stream Restoration Project on June 7, 2012. In a letter dated June 18, 2012 (**Appendix B**), the SHPO stated that they had "conducted a review of the project and are aware of no historic resources which would be affected by the project."

4.2 Reach Summary Information

Table 6. Reach Summary Information

Parameters	UT1-R1	UT1-R2	UT1-R3	UT1-R4	UT1-A	UT1-B
Length of reach (linear feet)	1,138	1,284	833	1,252	197	1,132
Valley Classification	VIII	VIII	VIII	VIII	VIII	VIII
Drainage area (acres)	136	248	384	728	88	120
NCDWQ stream identification score	35.0	22.5	30.0	31.0	35.0	35.0
NCDWQ Water Quality Classification	WS-III	WS-III	WS-III	WS-III	WS-III	WS-III
Morphological Description (stream type)	E4	E4	E4	C4	E4	E4/C4
Evolutionary trend	Stage I	Stage II	Stage II	Stage V	Stage I	Stage I/III
Underlying mapped soils	CmB	CmB, TbB2	CmB, TbB2	ChA	CmB	CmB
Drainage class	mod. well	mod. well; well	mod. well; well	somewhat poorly	mod. well	mod. well
Soil Hydric status	Not Hydric	Not Hydric	Not Hydric	Partially Hydric	Not Hydric	Not hydric
Slope	0.48%	0.70%	0.40%	0.50%	1.20%	1.80%
FEMA classification	N/A	N/A	N/A	Zone AE	N/A	N/A
Native vegetation community	mixed hardwood forest, cultivated	cultivated	cultivated	cultivated	cultivated	mixed hardwood forest, cultivated
Percent composition of exotic invasive vegetation	10%	0%	0%	0%	5%	15%

Table 6. Reach Summary Information (cont.)

Parameters	UT1-C	UT2-R1	UT2-R2	UT2-R3	UT2-R4	UT2-A
Length of reach (linear feet)	883	490	875	495	270	365
Valley Classification	VIII	VIII	VIII	VIII	VIII	VIII
Drainage area (acres)	250	631	726	792	861	49
NCDWQ stream identification score	35.0	33.5	33.5	22.5	33.5	33.5
NCDWQ Water Quality Classification	WS-III	WS-III	WS-III	WS-III	WS-III	WS-III
Morphological Description (stream type)	E4	C4c	N/A	E4	E4	C4
Evolutionary trend	Stage IV	Stage VI	N/A	Stage II	Stage II	Stage IV
Underlying mapped soils	TbB2	ChA	ChA	ChA, BaB	ChA	ChA, CmA
Drainage class	well	somewhat poorly	somewhat poorly	somewhat poorly; well	somewhat poorly	somewhat poorly; mod. well
Soil Hydric status	Not Hydric	Partially Hydric	Partially Hydric	Partially Hydric	Partially Hydric	Not Hydric
Slope	0.80%	0.27%	0.10%	0.57%	0.31%	1.30%
FEMA classification	N/A	Zone AE	Zone AE	Zone AE	Zone AE	N/A
Native vegetation community	cultivated	woody cover, cultivated	cultivated	cultivated	cultivated	cultivated
Percent composition of exotic invasive vegetation	0%	20%	0%	0%	0%	0%

*Most of the project area is characterized by rolling hills and narrow valleys, which does not exactly match any of the valley types characterized under the Rosgen (1996) classification system. The closest valley type representative of the project streams is type VIII; narrow or wide alluvial valleys that typically support C, D, E, F, or G stream types.

4.2.1 Channel Classification

The project area streams have been classified as intermittent and perennial using the NCDWQ Stream Identification Form version 4.11 (**Appendix B**) and are predominantly E4 or C4 stream types using the Rosgen stream classification method (Rosgen, 1994). The design reaches have been separated into 12 distinct sections that are described in **Section 4.2.3**. Channel characteristics are summarized in **Table 7**.

Table 7. Summary of Existing Channel Characteristics

Reach	Drainage Area (Ac)	A_{BKF}[1] (ft^2)	Width (ft)	Max Depth (ft)	Width:Depth Ratio	Sinuosity	Slope (ft/ft)
UT1-A	88	6.8	6.9	1.4	6.9	1.0	0.0120
UT1-B Pres.	120	6.1	11.2	1.0	20.4	1.1	0.0120
UT1-B Enh.	120	5.5	6.0	1.1	6.6	1.0	0.0180
UT1-C	250	10.0	10.0	1.1	10.0	1.0	0.0080
UT1-R1 Pres.	136	10.1	7.9	2.0	6.2	1.2	0.0048
UT1-R1 Enh.	136	10.4	7.5	1.8	5.4	1.0	0.0110
UT1-R2	250	14.2	9.9	2.0	7.0	1.0	0.0070
UT1-R3	384	22.2	12.8	2.4	7.4	1.0	0.0040
UT1-R4	728	21.9	17.5	2.3	14.0	1.0	0.0050
UT2-R1	631	19.6	25.6	1.7	33.5	1.1	0.0027
UT2-R2	726	---	---	---	---	---	0.0010
UT2-R3	792	22.4	16.2	2.6	11.8	1.0	0.0057
UT2-R4	861	12.6	12.1	1.6	11.6	1.0	0.0031
UT2-A	49	3.0	6.1	1.2	12.2	1.0	0.0130

[1] A_{BKF} = cross-sectional area (measured from top of bank)

4.2.2 Discharge

Estimating bankfull flows (discharge) for Poplin Ridge is difficult due to the existing ditches that have been maintained and channelized over time. Because bankfull indicators such as point bars and vegetation lines were not present, several models, regression equations, and Piedmont regional curves were used to estimate existing discharges. Land use and slope were considered when the discharge calculations were developed. All hydraulic and hydrologic analyses are discussed in **Section 7.3.1**. Data and analysis of the hydrologic and hydraulic models are included in **Appendix C**.

4.2.3 Channel Morphology

The project area is comprised of two perennial drainage features that flow from north to south towards their confluence with Stewarts Creek (**Figure 2**). UT1 has three smaller tributaries, one of which is intermittent. A small intermittent tributary (UT2-A) enters UT2 from the west and an impoundment is located on the UT2 stream channel near the upper end of the project. Each drainage feature was assessed using the NCDWQ Stream Identification Form (Version 4.11), and the scores are presented in **Appendix B**.

In general, the streams do not typically function to their full potential. Having been channelized in the past and ditched to drain nearby wetlands for row crops, the streams do not access their floodplains as often as they naturally would have prior to the farm operations. In some cases, the streams are not hydraulically stable, causing erosion and undercutting of the banks. Habitat along the restoration reaches is poor in that there is little to no debris for fish cover or protection for other aquatic species. Vegetation and habitat diversity are poor along the reaches and offers little benefit to area wildlife. Site photographs are located in **Section 2.5** and morphological parameters are in **Appendix B**.

Each project reach was classified using Simon's channel evolution model (Simon, 2006) in an attempt to predict future channel changes resulting from historical channel impacts or watershed changes. See **Table 6** for channel evolution stages. The majority of the project reaches exhibit disturbed and/or unstable characteristics resulting from straightening and channelization occurring prior to the 1950's or 1970's. Of the channelized reaches, UT1-R2, UT1-R3, UT2-R3, and UT2-R4 appear to be in Stage II – Channelized. If these channels continue through the evolutionary stages, the reaches will continue to degrade and widen before reaching a quasi-equilibrium stage. Reaches UT1-R4, UT1-B, UT1-C, and UT2-A appear to be in Stages III, IV and V where the channels are degrading and/or widening, or aggrading and widening. These channels are actively adjusting as they move toward the quasi-equilibrium stage. Finally, the remaining project reaches that are stable and are proposed for enhancement are either in Stage I – Sinuous, Pre-modified, or Stage VI – Quasi-equilibrium.

4.2.3.1 UT1

UT1-Reach 1 has a drainage area of 0.21 square miles (136 acres). It is a perennial stream that flows in a southeasterly direction. The upper segment of this stream reach is surrounded by a mature forested buffer. The lower half of this stream reach is bound by agricultural fields, although a narrow buffer is present. The planform of this E-type channel is slightly incised throughout, as bankfull elevations appear to be 0.5 to 1.0 feet below top of bank.. Within the forested (Stream Preservation and Buffer Enhancement) section, the channel exhibits a sinuosity of 1.2. The current cross sectional area of the section is 10.1 square feet with approximate dimensions of 7.9 feet wide and 2.0 feet deep, and a gradient of 0.0048 ft/ft. The existing length of the Stream Preservation and Buffer Enhancement section is 572 linear feet. Within the Enhancement I section of UT1-Reach 1, the channel has a sinuosity value of 1.0. The current cross sectional area of the Enhancement I section is 10.4 square feet with approximate dimensions of 7.5 feet wide and 1.8 feet deep, and a gradient of 0.0011 ft/ft. The existing length of the Enhancement I section is 566 linear feet. The channel scored 58 and 38 on the NCDWQ Habitat Assessment Form (Revision 6) for the upper and lower segments, respectively.

UT1-Reach 2 has a drainage area of 0.39 square miles (250 acres). It begins at a farm crossing just below the confluence of UT1-Reach 1 and UT1-A. This stream reach also flows in a southeasterly direction. A narrow shrubby and herbaceous buffer approximately 20 to 30 feet wide is present along the right bank of the stream channel. UT1-Reach 2 is surrounded by cultivated fields on both stream banks. Six poultry houses are located on the right bank approximately 150 LF upslope from this stream reach. The current cross sectional area is 14.2 square feet. This channel is 2.0 feet deep and 9.9 feet wide, and has a gradient of 0.0070 ft/ft. The planform of this E-type channel is generally straight with occasional bends and exhibits little to no incision. The channel has an existing length of 1,284 linear feet, and the banks are nearly vertical in many locations. UT1-Reach 2 had the highest volume of large woody debris present of the four assessed stream reaches due to the presence of a thin buffer. The channel scored 52 on the NCDWQ Habitat Assessment Form (Revision 6).

UT1-Reach 3 has a drainage area of 0.60 square miles (384 acres) and an existing length of 833 linear feet. It begins at the confluence of UT1-Reach 2 and UT1-B. This stream channel has a slope of 0.0040 ft/ft. Cultivated fields are adjacent on both banks leaving no buffer to contain sediment input and pollutants from adjacent agricultural uses. This reach has been historically straightened and dredged. UT1-Reach 3, an E-type channel, has a planform that is straight throughout. The current cross sectional area is 22.2 square feet, and the channel is approximately 2.4 feet deep and 12.8 feet wide. The entire reach has steep banks and bankfull stage is approximately located at top of bank. The dominant bed materials are cobble and gravel. The channel scored 40 on the NCDWQ Habitat Assessment Form (Revision 6).

UT1-Reach 4 is the downstream most segment of UT1. It has a drainage area of 1.34 square miles (728 acres) and an existing length of 1,252 linear feet. UT1-Reach 4 starts at the confluence of UT1-Reach 3 and UT1-C and flows south to the property boundary. This stream reach has similar land use as UT1-Reach 3 with agricultural fields on both left and right banks. A power line easement runs along the eastside through the field, and there is an existing farm crossing located at the downstream end of the reach. UT1-Reach 4 is a C-type channel with a sinuosity of 1.0. The current cross sectional area is 21.9 square feet, and the channel is 2.3 feet deep and 17.5 feet wide. It has a gradient of 0.0050 ft/ft. Bankfull stage is located near top of bank, and alternating, vegetated bars were observed along the reach. The banks are nearly vertical in many locations, the buffer is comprised of agricultural crops and/or grasses, and minimal amounts of woody debris were observed in the channel. The channel scored 27 on the NCDWQ Habitat Assessment Form (Revision 6).

UT1-A is an intermittent stream that flows from north to south before joining UT1-Reach 1. UT1-A has a drainage area of 0.14 square miles (88 acres), an existing length of 217 linear feet and is surrounded by agricultural fields. This stream reach is generally straight, is appropriately sized, and has little to no stream buffer within the project area. Above the project area, UT1-A has a forested stream buffer. The current cross sectional area is 6.8 square feet with approximate dimensions of 6.9 feet wide and 1.4 feet deep, and a gradient of 0.0120 ft/ft. The channel scored 36 on the NCDWQ Habitat Assessment Form (Revision 6).

UT1-B is a stable perennial channel that flows from north to south into UT1-Reach 2. UT1-B has a drainage area of 0.19 square miles (120 acres). The upper half of UT1-B is stable and has an intact stream buffer dominated by hardwoods with a few localized areas of dense privet. The lower portion of UT1-B presents areas of unstable stream banks where it has abandoned its historical flowpath within a channelized ditch and has cut a new channel through a cultivated field and has no stream buffer. Within the Stream Preservation and Buffer Enhancement section, the channel has a sinuosity value of 1.1. The current cross sectional area of the Stream Preservation and Buffer Enhancement section is 6.1 square feet with approximate dimensions of 11.2 feet wide and 1.0 feet deep, and a gradient of 0.0120 ft/ft. The existing length of this section is 620 linear feet. Within the Enhancement I section of UT1-B, the channel

has a sinuosity value of 1.0. The current cross sectional area of this section is 5.5 square feet with approximate dimensions of 6.0 feet wide and 1.1 feet deep, and a gradient of 0.0180 ft/ft. The existing length of the enhancement section is 512 linear feet. The channel scored 67 and 53 on the NCDWQ Habitat Assessment Form (Revision 6) for the upper and lower segments, respectively.

UT1-C is a perennial stream channel impaired by channelization to promote agricultural activities. UT1-C has a drainage area of 0.39 square miles (250 acres) and an existing length of 883 linear feet. There one culvert crossing located near the upstream end of the reach that is in poor condition. The current cross sectional area is 10.0 square feet with approximate dimensions of 10.0 feet wide and 1.1 feet deep, and a gradient of 0.0080 ft/ft. The channel flows straight down the middle of the valley, is slightly oversized in some areas, and exhibits localized bank instability throughout. The stream buffer is in poor condition as it has been cleared to the top of bank for agricultural purposes. UT1-C flows west to east to the confluence with UT1-Reach 3. The channel scored 61 on the NCDWQ Habitat Assessment Form (Revision 6).

4.2.3.2 UT2

UT2-Reach 1 is a stable perennial channel that lies between an active pasture and a cultivated field. The stream buffer, which lacks mature hardwoods, has been disturbed by agricultural practices and cattle access. UT2-Reach 1 flows into a farm pond (UT2-Reach 2). UT2-Reach 1 has a drainage area of 0.99 square miles (631 acres) and an existing length of 490 linear feet. This stream reach has a sinuosity of 1.1. The current cross sectional area is 19.6 square feet with approximate dimensions of 25.6 feet wide and 1.7 feet deep, and a gradient of 0.0027 ft/ft. The channel scored 56 on the NCDWQ Habitat Assessment Form (Revision 6).

UT2-Reach 2 is currently a 1.3-acre farm pond. This pond has a drainage area of 1.13 square miles (726 acres) and is surrounded by cultivated fields. The pond is shallow to bedrock around the edges and is approximately 3.0 feet at it deepest point. UT2-Reach 2 has an existing length of 875 linear feet and a gradient of 0.0010 ft/ft.

UT2-Reach 3 is a perennial channel that lies between an active pasture and a cultivated field. This stream reach has been straightened in the past, is appropriately sized, and has little to no stream buffer within the project area. The upper portion of this reach is experiencing active erosion of the bed and banks. The lower portion of the reach has a stable bed with moderate bank erosion. UT2-Reach 3 has a drainage area of 1.24 square miles (792 acres) and an existing length of 495 linear feet. The current cross sectional area is 22.4 square feet with approximate dimensions of 16.2 feet wide and 2.6 feet deep, and a gradient of 0.0057 ft/ft. The channel scored 37 on the NCDWQ Habitat Assessment Form (Revision 6).

UT2-Reach 4 is a perennial channel that flows through active pasture and cultivated fields. This reach is straight, undersized, and has a highly disturbed buffer with invasive species present. The bed is stable in most places, and the banks are moderately unstable through much of the reach. The downstream-most portion of the reach has stable banks. UT2-Reach 4 has a drainage area of 1.35 square miles (861 acres) and an existing length of 270 linear feet. The current cross sectional area is 12.6 square feet with approximate dimensions of 12.1 feet wide and 1.6 feet deep, and a gradient of 0.0031 ft/ft. The channel scored 27 on the NCDWQ Habitat Assessment Form (Revision 6).

UT2-A is an intermittent channel that flows into a farm pond (UT2-Reach 2). This reach flows through an active cattle pasture and lacks a vegetated buffer. UT2-A is appropriately sized for most of the reach; however, active erosion of the bed and banks was observed throughout. UT2-A has a drainage area of 0.08 square miles (49 acres) and an existing length of 365 linear feet. The current cross sectional area is 3.0 square feet with approximate dimensions of 6.1 feet wide and 1.2 feet deep, and a gradient of 0.0130 ft/ft. The channel scored 25 on the NCDWQ Habitat Assessment Form (Revision 6).

4.2.4 Channel Stability Assessment

A modified version of the channel stability assessment method (CSA) provided in "Assessing Stream Channel Stability at Bridges in Physiographic Regions" by Johnson (2006) was used to assess channel stability for the Poplin Ridge existing channels and reference reach. This method may be rapidly applied on a variety of stream types in different physiographic regions having a range of bed and bank materials.

The original CSA method was designed to evaluate thirteen stability indicators in the field. These parameters are: watershed characteristics (frequency of watershed disturbances such as agricultural activities, urbanization, etc), flow habit, channel pattern, entrenchment/channel confinement, bed material, bar development, presence of obstructions/debris jams, bank soil texture and coherence, average bank angle, bank vegetation/protection, bank cutting, mass wasting/bank failure, and upstream distance to bridge. See **Appendix B** for a detailed description of the stability indicators. As this method was initially developed to assess stability at bridges, a few minor adjustments were made to remove indicators that contradict stability characteristics of natural channels in favor of providing hydraulic efficiency at bridges. First, the "channel pattern" indicator was altered such that naturally meandering channels scored low as opposed to straightened/engineered channels that are favorable for stability near bridges. Secondly, the last indicator, "upstream distance to bridge," was removed from the assessment as bridges are not a focus of channel stability for this project. The twelve indicators were then scored in the field, and a rating of excellent, good, fair, or poor was assigned to each project reach based on the total score.

The CSA results (scores and ratings) for the Poplin Ridge project and reference reaches are provided in **Table 8** and **Table 9**. Five of the nine stream reaches along UT1 received "Fair" ratings, while three reaches received "Good" ratings. UT1-R4 had a rating of "Poor." UT2 stream reaches scored significantly higher with three "Poor" ratings. UT2-R1 received a rating of "Good" and UT2-A was "Fair." Overall, the existing project streams appear to be physically stable as there is little active erosion present; however, all channels have been straightened and most are slightly entrenched and are actively maintained. These characteristics are reflected in the poor CSA scores for channel pattern and bank vegetation/protection. Most reaches also scored poorly for watershed characteristics since the surrounding land use is dominated by agriculture activities (**Table 8** and **Table 9**).

Table 8. Channel Stability Assessment Results – UT1

		UT1-R1 Pres.	UT1-R1 Enh.	UT1-R2	UT1-R3	UT1-R4	UT1-A	UT1-B Pres.	UT1-B Enh.	UT1-C	Reference Reach
1	Watershed characteristics	6	7	7	7	9	7	4	7	7	7
2	Flow habit	9	9	7	6	9	9	9	8	5	2
3	Channel pattern	5	8	5	9	11	9	5	6	3	2
4	Entrenchment/channel confinement	7	3	8	9	8	4	5	5	5	2
5	Bed material	10	6	4	6	9	7	3	6	3	3
6	Bar development	10	2	5	7	11	1	10	7	6	5
7	Obstructions/debris jams	7	3	6	5	8	3	5	5	4	2
8	Bank soil texture and coherence	3	7	5	6	8	7	5	7	4	3
9	Average bank angle	5	9	7	10	11	9	6	6	6	5
10	Bank vegetation/protection	3	4	9	10	12	6	2	11	11	2
11	Bank cutting	6	4	8	6	10	6	2	7	5	2
12	Mass wasting/bank failure	5	4	7	6	11	4	2	7	3	2
13	Upstream distance to bridge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Score	**76**	**66**	**78**	**87**	**117**	**72**	**58**	**82**	**62**	**37**
	Rating*	**Fair**	**Good**	**Fair**	**Fair**	**Poor**	**Fair**	**Good**	**Fair**	**Good**	**Good**

*Excellent (0 < Score <= 33), Good (33 < Score <= 66), Fair (66 < Score <= 99), Poor (99 < Score <= 132)

Table 9. Channel Stability Assessment Results – UT2

		UT2-R1	UT2-R2	UT2-R3	UT2-R4	UT2-A	Reference Reach
1	Watershed characteristics	8	10	9	11	7	7
2	Flow habit	6	10	9	8	8	2
3	Channel pattern	7	12	10	11	9	2
4	Entrenchment/channel confinement	3	10	7	11	7	2
5	Bed material	10	12	10	10	5	3
6	Bar development	10	12	10	11	6	5
7	Obstructions/debris jams	4	12	8	11	4	2
8	Bank soil texture and coherence	5	10	8	9	6	3
9	Average bank angle	4	12	8	7	7	5
10	Bank vegetation/protection	3	12	10	10	11	2
11	Bank cutting	3	10	6	8	9	2
12	Mass wasting/bank failure	2	10	6	6	7	2
13	Upstream distance to bridge	NA	NA	NA	NA	NA	NA
	Score	**65**	**132**	**101**	**113**	**86**	**37**
	Rating*	**Good**	**Poor**	**Poor**	**Poor**	**Fair**	**Good**

*Excellent (0 < Score <= 33), Good (33 < Score <= 66), Fair (66 < Score <= 99), Poor (99 < Score <= 132)

4.2.5 Bankfull Verification

Bankfull can be difficult to identify on a streams that are actively maintained for agricultural purposes. Because the usual indicators rarely exist, other factors have to be taken into consideration in order to

accurately identify a bankfull stage. Other factors that can be used are wrack lines, vegetation lines, scour lines, or top of a bankfull bench. Throughout the entire project, most stream channels are slightly incised and actively maintained, which means bankfull indicators were limited or non-existent. Therefore, the bankfull stage was estimated by using the Piedmont Regional Curves, existing cross sections, and in-house spreadsheets to calculate bankfull area and bankfull discharge.

4.2.6 Vegetation

Current land use around the project is primarily agriculture and forestry. Land use immediately surrounding the project consists of concentrated animal feeding operations (CAFO), livestock grazing, row crops, and forestry. The pasture is a mix of tall fescue (*Schedonorus phoenix*), Bermuda grass (*Cynodon dactylon*), and other pasture grasses. The row crops are corn and soybeans. Weedy herbaceous species are also common and include Canada goldenrod (*Solidago canadensis*), beggarticks (*Bidens* sp.), blackberry (*Rubus argutus*), dogfennel (*Eupatorium capillifolium*), spiny plumeless thistle (*Carduus acanthoides*), and American pokeweed (*Phytolacca americana*).

Wetter areas in depressions and along the channel banks include common rush (*Juncus effusus*), Pennsylvania smartweed (*Polygonum pensylvanicum*), and sedges (*Carex* spp.). Where not maintained frequently, a few woody stems persist along the channel banks, including sweetgum (*Liquidambar styraciflua*), American black elderberry (*Sambucus nigra* ssp. *canadensis*), black willow (*Salix nigra)*, cottonwood (*Populus deltoides*), and tuliptree (*Liriodendron tulipifera*). Non woody species include sawtooth blackberry (*Rubus argutus*) and fescue. Some exotics were noted including Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora)*, tree-of-heaven (*Ailanthus altissima*), Nepalese browntop (*Microstegium vimineum*), and Japanese honeysuckle (*Lonicera japonica*). Only Chinese privet is widespread. **Table 10** summarizes the natural communities at the Site.

Table 10. Natural Community Summary

Land Use/Natural Community	Percent of Study Area	Schafale and Weakley Community
Agriculture – Row Crops	61	NA
Agriculture – Pasture/Hayfields	19	NA
Mixed Pines/Hardwoods	9	Mesic Mixed Hardwood Forest -Piedmont Subtype
Concentrated Animal Feeding Operation	7	NA
Open Water	1	NA
Residential/Managed Herbaceous	3	NA

4.2.7 Quantitative Habitat Assessment

A quantitative habitat assessment was performed in December 2012 on the reference reach and in January 2013 on existing Poplin Ridge reaches UT1-R2, UT1-R4, UT1-B, and UT2-R4 to measure the volume of woody debris and fish cover. These data were used to establish a baseline for measuring functional uplift and as a tool to determine the placement and volume of woody debris in the design reaches. The total available woody debris (not buried) in the reference reach exceeds the design reaches on a per linear foot basis. In addition, surveys conducted pre- and post-construction in the restoration reach will enable the quantification of habitat deficiencies and habitat gains over time.

The length of each sample reach was thirty to forty times the base-flow wetted width of the channel with a minimum reach size of 200 feet. The sample reach was divided into ten transects spaced evenly over the entire reach. Transect length was five feet upstream and five feet downstream of the transect midpoint, and extended the full width of the channel. Parameters measured at each transect were small woody

debris (SWD), fish cover, substrate material, and riparian composition. At each transect, the channel bed form was noted and an average width and depth were recorded. The following is an analysis of the habitat assessment data.

Stream Preservation and Buffer Enhancement reaches were not sampled during the habitat assessment due to the presence of an intact stream buffer. Any restoration or enhancement stream reach that was not sampled in the habitat assessment was due to similarity with other sampled reaches.

4.2.7.1 Small Woody Debris Methods and Results

Small woody debris was measured at the reference reach in order to design SWD habitat structures similar to those found in the reference reach (**Appendix B**). SWD greater than 0.2 inches in diameter was measured in each reference reach transect. A diameter of 0.2 was selected arbitrarily as a cutoff between individual small sticks that makeup a negligible percentage of the total SWD volume versus small branches that provide more significant volume and habitat benefits. Large woody debris was eliminated from the analysis since these are analogous to structures such as log grade controls and log toes currently applied to most restoration designs.

Transects were identified as either riffle, pool, run, or glide bed form types resulting in three pools, three riffles, two glides and two runs measured at the reference reach. Measurements of SWD were summed for each bed form type and divided by the number of corresponding transects to get the average volume of SWD per bed feature. The average volume was then divided by the average transect area to get the volume of SWD per square foot. The average design reach bed form area was calculated by assuming a length of ten feet (based on reference transects) and multiplying that by the average bottom cross section width. The average volume was multiplied by the ratio of average reference reach transect area to the average area in the design reach to obtain the volume of SWD to be installed at each fixed pool and at select locations along the design bed feature.

WK Dickson currently uses wattles, dead brush, and woody debris bundles in the design of restoration channels. Based on the reference reach SWD analysis, these SWD structures will be concentrated in pool habitats and throughout runs and glides in volumes and size classes similar to those found in the reference reach. Wattles are woody branch structures tied together and embedded into the bank so that the free ends stick out into the wetted channel. Dead brush structures are shrub or tree tops that are anchored to the bottom of the channel. Woody debris bundles are bundles of sticks one to four inches in diameter and one to four feet long that are anchored to the streambed. Although root wads serve as bank stability structures, they also provide a significant amount of SWD volume to the restoration reach. The average volume of each SWD structure is presented in **Table 11**. A combination of structures listed in **Table 11** will be used in the design to attempt to achieve the calculated average volume per bed form type listed in **Table 12**.

Table 11. Average volume (cubic inches) of SWD structures used in the design reach

SWD	Average Volume
Woody Debris Bundle	509
Dead Brush	589
Wattle	42
Root Wad	562
Leaf Pack	120

Table 12. Small Woody Debris calculations for the reference and design reach

Channel bed form	Number of transects	Total volume (in^3)	Average volume in reference reach (in^3)	Percent of WD	Average volume to be applied to design per 10 LF of channel (in^3)			
					UT1-R2	UT1-R3	UT2-R2/3	UT2-R4
Riffle	3	9721	3240	65%	2,819	3,240	4,083	4,342
Pool	3	710	237	5%	206	237	298	317
Run	2	2137	1069	14%	930	1,069	1,346	1,432
Glide	2	2315	1158	16%	1,007	1,158	1,458	1,551
Total	10	14883	5703	100%	4,962	5,703	7,186	7,642

In addition to the habitat assessment conducted at the reference site, UT1 and UT2 of the project site were assessed in order to measure representative habitat gains over time post-construction. Based on these assessments, there is a large disparity of SWD volume between the reference reach and the design reaches (**Chart 1**).

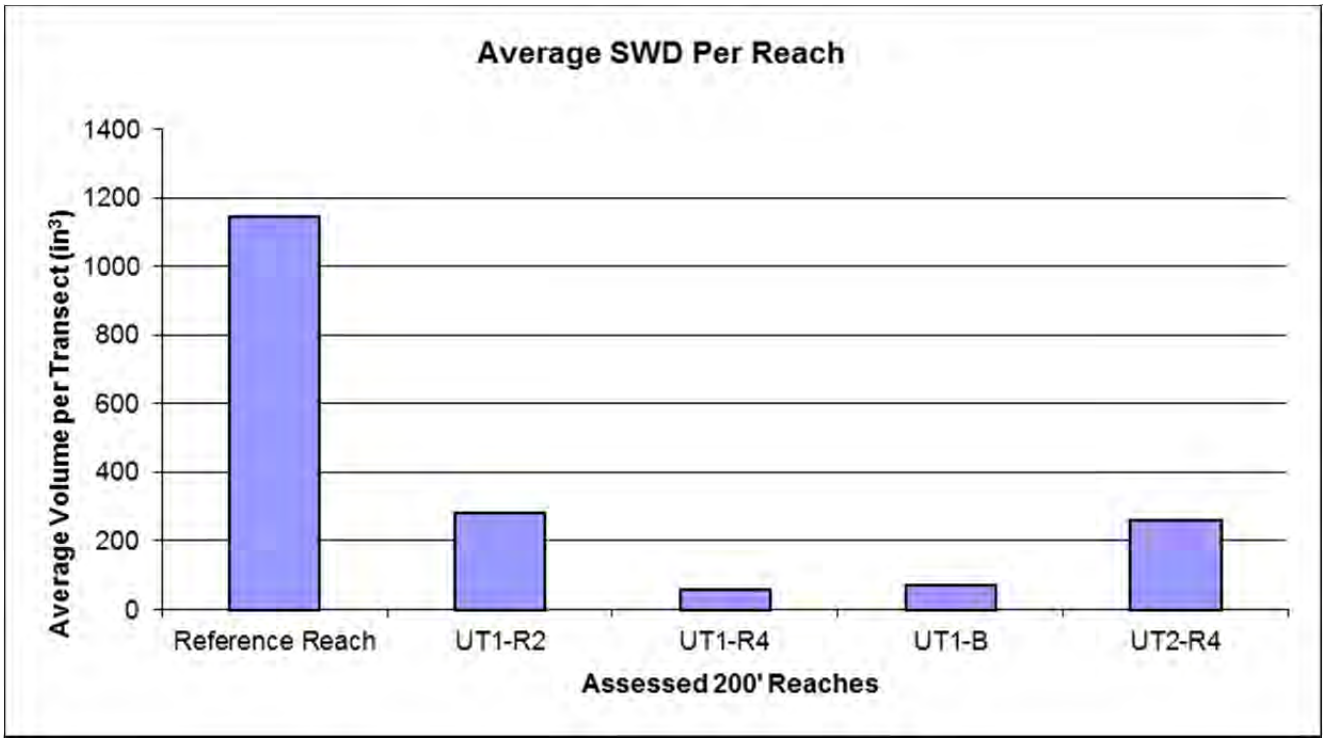


Chart 1. Average volume (cubic inches) of SWD per assessed reach. This chart represents existing conditions in all assessed reaches.

Woody debris collected in streams provides habitat for macroinvertebrates, fish, and amphibians, and increases stream productivity by retaining carbon in the channel. While it would be difficult to replicate the volume and spatial distribution of SWD found in the reference channel, this quantitative habitat assessment provides guidance for improving habitat conditions through specifically placed and sized SWD structures, and provides a means for assessing functional gains over time. These structures are included in the design plans (**Appendix D**).

4.2.7.2 Fish Cover Methods and Results

Fish cover measurements were taken at each transect along the reference reach and Poplin Ridge Reaches 1 and 2. Fish cover area was visually calculated within the ten-foot transect length. Fish cover types

include small woody debris and brush, aquatic macrophytes, overhanging vegetation, undercut banks, and boulders. For each transect, a percentage of total fish cover and individual cover type areas were calculated (**Chart 2**). Location and general habitat data was recorded for each fish cover measurement to assess spatial distribution.

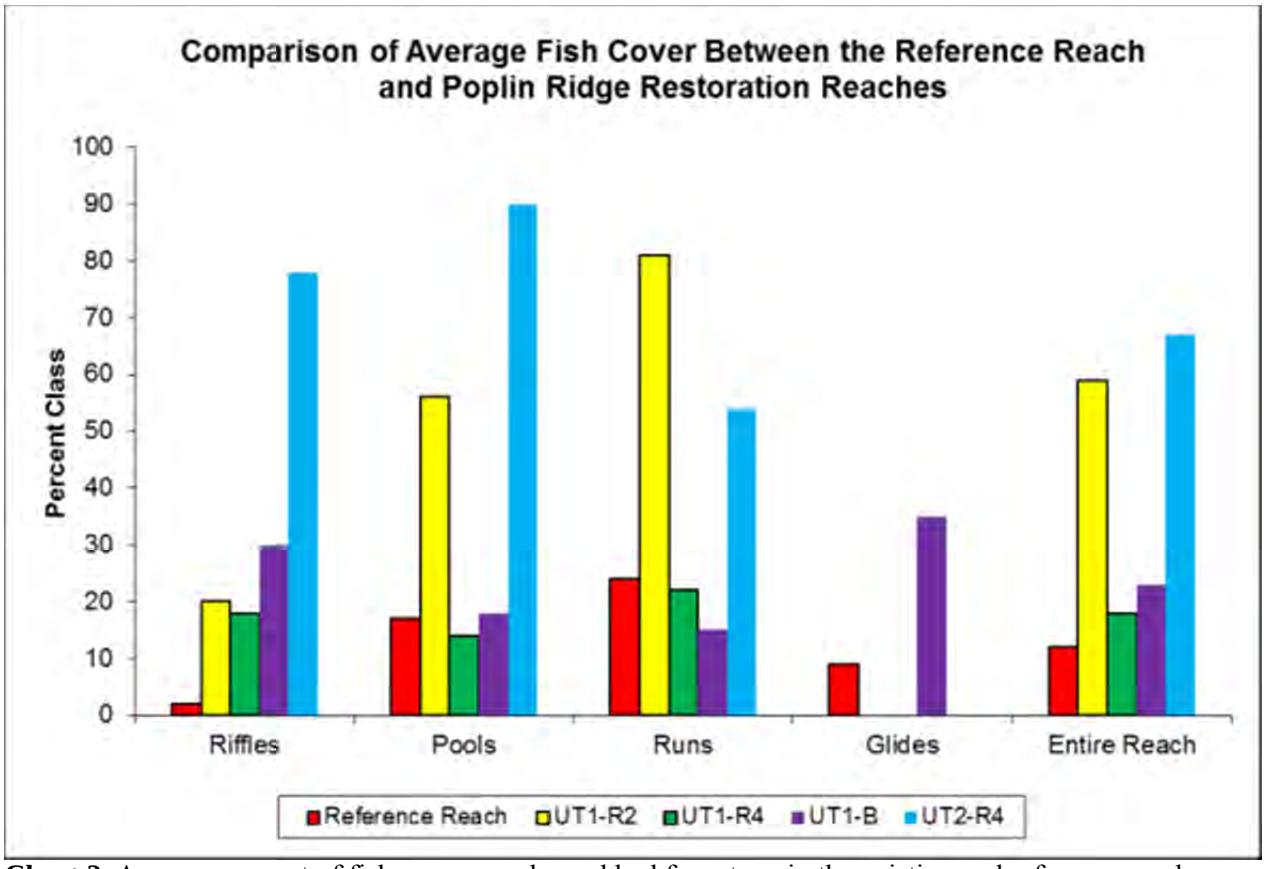


Chart 2. Average percent of fish cover per channel bed form type in the existing and reference reaches.

The fish cover analysis revealed that the average area of fish cover is almost twice as high in Poplin Ridge Reach UT1-R2 and UT2-R4 as in the reference reach. This is because the UT2-R4 streambed is mostly covered by macrophytic vegetation along the majority of the assessed reach. Both Poplin Ridge Reaches UT1-R2 and UT2-R4 also had shrubby overhanging bank vegetation, whereas the reference reach ran through a mature forested buffer with few shrubs and overhanging bank vegetation. Fish cover from low growing brush will increase in the restoration reaches after the riparian planting occurs. Woody debris structures will also provide additional fish cover habitat and resting areas for fish swimming upstream.

4.2.7.3 Substrate Composition

Substrates were divided into eight classes as follows: coarse/fine particulate organic matter, silt/clay/muck, fine sand, coarse sand, gravel, cobble, boulder, and bedrock (**Chart 3**). Channel width and water depth were measured at each transect in four equally spaced intervals from bank to bank. Substrate coverage was visually determined between widths measured at each major change in substrate type.

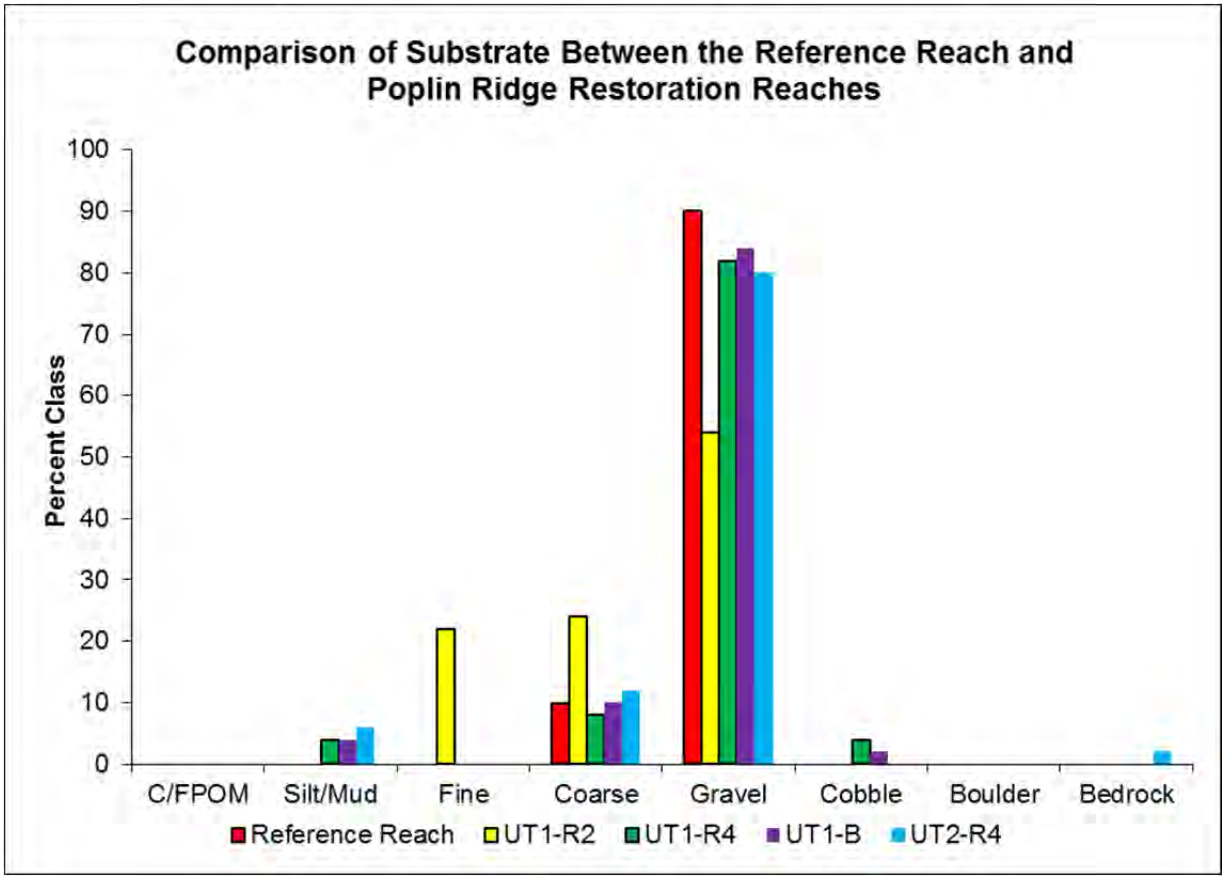


Chart 3. Comparison of substrate composition between the reference reach and the restoration reaches.

The substrate composition analysis revealed that the reference reach has similar substrate as the four assessed stream reaches. A slight difference is noticed in the amount of silt/mud and fine materials within the project reaches. These differences may be attributed to several factors, including the absence of a vegetated stream banks, a forested buffer and sediment input from adjacent agricultural fields. Macroinvertebrate abundance and diversity has been tied to the ability of a channel to retain carbon. Several design structures and vegetation plantings can be used to increase organic substrate composition. Constructed leaf packs will be installed in select locations for immediate macroinvertebrate colonization. SWD bundles will serve to collect organic matter flowing downstream increasing carbon retention. By adding sinuosity and creating a better floodplain connection, adding SWD in select locations, and creating pool habitats, restored substrate composition will more closely resemble reference reach conditions.

4.3 Wetland Summary Information

4.3.1 Existing Wetlands

The National Wetland Inventory (NWI) mapping depicts four wetlands within the project site area (**Figure 6**). Three of these wetlands are small ponds classified as PUBHh (Palustrine Unconsolidated Bottom Permanently Flooded Diked/Impounded). These small ponds are adjacent to the stream channels. Only one is in the proposed buffer on UT2 and will be breached/filled, and only one is within the project limits on UT2. A third, at the head of UT1, is classified a PFO1 (Palustrine Forested Broad-Leaved Deciduous Temporarily Flooded). This NWI wetland was field verified and found not to be present or within the proposed project area.

A wetland delineation was performed in February 2013. Wetland boundaries were delineated using current methodology outlined in the 1987 Army Corps of Engineers Wetland Delineation Manual (DOA

1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0) (U.S. Army Corps of Engineers 2012). Soils were characterized and classified using the Field Indicators of Hydric Soils in the United States, Version 7.0 (USDA-NRCS 2010). Wetland boundaries were marked with sequentially numbered wetland survey tape (pink/black striped). Flag locations were located using a mapping grade GPS handheld unit under the direction of a Professional Licensed Surveyor (PLS).

A jurisdictional determination of the wetlands has not been made by the US Army Corps of Engineers (USACE), but the USACE has visited the restoration site. Wetland forms are included in **Appendix B**. Onsite wetlands include riparian wetlands along both sides of UT-R1 and at the upstream limit of UT2-R3 on the right bank. An inline pond on UT2 is present but does not meet jurisdictional requirements to be classified as a wetland.

The existing wetland areas on-site are riparian. The wetlands are immediately adjacent to UT2 and have relatively high groundwater elevations. Based on vegetation, soil, and hydrology indicators, it appears that these areas are inundated or saturated for most of the growing season in a typical year. The wetlands are low topographic floodplain areas. They are impacted by some spoil material along the channel and runoff erosion from adjacent agriculture fields. Field indicators of wetland hydrology include water stained leaves, saturated soil within one foot of the surface, crayfish burrows, and hydrophytic vegetation. These wetlands are mapped on the somewhat poorly drained Chewacla soils.

Wetland A is identified within the floodplain along the east and west sides of UT2-R1 located approximately 590 feet upstream of the existing pond dam. Wetland B is located just below the pond dam on the west side of UT2-R3. Potential impacts associated with restoration efforts occurring adjacent to the existing wetlands (Wetlands A and B) along UT2-R1 and UT2-R3 have been minimized by placing the proposed channel in a non-wetland area. **Table 13** summarizes the sizes of each existing wetland and its location.

The existing wetlands have been historically disturbed and lack the typical vegetation of bottomland hardwood wetlands. Creating a new channel that will provide an overall increase in wetland function with the addition of native trees and shrubs planted along the stream banks. Impacts to hydrology should be minimal. Wetland A contains mostly invasive species (e.g., Chinese privet). Stream restoration and enhancement activities in these areas will also remove the invasive species.

Table 13. Wetland Summary Information

Parameters	Wetland A	Wetland B
Size of Wetland (acres)	0.52	0.01
Wetland Type	Riparian	Riparian
Mapped Soil Series	Chewacla	Chewacla
Drainage Class	Somewhat	Somewhat
Soil Hydric Status	Hydric with Hydric Inclusions	Hydric with Hydric Inclusions
Source of Hydrology	Overbank Flows & Groundwater	Overbank Flows & Groundwater
Hydrologic Impairment	NA	Ditched
Native vegetation community	Bottomland Hardwood Forest	Clear-cut
Percent composition of exotic invasive vegetation	20% Chinese Privet	0%

4.3.2 Wetland Impacts

Wetland impacts will be minimized to the maximum extent practicable and are anticipated to be minor and almost entirely temporary. Impacts within wetland A will be temporary and total 0.008 acre and

result from disturbance during grade control structure installation. Impacts to wetland B will be permanent, total 0.007 acre, and result from channel relocation (Figure 6a).

Figure 6. Project Site NWI Wetlands Map

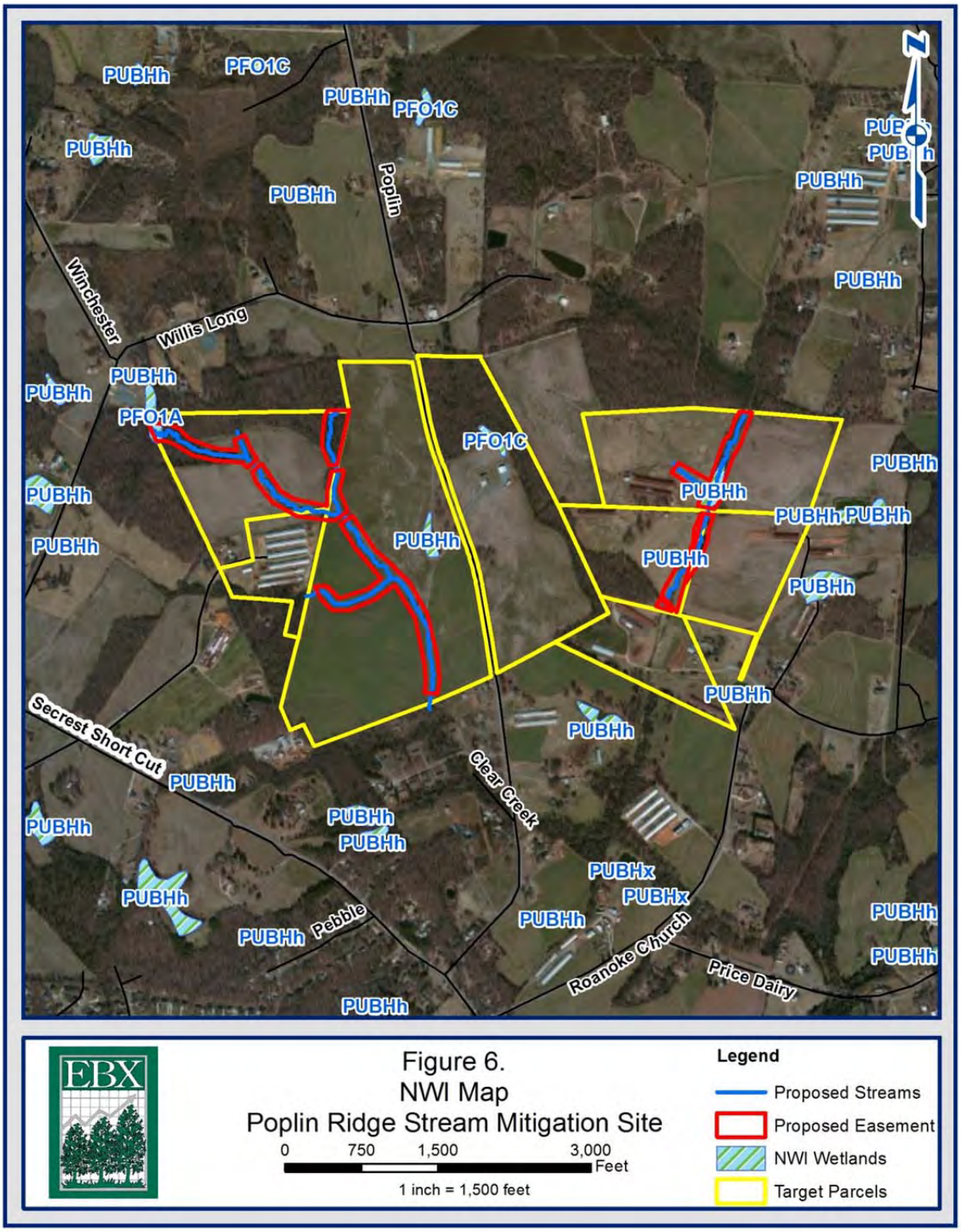


Figure 6a. Wetland Impacts

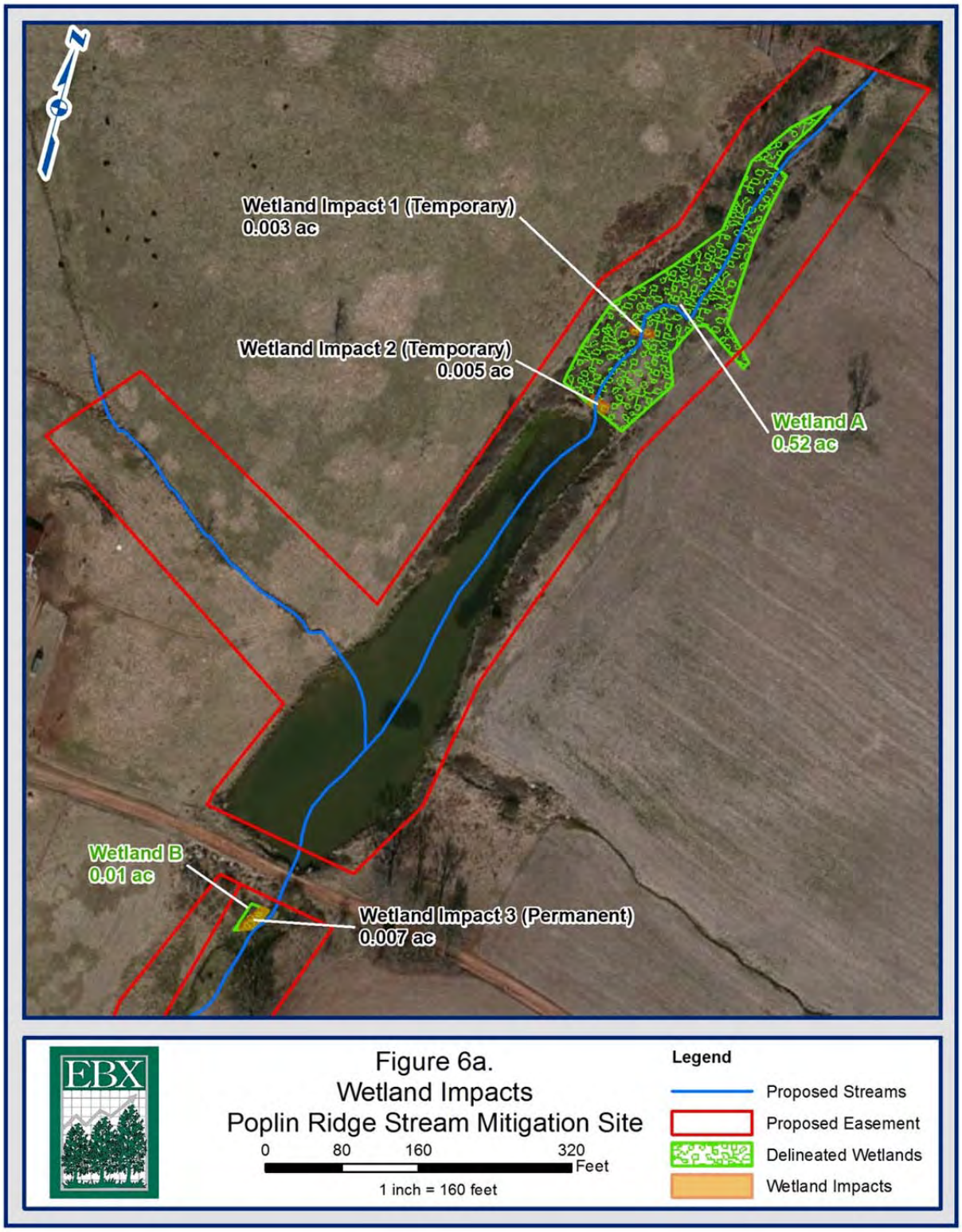


Figure 7. Project Site Land Use

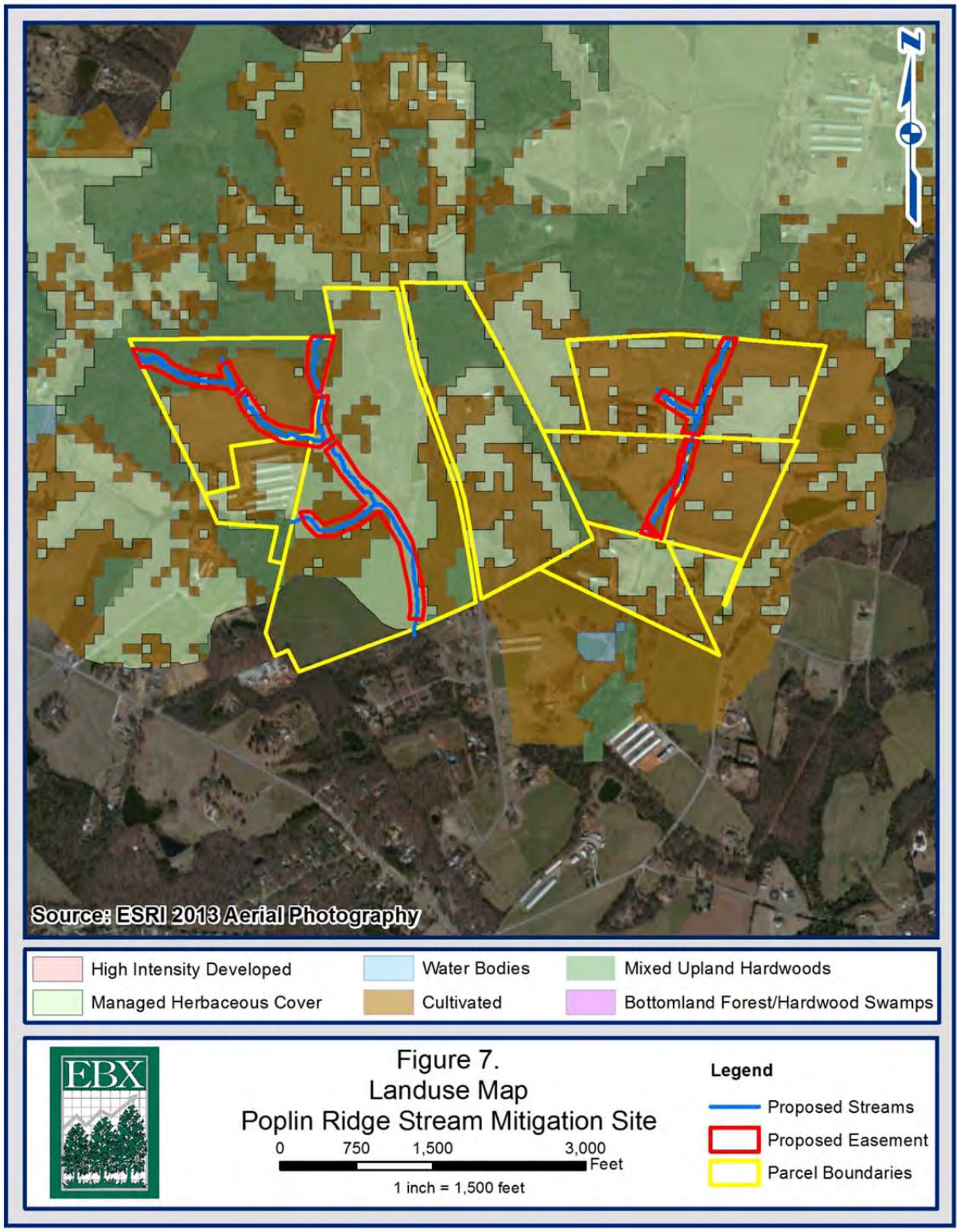
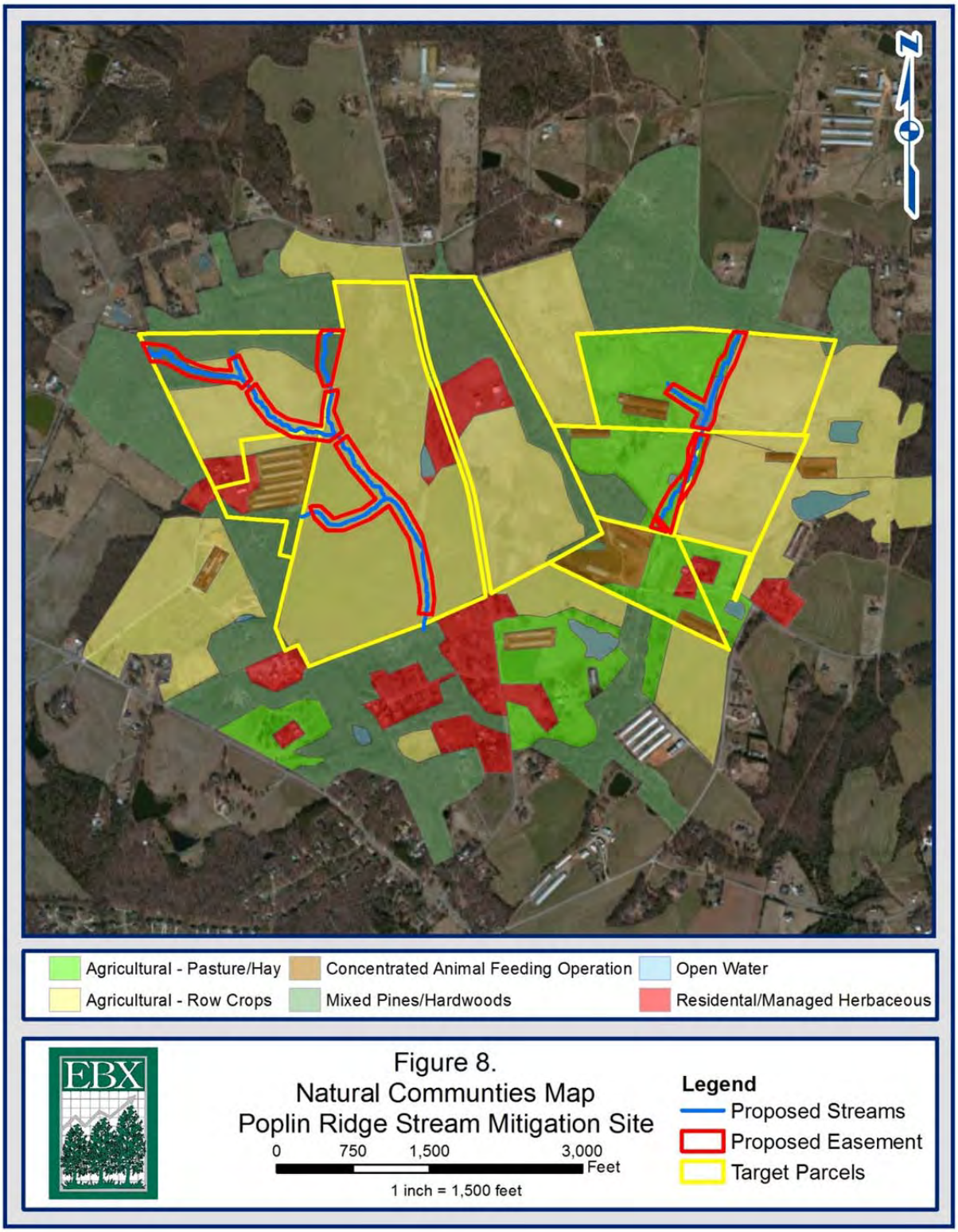


Figure 8. Project Site Natural Communities



4.4 Regulatory Considerations and Potential Constraints

4.4.1 Property Ownership, Boundary, and Utilities

There are no conflicts with the anticipated easement acquisition; however, there are several constraints at the Poplin Ridge Site. An existing overhead power line easement is located adjacent to the left bank near the downstream end of UT1. This results in approximately 0.09 acre of riparian buffer that cannot be planted with trees. An herbaceous/shrub planting zone is proposed in this area to provide stability, and the right bank buffer has been increased to a width that varies between 75 and 100 feet to compensate for the area that cannot be planted. The future Monroe Bypass is located immediately west and south of the proposed project. The Site is located within five miles of two General Aviation airports. The project will decrease waterfowl habitat by removing an existing dam and draining the pond along UT2.

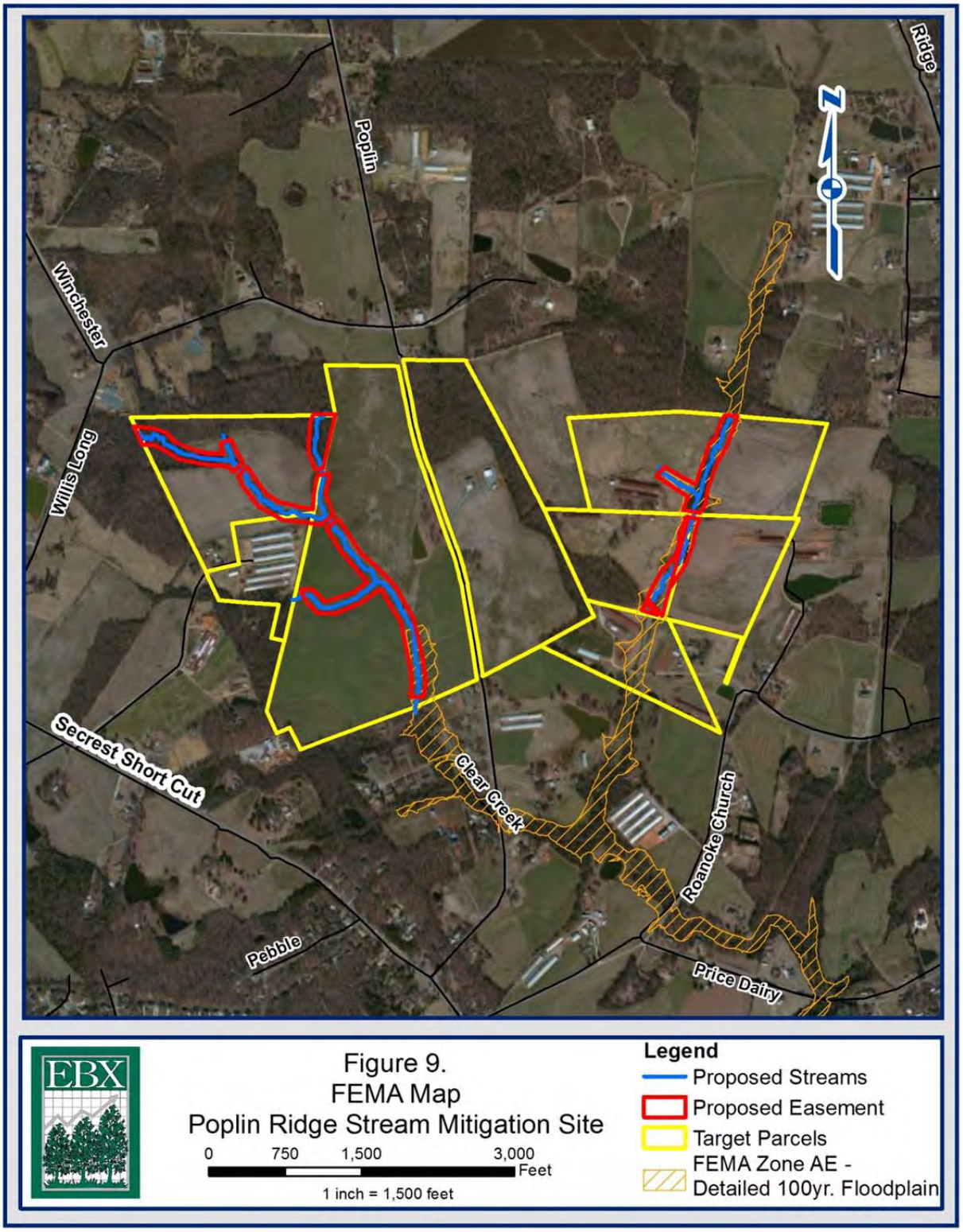
4.4.2 FEMA/ Hydrologic Trespass

There are no hydrologic constraints to the proposed Poplin Ridge project. Seven crossings will be improved and/or added, stabilized, and maintained for future use. These crossings will include appropriately sized culverts and will be fenced (where needed) to prevent livestock access to any part of the stream channel or riparian buffer. Five minor agricultural drainage swales will enter the proposed easement. Three of the swales, all non-jurisdictional, will be retrofitted with structures to provide diffuse flow into the riparian buffer. Both primary drainages (UT1 and UT2) are mapped FEMA 100-year floodplain (**Figure 9**). Restoration or enhancement on those channels will require a no-rise or a Conditional Letter of Map Revision (CLOMR) from FEMA. It is anticipated that a no-rise will meet the project requirements and the necessary report and documentation will be submitted to NCEM upon the final approval of the project from EEP and the IRT.

Table 14. Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	Appendix B
Waters of the United States - Section 401	Yes	Yes	Appendix B
Endangered Species Act	Yes	Yes	Section 4.1.3; Appendix B
Historic Preservation Act	Yes	Yes	Section 4.1.4; Appendix B
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	NA	N/A
FEMA Floodplain Compliance	Yes	No	Section 4.4.3; Appendix B
Essential Fisheries Habitat	No	NA	N/A

Figure 9. Project Site FEMA Map



5. DETERMINATION OF CREDITS

Mitigation credits presented in these **Tables 15-18** are projections based upon site design. Upon completion of site construction, the project components and credits data will be revised to be consistent with the as-built condition.

Table 15. Determination of Credits

Poplin Ridge Site, Union County EEP Project # 95359									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	6,107	238	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 16. Project Components

Project Component or Reach ID	Stationing/ Location	Existing Footage or Acreage	Approach (PI, PII, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage or Acreage	Mitigation Ratio	SMUs
UT1-1	1+20 to 6+92	572	Preservation	RE	572	1 : 5.0	114
UT1-1	6+92 to 12+58	566	Enhancement I	R	566	1 : 1.5	377
UT1-2	12+58 to 24+89	1,284	P1 Restoration	R	1,171	1 : 1.0	1,171
UT1-3	24+89 to 34+50	833	P1 Restoration	R	901	1 : 1.0	901
UT1-4	34+50 to 46+60	1,252	Enhancement I	R	1,210	1 : 1.5	807
UT1-A	0+65 to 2+82	197	Enhancement I	R	217	1 : 1.5	145
UT1-B	0+09 to 6+29	620	Preservation	RE	620	1 : 5.0	124
UT1-B	6+29 to 11+46	512	Enhancement I	R	455	1 : 1.5	303
UT1-C	1+21 to 9+78	883	Enhancement I	R	857	1 : 1.5	571
UT2-1	0+00 to 4+90	490	Enhancement II	R	490	1 : 2.5	196
UT2-2	4+90 to 13+97	875	P1 Restoration	R	847	1 : 1.0	847
UT2-3	13+97 to 19+18	495	P1 Restoration	R	521	1 : 1.5	347
UT2-4	19+18 to 22+07	270	P1 Restoration	R	257	1 : 1.0	257
UT2-A	0+65 to 5+28	365	Enhancement II	R	463	1 : 2.5	185

[1] P1 = Priority 1

[2] The calculations for existing and proposed lengths and SMUs do not include stream segments associated with existing culverts or breaks in the proposed conservation easement associated with culvert or utility crossings.

[3] Reach UT2-3 has a lower mitigation ratio of 1:1.5 due to previous impacts from the landowner. The proposed lower ratio is based on coordination with USACE.

[4] See Figures 11A and 11B for reach locations.

Table 17. Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	3,697					
Enhancement						
Enhancement I	3,305					
Enhancement II	953					
Creation						
Preservation	1,192					
High Quality Preservation						

6. 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 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 Interagency Review Team (IRT), 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 project credits will be subject to the criteria described as follows:

Table 18. Stream Credits

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation - see requirements below	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.	15%	70% (85%*)
5	Fifth year monitoring report demonstrates performance standards are being met and project has received close-out approval.	15%	85% (100%*)

*a reserve of 15% of the total stream credits shall be released after two bank-full events have occurred, in separate years, provided the channel is stable and all other performance standards are met.

6.1 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.

6.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, 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 bank-full 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 bank-full events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. 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.

7. MITIGATION WORK PLAN

7.1 Reference Stream Studies

7.1.1 Target Reference Conditions

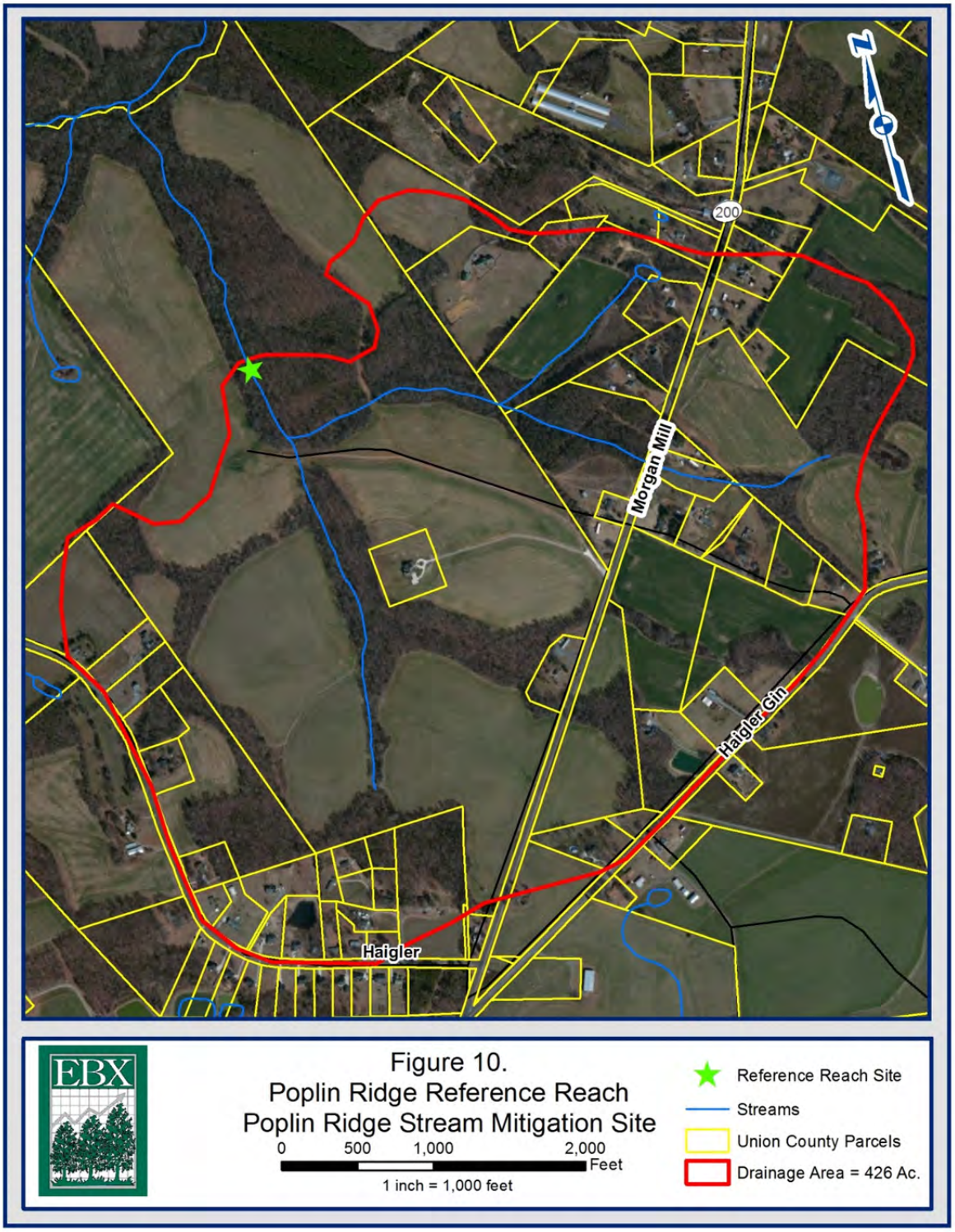
The restoration site is characterized by agricultural practices. Several ditches exist in the watershed and contribute to the project site. Physical parameters of the site were used, as well as other reference materials, to determine the target stream type. An iterative process was used to develop the final information for the site design.

To develop the target reference conditions, physical site parameters were reviewed. This included the drainage area, land use, soils mapping units from the Union County Soil Survey for the watershed and site, typical woody debris and habitat available for the area, as well as general topography. The "Classification of the Natural Communities of North Carolina" was also used to narrow the potential community types that would have existed at the site (Shafale and Weakley, 2003).

Targeted reference conditions included the following:

- Located within the Physiographic Region – Piedmont Region,
- Similar drainage area,
- Similar land use onsite and in the watershed,
- Similar watershed soil types,
- Similar site soil types,
- Ideal, undisturbed habitat – several types of woody debris present,
- Similar topography,
- Similar slope,
- Pattern common among Piedmont streams, and
- Minimal presence of invasive species.

Figure 10. Reference Reach Site Map



7.1.2 Reference Site Search Methodology

All the parameters in **Section 7.1.1** were used to find appropriate reference stream sites. Obtaining property owner information and owner authorization for access was another factor in locating suitable reference sites for the project. For this project, there was no predetermined amount of reference sites needed as long as the site was suitable and met nearly all the parameters. Six potential reference sites were visited, and their characteristics were noted. It is difficult to a find reference site because many have been disturbed by farming or residential development. Streams tend to be modified ditches and may have some of the characteristics that are sought in a reference, but too few to make it an ideal reference for the project site. One reference stream site that proves to be ideal in both geomorphology and habitat is located approximately eight miles northeast of the restoration site in a wooded corridor.

A GIS-based search was initially conducted for the identification of reference stream sites in the watershed. The GIS process was based on a search through quadrangle maps, aerial photography, and topography. Drainage areas for each reference site were delineated. Soils and land use were considered for each site, as well as accessibility and location in comparison to the restoration reach. Once sites were identified, all six sites were visited and assessed. Many of the identified reaches were affected by farming practices, dense invasive species, and disturbed or altered floodplains. This was the case for most of the sites visited; and therefore, these sites were not considered. One site was identified for use as a reference reach.

7.1.3 Reference Watershed Characterization

The reference stream flows north and drains into Grassy Creek (**Figure 10**). The reach that was surveyed and analyzed is approximately 320 feet long. The drainage area for the unnamed tributary to Grassy Creek (UT) is 0.67 square miles (427 acres). The land use in the watershed is characterized by mostly cultivation (57 percent), managed herbaceous cover (15 percent), mixed upland hardwoods (26 percent), unmanaged herbaceous upland (1 percent), and southern yellow pine (1 percent). Site photographs of the reference stream are located in **Section 2.5**.

The current State classification for the UT to Grassy Creek and Grassy Creek is Class C (NCDWQ, 2005). Class C waters are suitable for aquatic life, secondary recreation, and agricultural usage. Using Rosgen stream classification, the stream is classified as an E4 stream type.

7.1.4 Reference Soils Characterization

The soils found in and around the reference reach are mapped as Badin and Tatum, both of which are non-hydric soils. Badin soils typically are moderately deep and well drained. Badin soils are commonly found along ridges and side slopes of uplands ranging from 2 to 45 percent. Badin and Tatum soils are clayey, mixed, thermic Typic Hapludults, and are formed in material weathered from Carolina Slates. Tatum soils have similar characteristics and are commonly associated with Badin soils. The soils immediately adjacent to the reference reach have similar characteristics and properties to the soils found at the Poplin Ridge Restoration Site.

7.1.5 Reference Discharge

Several hydrologic models/methods were used to develop a bankfull discharge for the reference site. Existing drainage area, land use, slope, roughness, and cross-sectional area were all factors considered when performing the calculations. Using a combination of Piedmont Regional Curves, in-house spreadsheet tools, and a project specific regional flood frequency analysis; the existing discharge was calculated to be approximately 50 cubic feet per second (ft^3/s). See **Section 7.3.1.1** for a more detailed description of the hydrologic analyses performed for this project.

7.1.6 Reference Channel Morphology

In comparison to the restoration reaches, the reference reach is larger than UT1 when comparing pattern, dimension and profile and smaller than UT2, which is the reason for using a scaling factor for the design.

The scaling factor is based on a smaller or larger bankfull area of the reference channel. Since the reference stream is smaller than UT2, it was necessary to scale up the analog reach in order to use it for design. Likewise, since the reference stream is larger than UT1, it was necessary to scale down the analog reach. The new reach would then have the necessary dimensions of an appropriate stream similar in size to the existing channel that would correspond to the larger drainage area. The reference reach is typically thirteen to eighteen feet wide and one to three feet deep. The cross sectional area is typically around 19.1 square feet with a width to depth ratio close to 10.5.

7.1.7 Reference Channel Stability Assessment

The reference reach is stable and shows no evidence of incision or erosion in the portion that was surveyed and analyzed. The stream appears to maintain its slope and has sufficient amounts of vegetation to secure its banks. Riparian buffer widths exceed fifty feet on each side. The CSA results (scores and ratings) for the reference reach are provided above in **Table 8** and **Table 9** (**Section 4.2.4**). The reference reach received a "Good" rating as the channel demonstrates a stable meandering pattern and a well-vegetated riparian buffer.

7.1.8 Reference Bankfull Verification

Typical indicators of bankfull include vegetation at the bankfull elevation, benches/inner berm, and point bars. Throughout the entire length of the reference reach, bankfull is located at the top of bank elevation and/or the back of existing point bars. The accuracy of this bankfull stage is verified by comparing the discharges from the Piedmont Plain Regional Curves and flood frequency analysis results to the discharges generated using Manning's equation based on measured hydraulic geometry and slopes. Evidence that further supports the location of bankfull is the lack of any benches or berm features within the channel, and wrack lines present within the floodplain.

7.1.9 Reference Riparian Vegetation

The reference reach riparian community is characteristic of a Mesic Mixed Hardwood Forest-Piedmont Subtype. This community is approximately 20 to 25 years old, as evidenced by the representative diameter at breast height (DBH) measurements and historical aerial photography. **Table 19** lists the coverage estimates and species encountered. The right bank is denoted as RB and the left bank is denoted as LB.

Table 19. Tree Communities at the Reference Reach for Poplin Ridge Site

Transect	Location	Coverage	Percent Evergreen	Percent Deciduous	Representative DBH (in.)	Species
1	LB	85	---	100	10	*Quercus rubra, Quercus falcata, Liquidambar styraciflua*
	RB	80	---	100	6	*Quercus rubra, Quercus falcata, Carya ovata*
2	LB	90	---	100	10	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua*
	RB	80	---	100	6	*Quercus rubra, Quercus falcata, Quercus alba, Carya ovata, Quercus nigra*
3	LB	90	---	100	10	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua*
	RB	75	---	100	6	*Quercus rubra, Quercus falcata, Quercus alba, Carya ovata, Quercus nigra*
4	LB	85	---	100	12	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua*
	RB	75	---	100	8	*Quercus rubra, Quercus falcata, Quercus alba, Carya ovata, Quercus nigra*
5	LB	85	---	100	10	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua*
	RB	80	---	100	4	*Quercus rubra, Quercus falcata, Quercus alba, Carya ovata*
6	LB	90	---	100	10	*Quercus rubra, Quercus falcata, Quercus alba, Carya ovata, Liquidambar styraciflua*
	RB	70	1	99	4	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua, Juniperus virginiana, Magnolia grandiflora*
7	LB	80	1	99	8	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua, Ilex opaca*
	RB	70	1	99	6	*Quercus rubra, Quercus falcata, Pinus palustris, Quercus alba, Juniperus virginiana*
8	LB	80	---	100	8	*Liriodendron tulipifera , Liquidambar styraciflua, Quercus rubra, Quercus falcata*
	RB	70	1	99	4	*Quercus rubra, Quercus falcata, Liquidambar styraciflua, Pinus palustris, Juniperus virginiana*
9	LB	75	---	100	6	*Quercus rubra, Quercus falcata, Quercus alba, Liquidambar styraciflua*
	RB	70	5	95	4	*Pinus palustris, Quercus rubra, Quercus falcata, Quercus alba*
10	LB	80	1	99	8	*Quercus rubra, Quercus falcata, Ilex opaca, Quercus alba*
	RB	70	5	95	6	*Pinus palustris, Quercus rubra, Quercus falcata, Quercus alba*

It is anticipated that a local seed source for these high dispersal species is present and will disperse across much of the mitigation site. These species are often found in early successional communities and quickly fill disturbance gaps. Because many of these high dispersal species often become aggressive in these sites, they are not included in the Restoration Planting List (**Section 7.2.2**). Hardwood species typical of the target community were observed in adjacent and nearby communities, and were judged to be more appropriate for this site.

7.1.10 Stream Habitat Assessment – Woody Debris

The habitat assessment for the reference stream channel is included in the habitat assessment discussion for Poplin Ridge Site (**Section 4.2.7**).

7.2 Design Parameters

7.2.1 Stream Restoration Approach

Stream restoration efforts along the unnamed tributaries to East Fork Stewarts Creek were accomplished through analyses of geomorphic conditions and watershed characteristics. The design approach applies a combination of analytical and reference reach based design methods that meet objectives commensurate

with both ecological and geomorphic improvements. Proposed treatment activities may range from minor bank grading and planting to re-establishing stable planform and hydraulic geometry. For reaches requiring full restoration, natural design concepts have been applied and verified through rigorous engineering analyses and modeling. The objective of this approach is to design a geomorphically stable channel that provides habitat improvements and ties into the existing landscape.

The Poplin Ridge Site will include Priority Level I stream restoration, stream Enhancement Levels I and II, and Stream Preservation and Buffer Enhancement. Priority Level I stream restoration will incorporate the design of a single-thread meandering channel, with parameters based on data taken from the reference site described in **Section 7.1** above, published empirical relationships, NC Rural Piedmont Regional Curves, and hydrologic and hydraulic analyses. Approximately 4,444 linear feet of stream channel will be reconstructed. Enhancement Level I will be applied to 3,305 linear feet of channel that requires stabilization and bank improvements, and buffer restoration. Enhancement Level II will be applied to an additional 953 linear feet of channel that requires buffer enhancement and/or minimal bank and habitat improvements. Additionally, Stream Preservation and Buffer Enhancement is proposed on 1,192 feet of channel. Conceptual plan views are provided in **Figures 11a** and **11b**.

Current stream conditions along the proposed restoration reaches demonstrate significant habitat degradation as a result of impacts from livestock and channelization performed to promote agricultural activities. Additionally, the riparian buffer is in poor condition throughout most of the project area. Much of the riparian buffer is devoid of trees or shrubs and active pasture and/or crops are present up to the edge of the existing channel.

The Poplin Ridge Site design approach began with a thorough study of existing conditions, including the onsite streams and ditches, valleys, and watershed. Design parameters, including active channel, habitat and floodplain features were developed from analyses performed at the reference site. Analytical design techniques were used to determine the design discharge and to verify the design as a whole.

Engineering analyses were performed using various hydrologic and hydraulic models to verify the reference reach based design. A combination of methods (including Hydraflow Hydrographs, regional curves and flood frequency analysis) were used to calculate flows received by the channel for bankfull and other significant storm events. HEC-RAS was then used to simulate water surface elevations of flows generated by the hydrologic analysis. The development of the HEC models is an important component to the design; therefore, model input parameters are field verified when possible. Through this hydrologic analysis, the design discharge (typically referenced as bankfull or dominant discharge) was determined, and the subsequent design was based on this calculated discharge. Design parameters developed through the analyses of reference reach data and hydrologic and hydraulic modeling were confirmed using the Stable Channel Design function components within HEC-RAS and through spreadsheet tools.

Engineering analyses were performed concurrently to geomorphic and habitat studies. While the stream design was verified by simulations of hydrology and fluvial processes, analogs of desirable habitat features were derived from reference sites and integrated into the project design. Both riparian habitat features and in-stream structures such as riffle grade controls, cross weirs, log toes, and step pools were used throughout the project to act as grade control and for bank stabilization by dissipating and redirecting the stream's energy. Bank stability will also be enhanced through the installation of cuttings bundles and live stakes that include native species (e.g. black willow (*Salix nigra*) and silky dogwood (*Cornus amomum*)).

In-stream habitat is highly dependent on available cover and organic material. A quantitative habitat assessment method was used to measure type, location, and quantity of habitat in the reference streams.

During design, the habitat assessment results were scaled appropriately to the design parameters such that the quantity and placement of the habitat features along the restored channel mimics reference conditions. This process provides a natural channel design that addresses aquatic function improvements in addition to stability.

Sections of abandoned stream channel will be backfilled to the elevation of the floodplain in areas adjacent to the new channel with material excavated onsite and by installing channel plugs where necessary. The floodplain will be planted with native species creating a vegetated buffer, which will provide numerous water quality and ecological benefits. Stream banks will be stabilized using a combination of grading, erosion control matting, bare-root plantings, native material revetment techniques (i.e. bioengineering), structure placement, and sod transplants where possible. The stream and adjacent riparian areas will be protected by a minimum 50-foot permanent conservation easement, which will be fenced as needed to exclude livestock. However, an approximately 100-foot section along the east side of Reach UT1-R4 is proposed where the minimum 50-foot conservation easement cannot be met due to a Union Power Cooperative 100-foot right-of-way. At this location, the conservation easement will be extended to a width that varies between 75 and 100 feet along the west side of the channel to offset the loss of easement on the opposite side. Additionally, areas within the power easement that fall within the 50-foot buffer will be planted with herbaceous/shrub vegetation. No loss in stream credit is expected at this location since the buffer width will be increased along the west side to offset the encroachment of the powerline easement as was discussed with the IRT on July 11, 2012.

When all of these components are combined, a functional and stable channel with diverse habitat will be restored. According to Stream Mitigation Guidelines (2003) published by the US Army Corps of Engineers, the US Environmental Protection Agency, The North Carolina Wildlife Resources Commission, and the NCDWQ, the proposed restoration design will meet the guidelines of stream restoration and will be subject to a mitigation ratio of 1:1. Note: UT2-R3 has a proposed mitigation ratio of 1.5:1 per communication with USACE. The lower mitigation ratio accounts for minor unpermitted impacts to the channel by the landowner.

Throughout the project area, there will be several breaks within the conservation easement where stream credits will not be generated to account either for 60-foot farm crossings or for existing Union Power overhead utility crossings. Along UT1, one existing crossing will be moved outside of the project, one new culvert crossing will be installed, and three culvert crossings will be removed and replaced, two of which will remain outside of the project. Along UT2, the two existing culvert crossings will be removed and replaced at their current location, and there will be two 30-foot easement breaks associated with Union Power easements. These two easement breaks will be planted with herbaceous/shrub vegetation within the 50-foot buffer.

Poplin Ridge has been broken into the following design reaches:

- **UT1-R1 (STA 1+20 to 12+58)** – Upper-most portion of UT1 totaling 572 linear feet of Stream Preservation and Buffer Enhancement and 566 linear feet of Enhancement Level I. The upper portion of this reach is stable and has a mature hardwood buffer. The lower portion is only partially forested and flows through cultivated fields. This lower portion is experiencing active erosion and has a disturbed buffer. Stabilization/enhancement activities will include performing minor bank grading, installing grade control and habitat structures, and planting the buffer.

- **UT1-R2 (STA 12+58 to 24+89)** – Upper of the two middle reaches along UT1 totaling 1,171 linear feet of Priority I Restoration. This reach flows through cultivated fields and has highly unstable banks and a highly disturbed buffer. Restoration will involve constructing a meandering

channel, installing habitat and grade control structures, filling and plugging the abandoned channel, and re-vegetating the buffer with native plants.

- **UT1-R3 (STA 24+89 to 34+50)** – Lower of the two middle reaches along UT1 totaling 901 linear feet of Priority I Restoration. This reach flows through cultivated fields and has highly unstable banks and a highly disturbed buffer. Restoration will involve constructing a meandering channel, installing habitat and grade control structures, filling and plugging the abandoned channel, and the buffer planted with native vegetation. A 60-foot culvert crossing is proposed at STA 25+41.

- **UT1-R4 (STA 34+50 to 46+60)** – Downstream-most portion of UT1 totaling 1,210 linear feet of Enhancement Level I. This reach flows through cultivated fields, has moderately unstable banks and a highly disturbed buffer. Enhancement activities will include laying back banks, enhancing existing benches, installing grade control and habitat structures, and replanting the buffer. The existing culvert crossing just downstream of the project at STA 47+30 will be removed and replaced with upgraded culverts.

- **UT1-A (STA 0+65 to 2+82) –** Upper-most tributary to UT1 totaling 217 linear feet of Enhancement Level I. This reach originates just downstream of a forested area, flows through cultivated fields, and exhibits minor bank erosion. Enhancement activities will include reshaping the channel, removing an existing culvert, and installing habitat structures. A ford crossing will be installed just upstream of the project near STA 0+37 to allow the landowner continued access across the property.

- **UT1-B (STA 0+09 to 11+46)** – Tributary of UT1 that flows north to south totaling 620 linear feet of Stream Preservation and Buffer Enhancement and 455 linear feet of Enhancement Level I. This upper portion of this reach is stable and has an intact riparian buffer throughout. Below STA 6+29, the channel flows through a cultivated field, has no buffer, and exhibits channel incision along the downstream section. Enhancement activities will include reshaping the channel, removing an existing culvert, re-vegetating the buffer and installing habitat and grade control structures.

- **UT1-C (STA 1+21 to 9+78)** – Southern-most tributary to UT1 totaling 857 linear feet of Enhancement Level I. This reach flows west to east through cultivated fields and lacks a riparian buffer. Stabilization/enhancement activities will include bank grading and channel reshaping, installing grade control and habitat structures, and planting the buffer. The existing culvert near STA 1+22 will be removed and replaced just upstream of the proposed easement at STA 0+87.

- **UT2-R1 (STA 0+00 to 4+90)** – Upper-most portion of UT2 totaling 490 linear feet of Enhancement Level II. This reach flows between an active pasture and a cultivated field. The stream buffer, which lacks mature hardwoods, has been disturbed by agricultural practices and cattle access. Enhancement activities will include reshaping the channel, invasive species treatment, riparian plantings, and installing grade control structures at the downstream end of the reach.

- **UT2-R2 (STA 4+90 to 13+97)** – Upper of the two middle reaches along UT2 totaling 847 linear feet of Priority I Restoration. This reach is currently a 1.3 acre farm pond with a drainage area of 723 acres and is surrounded by cultivated fields. Restoration will involve draining the pond and removing and replacing the existing perched culverts at a lower elevation to maintain normal flow through the proposed culverts. It is anticipated that a baseflow channel will form on its own once the pond has been drained. Once the pond bed has dried sufficiently to support construction

equipment, the newly formed channel will be enhanced and stabilized. Habitat and grade control structures will be installed, and the buffer will be planted with native vegetation.

- **UT2-R3 (STA 13+97 to 19+18) –** Lower of the two middle reaches along UT2 totaling 521 linear feet of Priority I Restoration. This reach is a perennial channel that lies between an active pasture and a cultivated field. This stream reach is generally straight and has little to no stream buffer within the project area. The upper portion of this reach is experiencing active erosion of the bed and banks. The lower portion of the reach has a stable bed with moderate bank erosion. Restoration will involve constructing a meandering channel, installing habitat and grade control structures, filling and plugging the abandoned channel, and the buffer planted with native vegetation.

- **UT2-R4 (STA 19+18 to 22+07)** – Downstream-most portion of UT2 totaling 257 linear feet of Priority I Restoration. This reach is a perennial channel that flows through active pasture and cultivated fields. This reach is generally straight and has a highly disturbed buffer with invasive species present. Restoration will involve constructing a meandering channel, installing habitat and grade control structures, filling and plugging the abandoned channel, and the buffer planted with native vegetation.

- **UT2-A (STA 0+65 to 5+28) –** The only tributary to UT2 totaling 463 linear feet of Enhancement Level II. UT2-A is an intermittent channel that flows into a farm pond (UT2-Reach 2). This reach flows through an active cattle pasture, and lacks a vegetated buffer. Stabilization/enhancement activities will include minor bank grading, installing grade control and habitat structures, and replanting the buffer.

Figure 11a. Project Site Conceptual Plan Design

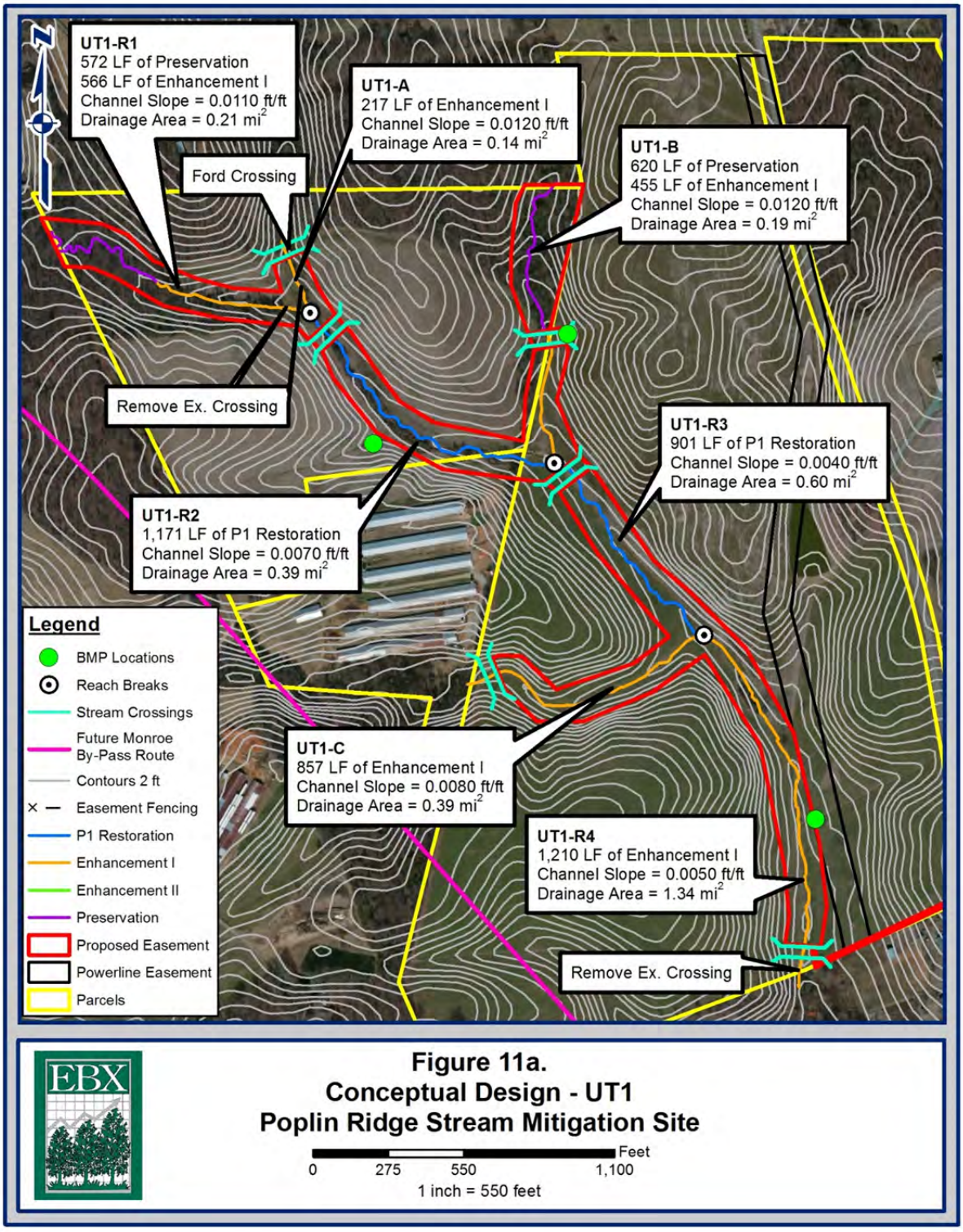
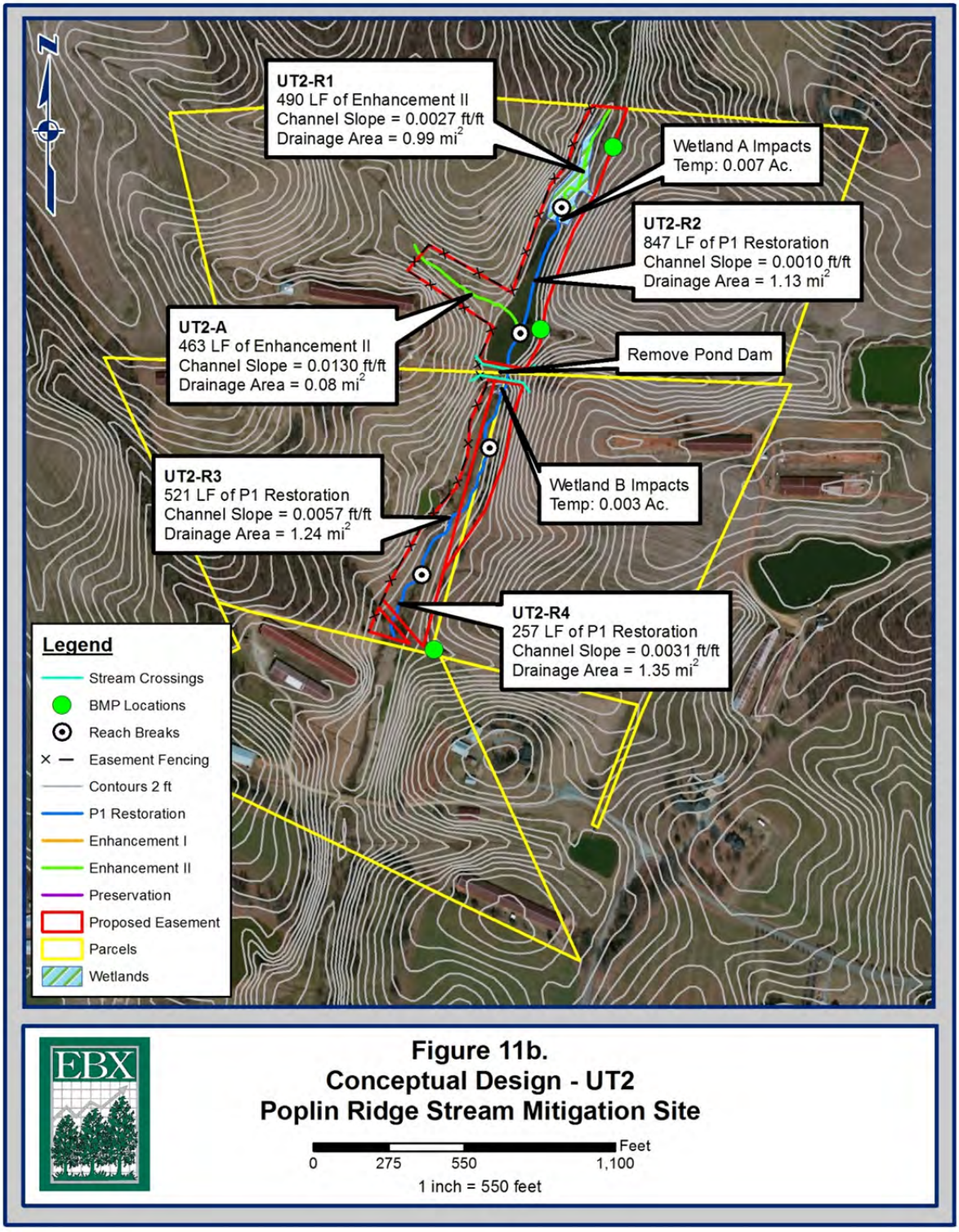


Figure 11b. Project Site Conceptual Plan Design



7.2.1.1 Design Discharge

Based upon the hydrologic analysis described in **Section 7.3.1.1** below, design discharges were selected that fell within ranges resulting from the 1 and 1.5-year flood frequency analysis and the 1-year

Hydraflow Hydrographs modeling for each reach. The selected flows are 36 ft^3/s, 52 ft^3/s, 65 ft^3/s, and 74 ft^3/s for Reaches UT1-R2, UT1-R3, UT2-R2/R3, and UT2-R4 respectively. These discharges will provide frequent inundation of the adjacent floodplain.

These discharges were selected based on the following rationale:

- The calculated bankfull discharge for the analog/reference reach closely matches the results of the 1.1-year flood frequency analysis,
- The results of the 1.5-year flood frequency analysis matched well with the NC regional curve,
- Approximate bankfull discharges for existing conditions for UT1fall between the 1.1 and 1.5-year flood frequency analysis results,
- Approximate bankfull discharges for existing conditions for UT2 fall near the 1-year Hydraflow Hydrographs analysis results,
- Selecting design discharges between the 1 and 1.5-year storm events allows frequent inundation of the floodplain, while also preventing adjacent active agriculture land from flooding at a high frequency.

7.2.1.2 Design Methods

There are three primary methods that have demonstrated success in stream restoration; analog, empirical, and analytical. All three methods have advantages and limitations, and it is often best to utilize more than one method to address site-specific conditions or to verify the applicability of design elements. This is particularly true in developed watersheds where existing conditions do not always reflect current inputs and events, and sediment and hydrologic inputs may remain unstable for some time. Combinations of analytical and analog methods were used to develop the stream designs for Poplin Ridge.

Analytical Approach

Analytical design is based on principles and processes considered universal to all streams, and can entail many traditional engineering techniques. The analytical approach utilizes continuity, roughness equations, hydrologic and hydraulic models, and sediment transport functions to derive equilibrium conditions. Since the project is located within a rural watershed, restoration designs are based on hydrologic and hydraulic analyses, including rainfall-runoff models to determine design discharges coupled with reference reach techniques.

Analog Approach

The analog method of natural channel design involves the use of a "template" or reference stream located near the design reach, and is particularly useful when watershed and boundary conditions are similar between the design and analog reaches (Skidmore et al., 2001). In an analog approach, the planform pattern, cross-sectional shape, longitudinal profile, and frequency and locations of woody debris along the analog reaches are mimicked when developing the design parameters for the subject stream. A scaling factor was calculated from the survey data in order to correctly size the planform design parameters for the project site. The scaling factors for each design reach were derived from the design cross-sectional area and topwidth of each reach as follows:

1. The appropriate bankfull cross-sectional area (A_{BKF}) of each design reach was calculated using an in-house spreadsheet based on Manning's equation. The input parameters included the design discharge as determined by the hydrologic analysis described above, and proposed slope based on site conditions and the sinuosity measured for the analog reach.

2. The cross-sectional shape was adjusted within the spreadsheet to replicate the width-depth ratios and side slopes surveyed along the analog reach, while also maintaining the A_{BKF} necessary to convey the design discharge.

3. The scaling factor is determined from the ratio of the design topwidth to the analog topwidth (**Table 20**). For this project, several cross-sections were obtained at the analog site, resulting in an average width of 13.6 feet.

4. Pool cross-sectional areas were calculated using both typical reference reach techniques and the analog approach. Design A_{BKF} areas were determined using the measured analog ratios of riffle A_{BKF} to pool A_{BKF} as applied to the design A_{BKF}s. The pool cross-sectional shape was adjusted within the in-house spreadsheet as described above in step 2.

Table 20. Scaling Factors for Sizing Planform Design Parameters

Reach	Drainage Area (ac)	Proposed Bankfull A_{BKF} (ft^2)	Design Topwidth (ft)	Analog Reach Topwidth (ft)	Scaling Factor
UT1-Reach 2	248	14.5	11.8	13.6	0.87
UT1-Reach 3	384	20.3	13.6	13.6	1.00
UT2-Reach 2/3	792	31.5	17.2	13.6	1.26
UT2-Reach 4	861	34.8	18.2	13.6	1.34

7.2.1.3 Typical Design Sections

Typical cross sections for shallows and pools are shown on the design plan sheets in **Appendix D**. The cross-section dimensions were developed for the three design reaches by using a WK Dickson in-house spreadsheet described in **Section 7.2.1.2** of this report. The cross-sections were altered slightly to facilitate constructability; however, the cross-sectional area, width to depth ratio, and side slopes were preserved. Typical pool sections include pools located on straight reaches and pools on meander bends.

7.2.1.4 Typical Meander Pattern

The design plans showing the proposed channel alignment are provided in **Appendix D**. The meander pattern was derived directly from the analog reach and sized using the scaling factors described in **Table 20**. The analog meander pattern was altered in some locations to provide variability in pattern, to avoid onsite constraints, to follow the valley pattern, and to make the channel more constructible. The morphologic parameters summarized in **Appendix C** were applied wherever these deviations occurred.

7.2.1.5 Longitudinal Profiles

The design profiles are presented in **Appendix C**. These profiles extend throughout the entire project for the proposed channel alignment. The profiles were designed using the analog reach bed features that were sized with the scaling factors. The bed slopes and bankfull energy gradients were determined for each design reach based on the existing valley slope and the sinuosity of the design reach. Log structures will be utilized in the design to control grade, divert flows, and provide additional habitat diversity and stability.

7.2.1.6 In-Stream Structures

Structures will be incorporated into the channel design to provide additional stability and improve aquatic habitat. Native materials and vegetation will be used for revetments and grade control structures where applicable. Additionally, woody debris will be placed throughout the channel at locations and at a frequency that is similar to those mapped in the analog reaches. The analog reach has woody debris throughout the length of the channel, providing grade control for shallows and forcing scour pools. Woody habitat features installed will include leaf packs, dead brush, woody debris bundles, root wads, and wattles. Sod mats harvested onsite will be installed along stream banks during construction if and when feasible. Sod mats will only be harvested and used if comprised of appropriate vegetation. The use of sod mats that include aggressive turf grasses will be avoided. Sod mats are natural sections of

vegetation taken from the banks when they were cut during construction, and generally range between 0.75 to 1.0 feet in thickness. Before installation, proposed banks are graded lower than specified to accommodate the thickness of the mat. The mats are placed on top of the bank to act as a natural stabilizer of native species, and they grow much faster than the combination of coir fiber matting and seeding (see detail **Appendix D**). Other bank stability measures include the installation of cuttings bundles at three to five foot intervals along the tops of banks, live staking, and log toes. Typical details for proposed in-stream structures and revetments are in **Appendix D**.

7.2.2 Natural Plant Community Restoration

7.2.2.1 Plant Community Restoration

The restoration of the plant communities is an important aspect of the site's restoration. The selection of plants is based on what was observed at the reference reach and the forest surrounding the restoration site and what is typically native to the area. Several sources of information were used to determine the most appropriate species for the restoration project along with existing and proposed topography. The reference stream is located within a narrow Piedmont Bottomland Forest that is surrounded by Mesic Mixed Hardwood Forest. Dominant species along the reference reach include northern red oak (*Quercus rubra*), southern red oak (*Quercus falcata*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*) and sweetgum (*Liquidambar styraciflua*) in the canopy. Shrubs include American holly (*Ilex opaca*) and eastern red cedar (*Juniperus virginiana*). Canopy closure limited herbaceous vegetation along the reference reach. The forests near the mitigation site also support many species typical of this community type.

A narrow Piedmont Bottomland Forest is located along the reference reach's banks and grades upward into well-drained Mesic Mixed Hardwood Forest. The restoration site exhibits a typical narrow floodplain between the steeper slopes found in this area of the Piedmont. Based on observations of the reference community, the communities surrounding the mitigation site, and the narrow floodplain, a single community is appropriate. Therefore, Mesic Mixed Hardwood Forest will be the target community type and will be used for all areas within the project, as well as for buffer around the site. A plant species list has been developed and can be found in **Table 21**. Species with high dispersal rates are not included because of local occurrence and the high potential for natural regeneration. The high dispersal species include red maple, tulip poplar, and sweetgum.

The restoration of plant communities along Poplin Ridge will provide stabilization and diversity. For rapid stabilization, silky dogwood, silky willow, and black willow were chosen for live stakes along the restored channel because of their rapid growth patterns and high success rates. Willows will also be quicker to contribute organic matter to the channel. Willows typically grow at a faster rate than species planted around them and stabilize the stream banks. When the other species are larger, the black willow and silky willows will slowly stop growing or die out because the other species would outgrow them and create shade that the willows do not tolerate. The live stake species will be planted along the outside of the meander bends three feet from the top of bank, creating a section along the top of bank to provide stabilization. The willows will be spaced every three feet with alternate spacing. See **Appendix D** for a detailed planting plan.

Table 21. Proposed Plant List

Bare Root Planting Tree Species			
Common Name	**Scientific Name**	**Wetland Indicator**	**Percent Composition***
River birch	*Betula nigra*	FACW	5%
Common hackberry	*Celtis occidentalis*	FACU	10%
Green ash	*Fraxinus pennsylvanica*	FACW	10%
American sycamore	*Platanus occidentalis*	FACW	10%
Southern red oak	*Quercus falcata*	FACU	20%
Water oak	*Quercus nigra*	FAC	15%
Northern red oak	*Quercus rubra*	FACU	15%
Slippery Elm	*Ulmus rubra*	FAC	15%

*Planting density = approximately 680 stems per acre

Live Staking and Live Cuttings Bundle Tree Species			
Common Name	**Scientific Name**	**Wetland Indicator**	**Percent Composition**
Silky dogwood	*Cornus amomum*	FACW+	45%
Silky willow	*Salix sericea*	OBL	45%
Black willow	*Salix nigra*	OBL	10%

7.2.2.2 On-Site Invasive Species Management

Some invasive species have been noted on the site. They include Chinese privet (*Ligustrum sinense*) and Japanese honeysuckle (*Lonicera sempervirens*). These invasive species are common but not limited to any confined location. The movement of topsoil will also activate "weed seeds," but most will be inhibited by raising the water table on the site. It will be important during monitoring site visits to check for significant encroachment of invasive species and to develop a plan of action to control any such problem.

Control for invasive species will be required within all grading limits associated with stream restoration and stream Enhancement Levels I and II. Three areas outside the grading limits are designated for invasive species control and consist of spot treatment or full invasive control based upon density of aerial coverage: low (less than 10 percent aerial coverage; medium (10 to 50 percent aerial coverage; and, high (greater than 50 percent aerial coverage). Full invasive control will be required within all areas designated as high density. (Where invasive coverage is greater than 50 percent, mechanical removal of top growth and spraying of herbicide may be used.) Spot treatment will be required within all areas designated as moderate density. (Where stems and coverage are greater than 10 percent, but less than 50 percent, individuals shall be cut and stumps sprayed with appropriate herbicide.) Areas of low coverage will be evaluated on a case by case basis and may be reclassified for spot treatment.

Invasive species will require different and multiple treatment methods, depending on plant phenology and the location of the species being treated. All treatment will be conducted so as to minimize its effectiveness and reduce chances of detriment to surrounding native vegetation. Treatment methods will include mechanical control (cutting with loppers, clippers, or chain saw and chemical control (foliar spray, cut stump, and hack and quirt techniques). Plants containing mature, viable seeds will be removed from the site and properly disposed of. All herbicide applicators will be supervised by a certified ground pesticide applicator with a North Carolina Department of Agriculture and Consumer Services (NCDA&CS) license and adhere to all legal and safety requirements according to herbicide labels and NC and Federal laws. Management records will be kept on the plant species treated, type of treatment

employed, type of herbicide used, application technique, and herbicide concentration and quantities used. These records will be included in all reporting documents. In areas where full invasive control is performed, seed from appropriate bottomland mast producing species will be planted in the fall following the first full year after invasive control is performed. Records will be kept of date collected, species, provenance, approximate density of each species (pounds/acre), and location planted. Mast seed planted will be recorded. These records will be included in all reporting documents.

Areas where full invasive species control is performed will be direct seeded with bottomland mast-producing species. The seeding will take place the first fall after invasive species control is performed. These areas will be monitored for additional invasive species control.

7.2.3 Best Management Practices

Due to the rural nature of this project, individual stormwater best management practices (BMPs) will not be required. However, diffuse flow structures will be applied at locations where ditches or other forms of concentrated flow enter the conservation easement. These structures will consist of a pool (forebay) located just outside the conservation easement that will attenuate runoff combined with grading and stabilization techniques that will diffuse flow upon entering the buffer. All diffuse flow structures will be installed within the conservation easement so that landowners will not have access to the structures. Failure or maintenance of the structures is not anticipated as these structures will be installed in low-gradient areas, and the areas proposed to diffuse flow will be well vegetated and matted.

Stormwater management issues resulting from future development of adjacent properties will be governed by the applicable state and local ordinances and regulations. It is recommended that any future stormwater entering the site maintain pre-development peak flow. Any future stormwater diverted into the project should be done in a manner as to prevent erosion, adverse conditions, or degradation of the project in any way.

7.2.4 Site Preparation

After construction activities, the subsoil will be scarified and any compaction will be deep tilled before the topsoil is placed back over the site. Any topsoil that is removed during construction will be stockpiled and placed over the site during final soil preparation. This process should provide favorable soil conditions for plant growth. Rapid establishment of vegetation will provide natural stabilization for the site.

7.3 Data Analysis

7.3.1 Stream Data Analysis

7.3.1.1 Stream Hydrologic Analysis

Hydrologic evaluations were performed for the design reaches using multiple methods to determine and validate the design bankfull discharge and channel geometry required to provide regular floodplain inundation. The use of various methods allows for comparison of results and eliminates reliance on a single model. Peak flows (**Table 22**) and corresponding channel cross-sectional areas were determined for comparison to design parameters using the following methods:

- Regional Flood Frequency Analysis,
- AutoCAD's Hydraflow Hydrographs,
- NC and VA Regional Curves for the Piedmont, and
- USGS regional regression equations for rural conditions in the Piedmont.

Regional Flood Frequency Analysis

A flood frequency analysis was completed for the study region using historic gauge data on all nearby USGS gauges with drainage areas less than 6,400 acres (10 mi^2) which passed the Dalrymple homogeneity test (Dalrymple, 1960). This is a subset of gauges used for USGS regression equations. Regional flood frequency equations were developed for the 1.1-, 1.5-, and 2-year peak discharges based on the gauge data. Discharges were then computed for the design reach. These discharges were compared to those predicted by the discharge regional curve bankfull flow, USGS regional regression for the 2-year peak flow, and modeling results for the 1-year and 2-year storm events.

AutoCAD's Hydraflow Hydrographs

Hydraflow Hydrographs was used to simulate the rainfall-runoff process and establish peak flows for the watersheds. Hydraflow Hydrographs was chosen over the U.S. Army Corps of Engineers model HEC-1 because it allows the user to adjust the peak shape factor for existing watershed conditions. Rainfall data reflecting a 284 peak shape factor and a standard Type II distribution were used, along with NRCS hydrology (time of concentrations and runoff curve numbers), to simulate the rainfall-runoff process.

Regional Curve Regression Equations

The North Carolina Piedmont regional curves by Doll et al. (2002) and Harman et al. (1999) and the Virginia (Lotspeich, 2009) Piedmont regional curves for discharge were used to predict the bankfull discharge for the site. The NC regional curves predicted flows that are similar to those predicted by the 1.1-year flood frequency, while the VA curves are comparable to flows predicted by the 1.5-year flood frequency. The equations for North Carolina and Virginia regional discharges are:

(1) $Q_{bkf}=91.62*(DA)^{0.71}$ (Doll et al., 2002)
(2) $Q_{bkf}=89.04*(DA)^{0.73}$ (Harman et al., 1999)
(3) $Q_{bkf}= 43.895*(DA)^{0.9472}$ (Lotspeich, 2009)

Where Q_{bkf}=bankfull discharge (ft^3/s) and DA=drainage area (mi^2).

USGS Regional Regression Equations

USGS regression equations estimate the magnitude and frequency of flood-peak discharges (Gotvald, et al., 2009). The regression equations were developed from gauge data in different physiographic regions of the Southeastern United States. For this analysis, there was only concern for the 2-year return interval. The equation for the rural Piedmont/Foothills (Hydrologic Region 1) is:

(1) $Q_2=158*(DA)^{0.649}$

Where Q_2=2-year peak discharge (ft^3/s) and DA=drainage area (mi^2).

Table 22. Peak Flow Comparison

Reach	Drainage Area (Ac)	Hydraflow Hydrographs Q_1	FFQ $Q_{1.1}$	FFQ $Q_{1.5}$	NC Regional Curve Q	VA/MD Regional Curve Q	Regional Regression Eqns. Q_2	Design/ Calculated Q
Reference	426	NA	48	73	66	30	121	50
UT1-1	136	15	19	29	29	10	58	22
UT1-2	250	32	31	48	45	18	85	36
UT1-3	384	46	44	67	61	27	113	52
UT1-4	631	86	74	113	98	50	172	70
UT1-A	88	NA	13	21	21	7	44	15
UT1-B	120	NA	17	27	26	9	53	17
UT1-C	250	NA	31	48	45	18	86	31
UT2-1	631	47	66	100	88	43	157	51
UT2-2	726	56	74	112	98	49	171	60
UT2-3	792	61	79	120	104	54	181	65
UT2-4	861	71	85	129	111	58	192	74

Based upon the hydrologic analysis described above, design discharges were selected that fell within ranges resulting from the 1 and 1.5-year flood frequency analysis and the 1-year Hydraflow Hydrographs modeling for each reach. These discharges will provide frequent inundation of the adjacent floodplain. Selection of design discharge for the restoration reaches (UT1-2, UT1-3, UT2-2, UT2-3, and UT2-4) was selected based on the following rationale:

- The calculated bankfull discharge for the analog/reference reach closely matches the results of the 1.1-year flood frequency analysis,
- The results of the 1.5-year flood frequency analysis matched well with the NC regional curve,
- Approximate bankfull discharges for existing conditions for UT1fall between the 1.1 and 1.5-year flood frequency analysis results,
- Approximate bankfull discharges for existing conditions for UT2 fall near the 1-year Hydraflow Hydrographs analysis results,
- Selecting design discharges between the 1 and 1.5-year storm events allows frequent inundation of the floodplain, while also preventing adjacent active agriculture land from flooding at a high frequency.

7.3.1.2 Sediment Transport Analysis

An erosion and sedimentation analysis was performed to confirm that the restoration design creates a stable gravel that neither aggrades nor degrades over time. Typically, sediment transport is assessed to determine a stream's ability to move a specific grain size at specified flows. Various sediment transport equations are applied when estimating entrainment for sand and gravel bed streams found in the piedmont. The US Army Corps of Engineers (USACE) report, *Stability Thresholds for Stream Restoration Materials* (Fichenich, 2001), was used to obtain permissible shear stresses and velocities. Data found in this document was obtained from multiple sources using different testing conditions. The following methods and published documents were utilized during the sediment transport analysis:

- HEC-RAS Stable Channel Design (Copeland Method)
- Permissible Shear Stress Approach
- Permissible Velocity Approach

Stable Channel Design

Design cross-section dimensions as determined from the analog approach were evaluated using the stable channel design functions within HEC-RAS. These functions are based upon the methods presented in the SAM Hydraulic Design Package for Channels developed by the USACE Waterways Experiment Station. The Copeland Method was chosen to determine stable channel dimensions as a function of slope, discharge, roughness, side slope, bed material gradation, and the inflowing sediment discharge. Results are presented as a range of widths and slopes, and their unique solution for depth, making it easy to adjust channel dimensions to achieve stable channel configurations. The stable design output parameters are listed in **Table 23**. The results are acceptable and match closely with the design reach parameters.

Table 23. Stable Channel Design Output

Reach	Q (ft/s^3)	Bottom Width (ft)	Depth (ft)	Energy Slope (ft/ft)	Composite n value	Velocity (ft/s)	Shear Stress (lbs/ft^2)
UT1-2	36	8	1.6	0.0058	0.061	2.08	0.58
UT1-3	52	9	1.9	0.0045	0.057	2.2	0.54
UT2-3	65	11	2.1	0.0032	0.056	2.07	0.42
UT2-4	74	12	2.2	0.003	0.055	2.08	0.41

Permissible Shear Stress Approach

Shear stress is a commonly used tool for assessing channel stability. Allowable channel shear stresses are a function of bed slope, channel shape, flows, bed material (shape, size, and gradation), cohesiveness of bank materials, vegetative cover, and incoming sediment load. The shear stress approach compares calculated shear stresses to those found in the literature. Shear stress is the force exerted on a boundary during the resistance of motion as calculated using the following formula:

(1) $\tau = \gamma RS$

τ = shear stress (lb/ft^2)

γ = specific gravity of water (62.4 lb/ft^3)

R = hydraulic radius (ft)

S = average channel slope (ft/ft)

Table 24. Comparison of Allowable and Proposed Shear Stresses

Reach	Proposed Shear Stress at Bankfull Stage (lbs/ft^2)	Critical Shear Stress (lbs/ft^2)	Allowable Shear Stress[1] (lbs/ft^2)
UT1-1	0.3	0.27	0.5
UT1-2	0.42	0.07	0.33
UT1-3	0.42	0.13	0.33
UT1-4	NA	0.42	0.5
UT2-2	NA	NA	NA
UT2-3	0.27	0.13	0.33
UT2- 4	0.26	0.13	0.33

[1](Fischenich, 2001)

Review of **Table 24** shows that the proposed shear stresses for the Poplin Ridge design reaches fall between the critical shear stress (shear stress required to initiate motion) and the allowable limits for reaches UT1-1, UT2-3 and UT2-4; and just above the allowable limits for reaches UT1-2 and UT1-3. The published allowable shear stresses do not take into account additional bed stability provided by the cohesiveness of the existing bed materials. In addition, the bed material found in reaches UT1-2 and UT1-3 has a relatively wide range in size, which provides an additional degree of stability to the bed that is not accounted for in the published allowable shear stress. For these reasons, the allowable shear stresses shown in **Table 24** are considered conservative and can be described more as targeted design values and not as maximum values to initiate motion. The existing channels currently exhibit little to no vertical instabilities. The reduced bank heights and bed slopes will slightly reduce shear stresses in the proposed conditions when compared to pre-project conditions. Because the existing channel is relavely stable vertically, there is not a concern with the allowable shear stresses in reaches UT1-2 and UT1-3 shown in **Table 24** being larger than the targeted values. An additional level of protection to prevent channel downcutting and incision is the natural bedrock observed throughout reach UT1 and the proposed grade control structures proposed throughout the project. These existing and proposed structures will further provide bed stability. Because UT1-A, UT1-B, and UT1-C are enhancement sections only, a hydraulic evaluation of allowable shear stress was not performed on these reaches.

Permissible Velocity Approach

Published data are readily available that provide entrainment velocities for different bed and bank materials. A comparison of calculated velocities to these permissible velocities is a simple method to aid in the verification of channel stability. **Table 25** compares the proposed velocities calculated using Manning's equation with the permissible velocities presented in the USACE *Stability Thresholds for Stream Restoration Materials* report.

Table 25. Comparison of Allowable and Proposed Velocities

Reach	Manning's "n" value	Design Velocity (ft/s)	Bed Material	Allowable Velocity[1] (ft/sec)
			Silty-sand to very coarse pebbles	4
UT1-Reach 2	0.055	2.4	Fine to course pebbles	3.75
UT1-Reach 3	0.055	2.3	Fine to course pebbles	3.75
UT1-Reach 4	0.045	2.3	Course pebbles to very coarse pebbles	4.5
UT1-A	0.045	2.4	Silty-sand to medium sand	3
UT1-B	0.045	3.75	Medium to course pebbles	3.75
UT1-C	0.045	2.6	Medium to course pebbles	3.75
UT2-Reach 2	0.055	2	Fine to course pebbles	3.75
UT2-Reach 3	0.055	2	Fine to course pebbles	3.75
UT2-Reach 4	0.055	2	Fine to course pebbles	3.75

1(USACE Fischenich Report, 2001)

The calculated velocities from HEC-RAS are average values for a cross section. These average values may underestimate velocities in sections of the channel that are constricted or located on meandering bends. Review of **Table 25** shows that all of the proposed channels are at or below the threshold limits for stability.

Sediment Supply

In addition to the stability assessment, a qualitative analysis of sediment supply was performed by characterizing watershed conditions. A combination of field reconnaissance and windshield surveys, existing land use data, and historical aerial photography were analyzed to assess existing and past watershed conditions and to determine if any changes occurred that would significantly impact sediment

supply. As discussed in **Section 2.2.3**, the land use throughout the site, and primarily around restoration reaches UT1-R2, UT1-R3, UT2-3, and UT2-4 has changed little since 1961. Much of the project area has been used primarily for agricultural purposes over the past 50 years; and current land use within the project is composed of approximately 78% cultivated land and 22% forest cover. Since 1961, there have been several significant land disturbing events near the project. During the 1970's, forested corridors along UT1-R3, UT1-R4, and UT1-C were cleared, poultry houses were added adjacent to both UT1 and UT2, and the inline pond on UT2 was installed. During the 1980's and 1990's, eight more poultry houses were added to the project area; two adjacent to UT1 and six adjacent to UT2. The only other noticeable event occurred between 1993 and 1998 when portions of the forested buffer along UT2 just upstream of the project area were cleared and converted to agricultural fields. Overall, the project watershed is relatively stable and has largely been maintained as agricultural land since the 1960's. Much of the forested areas are located either within the headwater portions of the watersheds or along existing stream channels. Land use has remained relatively constant within this rural watershed, and significant land disturbing activities are not anticipated for the future.

A large percentage of the cultivated areas are located in the middle and lower portions of the project watershed for UT1 and within the upper and lower portions of the watershed for UT2. Additionally, the land use within the watersheds of the restoration reaches is comprised of over 60% agriculture fields and between 20% and 30% forest. Observations and assessments of these reaches show little signs of aggradation (deposition) or degradation and that the streams appear physically stable, indicating that the reaches are able to effectively transport the sediment supplied by their respective watersheds. There are several localized areas of instability and erosion along the channels, which appear to be a result of cattle activity and agricultural activities occurring up to and along channel banks and not from watershed activities. It is anticipated that sediment supply from agricultural land adjacent to the project will decrease as buffers are enhanced and widened, and flow from existing agricultural ditches will be diffused before entering the proposed channel.

Since little deposition or degradation (scour) was observed along the restoration reaches, it appears that the channels are able to effectively move the sediment supplied from the surrounding watershed. Because observed areas of degradation can be attributed to farming practices adjacent to the channel and not watershed activities, a threshold channel design approach was used. This approach assumes minimal movement (vertical or lateral migration) of the channel boundary during design flow conditions, and that the channel is not sensitive to sediment supply. Additionally, grade controls have been integrated throughout the design to provide vertical stability in the event scour should occur.

7.3.1.1 Hydraulic Analyses

Hydraulic evaluations were performed for the restoration design reaches of UT1 and UT2. These analyses were performed to confirm that the restoration designs will convey the design discharge, provide more frequent overbank flooding, and that significant structures will perform as designed.

HEC-RAS Analysis

A hydraulic analysis was performed to confirm that the restoration design results in a channel that will convey the design discharge and provide for frequent flooding of the adjacent riparian floodplain and wetlands. Channel characteristics, including cross-sectional dimension, slope, and roughness, were used to analyze and adjust design parameters calculated by the analog/reference reach approach.

HEC-RAS was used to perform the hydraulic analysis. This model is a hydraulic model developed by the US Army Corps of Engineers' Hydrologic Engineering Center to perform one-dimensional (1-D) steady and unsteady flow calculations. The model uses representative geometric data (cross-sections) and hydraulic computation routines.

Design cross-sectional dimensions determined through the analog/reference reach approach were evaluated using the 1-D steady flow analysis component and the channel design functions within the HEC-RAS Model (Version 4.0.0). The cross-sectional dimensions for reaches UT1 and UT2 were iteratively adjusted based on the model results to produce a channel design that will regularly flood the adjacent riparian areas. Model results are presented in **Appendix C.** The results are organized by reach, discharge, and STA number and include water surface elevation, velocity, flow area, stream power, and shear stress.

7.3.1 Mitigation Summary

Natural channel design techniques have been used to develop the restoration designs described in this document. The combination of the analog and analytical design methods was determined to be appropriate for this project because the watershed is rural, the causes of disturbance are known and have been abated, and there are minimal infrastructure constraints. The original design parameters were developed from the measured analog/reference reach data and applied to the subject stream. The parameters were then analyzed and adjusted through an iterative process using analytical tools and numerical simulations of fluvial processes. The designs presented in this report provide for the restoration of natural Piedmont gravel channel features and stream bed diversity to improve benthic habitat. The proposed design will allow flows that exceed the design bankfull stage to spread out over the floodplain.

A large portion of the existing stream will be filled using material excavated from the restoration channel. However, many segments will be left only partially filled to provide habitat diversity and flood storage. Native woody material will be planted throughout the restored reach to reduce bank stress, provide grade control, and increase habitat diversity.

Forested riparian buffers of at least fifty feet on both sides of the channel will be established along the project reach. An appropriate riparian plant community (Mesic Mixed Hardwood Forest-Piedmont Subtype) will be established to include a diverse mix of species. Replanting of native species will occur where the existing buffer is impacted during construction. Reductions in nutrients and other pollutants will be achieved with the buffer restoration work, providing substantial benefits to the watershed.

8. MAINTENANCE PLAN

NCEEP shall monitor the site on a regular basis and shall conduct a physical inspection of the site a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Table 26. Maintenance Plan

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.The entire boundary will be checked annually as part of monitoring.
Utility Right-of-Way	Utility rights-of-way within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Ford Crossing	Ford crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Other Activities	Beaver activity will be evaluated annually during the monitoring period and will be managed as necessary.

9. PERFORMANCE STANDARDS

The success criteria for the Poplin Ridge Site stream restoration will follow accepted and approved success criteria presented in the USACE Stream Mitigation Guidelines and subsequent NCEEP and agency guidance. Specifically, success criteria will be established in accordance with the Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for Stream and Wetland Mitigation (Section IV C) dated November 7, 2011. The performance standards shall be consistent with the requirements described in Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.5 paragraphs (a) and (b). Specific success criteria components are presented below.

9.1 Stream Restoration Success Criteria

9.1.1 Bankfull Events

Two bankfull flow events must be documented within the seven-year monitoring period. The two bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

9.1.2 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 less stable condition (for example down-cutting or erosion), or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen stream classification method, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

9.1.3 Digital Image Stations

Digital images will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal images should not indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral images should not indicate excessive erosion or continuing degradation of the banks over time. A series of images over time should indicate successional maturation of riparian vegetation.

9.2 Vegetation Success Criteria

Specific and measurable success criteria for plant density within the riparian buffers on the site will follow NCEEP Guidance. Vegetation monitoring plots will be a minimum of 0.02 acres in size, and cover a minimum of two percent of the planted area. Vegetation monitoring will occur annually in the fall of each year. The interim measures of vegetative success for the site will be the survival of at least 320 three-year old trees per acre at the end of Year 3, 260 five-year old trees at the end of Year 5, and the final vegetative success criteria will be 210 trees per acre at the end of Year 7.

9.3 Scheduling/Reporting

A monitoring baseline document and as-built drawings documenting stream restoration activities will be developed within 60 days of the planting completion on the mitigation site. The report will include all information required by NCEEP monitoring baseline document guidelines (Baseline Monitoring Report Template and Guidance version 2.0 (10/14/10)), including elevations, photographs and sampling plot locations, gauge locations, and a description of initial species composition by community type. The report will also include a list of the species planted and the associated densities. Baseline vegetation monitoring will follow CVS-NCEEP Protocol for Recording Vegetation Version 4.0. Level 1 and Level 2 monitoring

will be conducted. The baseline report will follow Baseline Monitoring Report Template and Guidance version 2.0 (10/14/10).

The monitoring program will be implemented to document system development and progress toward achieving the success criteria. The restored stream morphology will be assessed to determine the success of the mitigation. 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 year of monitoring and submitted to NCEEP. The monitoring reports will include all information, and be in the format required by NCEEP in Version 2.0 of the NCEEP Monitoring Report Template.

10. MONITORING REQUIREMENTS

Annual monitoring data will be reported using the EEP monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, population of EEP databases for analysis, research purposes, and assist in decision making regarding project close-out. The success criteria for the Poplin Ridge Site stream and wetland mitigation will follow current accepted and approved success criteria presented in the USACE Stream Mitigation Guidelines, NCEEP requirements, and subsequent agency guidance. Specific success criteria components are presented in **Table 27**. Monitoring reports will be prepared annually and submitted to EEP.

Table 27. Monitoring Requirements

Required	Parameter	Quantity	Frequency	Notes
	Pattern	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline	Additional surveys will be performed if monitoring indicates instability or significant channel migration.
	Dimension	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline, Years 1,2,3,5, and 7	Surveyed cross sections and bank pins.
	Profile	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline	Additional surveys will be performed if monitoring indicates instability.
	Substrate	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline, Years 1,2,3,5, and 7	Substrate data will be collected at cross-section locations.
	Surface Water Hydrology	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Annual	Crest Gauges and/or Pressure Transducers will be installed on site; the devices will be inspected on a quarterly/semi-annual basis to document the occurrence of bankfull events on the project.
	Vegetation		Annual	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols.
	Exotic and Nuisance Vegetation		Annual	Locations of exotic and nuisance vegetation will be mapped.
	Project Boundary		Semi-annual	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be mapped.
	Stream Visual		Annual	Semi-annual visual assessments.

10.1 As-Built Survey

An as-built survey will be conducted following construction to document channel size, condition, and location. The survey will include a complete profile of thalweg, water surface, bankfull, and top of bank to compare with future geomorphic data. As-built drawings will be produced and will conform to the EEP digital drawings guidance (EEP Baseline Monitoring Template Version 2.0 10/14/10). Longitudinal profiles will not be required in annual monitoring reports unless requested by NCEEP or USACE. Stream channel stationing will be marked with stakes placed near the top of bank every 100 feet.

10.2 Visual Monitoring

Visual monitoring of all mitigation areas will be conducted a minimum of twice per monitoring year by qualified individuals. The visual assessments will include vegetation density, vigor, invasive species, and

easement encroachments. Visual assessments of stream stability will include a complete streamwalk and structure inspection. Digital images will be taken at fixed representative locations to record each monitoring event, as well as any noted problem areas or areas of concern. Results of visual monitoring will be presented in a plan view exhibit with a brief description of problem areas and digital images. Photographs will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal photos should indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral photos should not indicate excessive erosion or continuing degradation of the banks over time. A series of photos over time should indicate successional maturation of riparian vegetation.

10.3 Cross Sections

Permanent cross-sections will be installed at a minimum of one per 20 bankfull widths with half in pools and half in shallows. All cross-section measurements will include bank height ratio and entrenchment ratio. Cross-sections will be monitored annually. There should be little change in as-built cross-sections. If changes do take place, they should be evaluated to determine if they represent movement toward a less stable condition (for example down-cutting or erosion), or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be no less than 2.2 within restored reaches. Channel stability should be demonstrated through a minimum of two bankfull events documented in the seven-year monitoring period.

10.4 Bank Pin Arrays

Bank pin arrays will be used as a supplemental method to monitor erosion on selected meander bends where there is not a cross section. Bank pin arrays will be installed along the outer bend and upstream third and downstream third of the meander. Bank pins will be installed just above the water surface and every two feet above the lowest pin. Bank pin exposure will be recorded at each monitoring event, and the exposed pin will be driven flush with the bank.

10.5 Surface Flow

Headwater valley restoration areas will be monitored to document intermittent or seasonal surface flow. This will be accomplished through direct observation, photo documentation of dye tests, and surface flow gauges.

10.1 Vegetative Success Criteria

Vegetative monitoring success criteria for plant density within the riparian buffers on the site will follow NCEEP Guidance dated 7 November 2011. Vegetation monitoring plots will be a minimum of 0.02 acres in size, and cover a minimum of two percent of the planted area. The following data will be recorded for all trees in the plots: species, height, planting date (or volunteer), and grid location. Monitoring will occur each year during the monitoring period. The interim measures of vegetative success for the site will be the survival of at least 320 three-year old trees per acre at the end of Year 3 and 260 five-year old trees per acre at the end of Year 5. The final vegetative success criteria will be the survival of 210 trees per acre at the end of Year 7 of the monitoring period.

Invasive and noxious species will be monitored and controlled so that none become dominant or alter the desired community structure of the site. If necessary, EBX will develop a species-specific control plan.

10.2 Remedial Actions

The Mitigation Plan will include a detailed adaptive management plan that will address how potential problems are resolved. In the event that the site, or a specific component of the site, fails to achieve the

defined success criteria, EBX will develop necessary adaptive management plans and/or implement appropriate remedial actions for the site in coordination with NCEEP and the review agencies. Remedial action required will be designed to achieve the success criteria specified previously, and will include identification of the causes of failure, remedial design approach, work schedule, and monitoring criteria that will take into account physical and climatic conditions.

11. LONG-TERM MANAGEMENT PLAN

Upon approval for closeout by the Interagency Review Team (IRT), the site will be transferred to the State of North Carolina (State). The State shall be responsible for periodic inspection of the site to ensure that restrictions required in the conservation easement or the deed restriction document(s) are upheld. Endowment funds required to uphold easement and deed restrictions shall be negotiated prior to site transfer to the responsible party.

The NCDENR Division of Natural Resource Planning and Conservation's Stewardship Program currently houses EEP stewardship endowments within the non-reverting, interest-bearing Conservation Lands Stewardship Endowment Account. The use of funds from the Endowment Account is governed by North Carolina General Statute GS 113A-232(d)(3). Interest gained by the endowment fund may be used only for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable. The NCDENR Stewardship Program intends to manage the account as a non-wasting endowment. Only interest generated from the endowment funds will be used to steward the compensatory mitigation sites. Interest funds not used for those purposes will be re-invested in the Endowment Account to offset losses due to inflation.

12. ADAPTIVE MANAGEMENT PLAN

Upon completion of site construction EEP will implement the post-construction monitoring protocols previously defined in this document. Project maintenance will be performed as described previously in this document. If, during the course of annual monitoring it is determined the site's ability to achieve site performance standards are jeopardized, EEP will notify the USACE of the need to develop a Plan of Corrective Action. The Plan of Corrective Action may be prepared using in-house technical staff or may require engineering and consulting services. Once the Corrective Action Plan is prepared and finalized EEP will:

1. Notify the USACE as required by the Nationwide 27 permit general conditions.
2. Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE.
3. Obtain other permits as necessary.
4. Implement the Corrective Action Plan.
5. Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

13. FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Ecosystem Enhancement Program's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by EEP. This commitment provides financial assurance for all mitigation projects implemented by the program.

14. OTHER INFORMATION

14.1 References

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14.2 Definitions

Morphological description – the stream type; stream type is determined by quantifying channel entrenchment, dimension, pattern, profile, and boundary materials; as described in Rosgen, D. (1996), *Applied River Morphology, 2nd edition*

Native vegetation community – a distinct and reoccurring assemblage of populations of plants, animals, bacteria and fungi naturally associated with each other and their population; as described in Schafale, M.P. and Weakley, A. S. (1990), *Classification of the Natural Communities of North Carolina, Third Approximation*

Project Area – includes all protected lands associated with the mitigation project

14.3 Appendix A – Site Protection Instrument(s)

Conservation Easement Deeds
Draft Plats

Note: This appendix will be updated as the easement deeds and plats become available.

WK DICKSON
community infrastructure consultants

Exhibit A

Being all of Areas A through K, containing a total 27.12 acres, as shown on a final plat of a Conservation Easement Survey entitled "Conservation Easement Survey for the State of North Carolina" prepared by WK Dickson, Donald G. Crews, PLS NC-3322, dated October 2013 and recorded on _____ in Plat Cabinet _____, Slide_____, to which reference is hereby made and incorporated herein, see plat for a more particular description of metes and bounds.

1/30/2014

(WKD Job# 20120142.00.WL)
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Exhibit:

A Conservation Easement for
The State of North Carolina
Ecosystem Enhancement Program,
The Property of Thomas Ray Poplin and wife Judy H. Poplin
SPO File Number _____ EEP Project ID: _____

The following conservation easement area is located off Poplin Road (SR #1508) within the Goose Creek Township, Union County, North Carolina and being a portion of that property conveyed to Thomas Ray Poplin and wife Judy H. Poplin and described in Deed Book 2079, Page 825 as recorded in the Union County Register of Deeds and being more particularly described as follows:

Conservation Easement Area "A" +/- 8.73 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1022), said rebar being located S 50-07-40 W a horizontal ground distance of 608.34 feet from an iron rod set, said iron rod being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (25) courses and distances:

(1) N 13-21-10 W a distance of 406.00 feet to a 5/8" rebar set with an EEP cap (corner 1023);
(2) S 06-24-26 E a distance of 238.44 feet to a 5/8" rebar set with an EEP cap (corner 1024);
(3) S 08-24-45 W a distance of 148.37 feet to a 5/8" rebar set with an EEP cap (corner 1025);
(4) N 85-51-38 W a distance of 130.58 feet to a 5/8" rebar set with an EEP cap (corner 1001);
(5) N 08-26-48 E a distance of 104.44 feet to a 5/8" rebar set with an EEP cap (corner 1002);
(6) N 05-06-21 W a distance of 177.35 feet to a 5/8" rebar set with an EEP cap (corner 1003);
(7) N 11-30-59 W a distance of 454.85 feet to a 5/8" rebar set with an EEP cap (corner 1004);
(8) N 31-30-53 W a distance of 385.12 feet to a 5/8" rebar set with an EEP cap (corner 1005);
(9) S 54-34-49 W a distance of 234.46 feet to a 5/8" rebar set with an EEP cap (corner 1006);
(10) S 66-58-39 W a distance of 270.04 feet to a 5/8" rebar set with an EEP cap (corner 1007);
(11) S 89-50-52 W a distance of 172.71 feet to a 5/8" rebar set with an EEP cap (corner 1008);
(12) N 45-18-48 W a distance of 163.02 feet to a 5/8" rebar set with an EEP cap (corner 1009);
(13) N 23-00-18 W a distance of 123.74 feet to a 5/8" rebar set with an EEP cap (corner 1010);
(14) N 64-19-38 E a distance of 28.47 feet to a 5/8" rebar set with an EEP cap (corner 1011);
(15) S 86-45-13 E a distance of 83.02 feet to a 5/8" rebar set with an EEP cap (corner 1012);
(16) S 46-17-47 E a distance of 174.88 feet to a 5/8" rebar set with an EEP cap (corner 1013);
(17) N 71-18-18 E a distance of 298.18 feet to a 5/8" rebar set with an EEP cap (corner 1014);
(18) N 52-50-57 E a distance of 161.62 feet to a 5/8" rebar set with an EEP cap (corner 1015);
(19) N 40-37-56 W a distance of 396.22 feet to a 5/8" rebar set with an EEP cap (corner 1016);
(20) N 32-12-16 W a distance of 269.64 feet to a 5/8" rebar set with an EEP cap (corner 1017);
(21) N 53-38-14 E a distance of 148.76 feet to a 5/8" rebar set with an EEP cap (corner 1018);
(22) S 33-37-43 E a distance of 408.86 feet to a 5/8" rebar set with an EEP cap (corner 1019);
(23) S 49-08-02 E a distance of 185.16 feet to a 5/8" rebar set with an EEP cap (corner 1020);
(24) S 44-40-14 E a distance of 277.31 feet to a 5/8" rebar set with an EEP cap (corner 1021);
(25) S 29-29-08 E a distance of 355.50 feet to the TRUE POINT OF BEGINNING.

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Conservation Easement Area "B" +/- 1.40 Acres:

Beginning at an iron rod found, said iron rod being located N 67-20-59 W a horizontal ground distance of 1584.80 feet from an iron rod set, said iron rod set being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (8) courses and distances:

(1) N 12-53-25 E a distance of 415.39 feet to a 5/8" rebar set with an EEP cap (corner 1028);
(2) N 79-45-33 E a distance of 77.64 feet to a 5/8" rebar set with an EEP cap (corner 1029);
(3) S 04-37-11 E a distance of 36.68 feet to a 5/8" rebar set with an EEP cap (corner 1030);
(4) S 13-40-53 W a distance of 172.35 feet to a 5/8" rebar set with an EEP cap (corner 1031);
(5) S 22-08-19 E a distance of 221.40 feet to a 5/8" rebar set with an EEP cap (corner 1032);
(6) S 53-38-14 W a distance of 160.75 feet to a 5/8" rebar set with an EEP cap (corner 1026);
(7) N 82-52-06 W a distance of 102.68 feet to a 5/8" rebar set with an EEP cap (corner 1027);
(8) N 12-51-02 E a distance of 74.80 feet to the TRUE POINT OF BEGINNING.

Conservation Easement Area "C" +/- 0.05 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1033); said rebar set being located N 12-53-25 E a horizontal ground distance of 480.64 feet from an iron rod found; said iron rod found being located N 67-20-59 W a horizontal ground distance of 1584.80 feet from an iron rod set; said iron rod set being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (3) courses and distances:

(1) N 12-53-25 E a distance of 99.23 feet to a 5/8" rebar set with an EEP cap (corner 1034);
(2) S 15-42-41 E a distance of 91.67 feet to a 5/8" rebar set with an EEP cap (corner 1035);
(3) S 79-45-33 W a distance of 47.72 feet to the TRUE POINT OF BEGINNING.

1/30/2014

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Exhibit:

A Conservation Easement for
The State of North Carolina
Ecosystem Enhancement Program,
The Property of Billy F. Aycoth, Trustee
SPO File Number _____ EEP Project ID: _____

The following conservation easement area is located off Poplin Road (SR #1508) within the Goose Creek Township, Union County, North Carolina and being a portion of that property conveyed to Billy F. Aycoth, Trustee and described in Deed Book 5304, Page 860 as recorded in the Union County Register of Deeds and being more particularly described as follows:

Conservation Easement Area "D" +/-2.81 Acres:

Beginning at an iron rod found, said iron rod found being located N 67-20-59 W a horizontal ground distance of 1584.80 feet from an iron rod set, said iron rod set being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (14) courses and distances:

(1) S 82-08-59 W a distance of 287.92 feet to a 5/8" rebar set with an EEP cap (corner 1036);
(2) N 60-50-18 W a distance of 274.88 feet to a 5/8" rebar set with an EEP cap (corner 1037);
(3) N 38-41-32 W a distance of 253.15 feet to a 5/8" rebar set with an EEP cap (corner 1038);
(4) N 23-12-05 W a distance of 109.91 feet to a 5/8" rebar set with an EEP cap (corner 1039);
(5) N 47-14-57 E a distance of 124.16 feet to a 5/8" rebar set with an EEP cap (corner 1040);
(6) S 42-17-09 E a distance of 29.01 feet to a 5/8" rebar set with an EEP cap (corner 1041);
(7) S 33-18-05 E a distance of 145.84 feet to a 5/8" rebar set with an EEP cap (corner 1042);
(8) S 36-42-31 E a distance of 157.04 feet to a 5/8" rebar set with an EEP cap (corner 1043);
(9) S 58-55-58 E a distance of 146.96 feet to a 5/8" rebar set with an EEP cap (corner 1044);
(10) S 77-57-25 E a distance of 332.81 feet to a 5/8" rebar set with an EEP cap (corner 1045);
(11) N 02-36-24 E a distance of 156.78 feet to a 5/8" rebar set with an EEP cap (corner 1046);
(12) N 10-24-15 E a distance of 180.39 feet to a 5/8" rebar set with an EEP cap (corner 1047);
(13) N 79-45-33 E a distance of 44.48 feet to a 5/8" rebar set with an EEP cap (corner 1028);
(14) S 12-53-25 W a distance of 415.39 feet to the TRUE POINT OF BEGINNING.

NORTH CAROLINA PROFESSIONAL SEAL L-3322 LAND SURVEYOR DONALD G. CREWS

1/30/2014

(WKD Job# 20120142.00.WL)
NC License No. F-0374

909 Market Street
Wilmington, NC 28401
Tel. 910.762.4200
Fax 910.762.4201
www.wkdickson.com

Conservation Easement Area "E" +/- 2.29 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1033); said rebar set being located N 12-53-25 E a horizontal ground distance of 480.64 feet from an iron rod found; said iron rod found being located N 67-20-59 W a horizontal ground distance of 1584.80 feet from an iron rod set; said iron rod set being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (8) courses and distances:

(1) S 79-45-33 W a distance of 80.39 feet to a 5/8" rebar set with an EEP cap (corner 1048);
(2) N 19-46-47 W a distance of 192.61 feet to a 5/8" rebar set with an EEP cap (corner 1049);
(3) N 01-32-53 E a distance of 115.02 feet to a 5/8" rebar set with an EEP cap (corner 1050);
(4) N 05-13-46 E a distance of 181.54 feet to a 5/8" rebar set with an EEP cap (corner 1051);
(5) N 25-20-56 E a distance of 73.74 feet to a 5/8" rebar set with an EEP cap (corner 1052);
(6) N 89-01-25 E a distance of 215.08 feet to An iron rod found;
(7) S 12-53-25 W a distance of 447.58 feet to a 5/8" rebar set with an EEP cap (corner 1034);
(8) S 12-53-25 W a distance of 99.23 feet to the TRUE POINT OF BEGINNING.

Conservation Easement Area "F" +/- 3.70 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1068), said rebar being located S 58-50-43 W a horizontal ground distance of 2641.81 feet from an iron rod set, said iron rod set being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (18) courses and distances:

(1) S 24-23-54 E a distance of 151.94 feet to a 5/8" rebar set with an EEP cap (corner 1069);
(2) S 31-42-01 E a distance of 113.07 feet to a 5/8" rebar set with an EEP cap (corner 1070);
(3) S 47-14-57 W a distance of 129.35 feet to a 5/8" rebar set with an EEP cap (corner 1053);
(4) N 44-43-58 W a distance of 70.20 feet to a 5/8" rebar set with an EEP cap (corner 1054);
(5) N 84-38-05 W a distance of 265.28 feet to a 5/8" rebar set with an EEP cap (corner 1055);
(6) N 77-45-24 W a distance of 224.55 feet to a 5/8" rebar set with an EEP cap (corner 1056);
(7) N 59-31-00 W a distance of 203.98 feet to a 5/8" rebar set with an EEP cap (corner 1057);
(8) N 66-57-46 W a distance of 95.66 feet to a 5/8" rebar set with an EEP cap (corner 1058);
(9) N 87-56-02 W a distance of 97.39 feet to a 5/8" rebar set with an EEP cap (corner 1059);
(10) N 25-34-53 W a distance of 197.48 feet to a 5/8" rebar set with an EEP cap (corner 1060);
(11) S 83-53-07 E a distance of 221.93 feet to a 5/8" rebar set with an EEP cap (corner 1061);
(12) S 66-56-37 E a distance of 103.34 feet to a 5/8" rebar set with an EEP cap (corner 1062);
(13) S 45-28-22 E a distance of 134.23 feet to a 5/8" rebar set with an EEP cap (corner 1063);
(14) S 67-37-16 E a distance of 174.99 feet to a 5/8" rebar set with an EEP cap (corner 1064);
(15) S 75-33-34 E a distance of 131.83 feet to a 5/8" rebar set with an EEP cap (corner 1065);
(16) S 85-50-18 E a distance of 177.42 feet to a 5/8" rebar set with an EEP cap (corner 1066);
(17) N 16-46-04 W a distance of 104.69 feet to a 5/8" rebar set with an EEP cap (corner 1067);
(18) N 65-22-28 E a distance of 114.98 feet to the TRUE POINT OF BEGINNING.

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Exhibit:

A Conservation Easement for
The State of North Carolina
Ecosystem Enhancement Program,
The Property of Frank Phung and wife Sylvia Phung
SPO File Number _____ EEP Project ID: _____

The following conservation easement area is located off Poplin Road (SR #1508) within the Goose Creek Township, Union County, North Carolina and being a portion of that property conveyed to Frank Phung and wife Sylvia Phung and described in Deed Book 4187, Page 241 as recorded in the Union County Register of Deeds and being more particularly described as follows:

Conservation Easement Area "G" +/- 0.23 Acres:

Beginning at an iron rod found, said iron rod found being located N 67-20-59 W a horizontal ground distance of 1584.80 feet from an iron rod set, said iron rod being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (3) courses and distances:

(1) S 12-51-02 W a distance of 74.80 feet to a 5/8" rebar set with an EEP cap (corner 1027);
(2) N 82-52-06 W a distance of 270.68 feet to a 5/8" rebar set with an EEP cap (corner 1036);
(3) N 82-08-59 E a distance of 287.92 feet to the TRUE POINT OF BEGINNING.

1/30/2014

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Exhibit:

A Conservation Easement for
The State of North Carolina
Ecosystem Enhancement Program,
The Property of Karen S. Hamilton
SPO File Number _____ EEP Project ID: _____

The following conservation easement area is located off Poplin Road (SR #1508) within the Monroe and Goose Creek Township, Union County, North Carolina and being a portion of that property conveyed to Karen S. Hamilton and described in Deed Book 4959, Page 38 as recorded in the Union County Register of Deeds and being more particularly described as follows:

Conservation Easement Area "H" +/- 0.17 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1072), said rebar being located S 82-48-06 E a horizontal ground distance of 1829.13 feet from an iron rod set, said iron rod being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (3) courses and distances:

(1) S 40-49-11 E a distance of 171.23 feet to a 5/8" rebar set with an EEP cap (corner 1073);
(2) N 73-48-10 W a distance of 155.07 feet to a 5/8" rebar set with an EEP cap (corner 1071);
(3) N 23-11-40 E a distance of 93.91 feet to the TRUE POINT OF BEGINNING.

Conservation Easement Area "I" +/- 1.95 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1074), said rebar being located S 83-48-06 E a horizontal ground distance of 1838.60 feet from an iron rod set, said iron rod being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (10) courses and distances:

(1) N 23-11-40 E a distance of 72.94 feet to a 5/8" rebar set with an EEP cap (corner 1075);
(2) N 30-03-04 E a distance of 223.88 feet to a 5/8" rebar set with an EEP cap (corner 1076);
(3) N 41-04-19 E a distance of 192.04 feet to a 5/8" rebar set with an EEP cap (corner 1077);
(4) N 20-19-10 E a distance of 121.09 feet to a 5/8" rebar set with an EEP cap (corner 1078);
(5) N 04-15-59 E a distance of 127.81 feet to a 5/8" rebar set with an EEP cap (corner 1079);
(6) N 23-24-28 E a distance of 169.81 feet to a 5/8" rebar set with an EEP cap (corner 1080);
(7) S 79-42-50 E a distance of 23.90 feet to a 5/8" rebar set with an EEP cap (corner 1081);
(8) S 15-04-32 W a distance of 722.07 feet to a 5/8" rebar set with an EEP cap (corner 1082);
(9) S 15-04-32 W a distance of 282.37 feet to a 5/8" rebar set with an EEP cap (corner 1083);
(10) N 40-49-11 W a distance of 226.87 feet to the TRUE POINT OF BEGINNING.

1/30/2014

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Exhibit:

A Conservation Easement for
The State of North Carolina
Ecosystem Enhancement Program,
The Property of Tammy Renee S. Baucom
SPO File Number _____ EEP Project ID: _____

The following conservation easement area is located off Poplin Road (SR #1508) within the Monroe and Goose Creek Township, Union County, North Carolina and being a portion of that property conveyed to Tammy Renee S. Baucom and described in Deed Book 4959, Page 48 as recorded in the Union County Register of Deeds and being more particularly described as follows:

Conservation Easement Area "J" +/- 1.35 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1082), said rebar being located S 87-16-30 E a horizontal ground distance of 2051.92 feet from an iron rod set, said iron rod being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (6) courses and distances:

(1) N 15-04-32 E a distance of 722.07 feet to a 5/8" rebar set with an EEP cap (corner 1081);
(2) S 79-42-50 E a distance of 106.30 feet to a 5/8" rebar set with an EEP cap (corner 1084);
(3) S 19-18-42 W a distance of 133.44 feet to a 5/8" rebar set with an EEP cap (corner 1085);
(4) S 08-50-14 W a distance of 134.04 feet to a 5/8" rebar set with an EEP cap (corner 1086);
(5) S 21-20-40 W a distance of 214.01 feet to a 5/8" rebar set with an EEP cap (corner 1087);
(6) S 34-10-59 W a distance of 266.59 feet to the TRUE POINT OF BEGINNING.

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Exhibit:

A Conservation Easement for
The State of North Carolina
Ecosystem Enhancement Program,
The Property of Don Scott Simpson
SPO File Number _____ EEP Project ID: _____

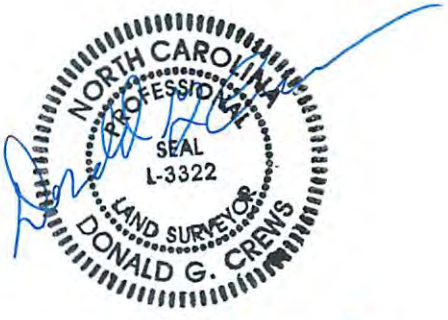
The following conservation easement area is located off Poplin Road (SR #1508) within the Goose Creek Township, Union County, North Carolina and being a portion of that property conveyed to Don Scott Simpson and described in Deed Book 4959, Page 42 as recorded in the Union County Register of Deeds and being more particularly described as follows:

Conservation Easement Area "K" +/- 4.44 Acres:

Beginning at a 5/8" rebar set with an EEP cap (corner 1091), said rebar being located N 62-29-24 E a horizontal ground distance of 2163.77 feet from an iron rod set, said iron rod being located in the right-of-way of Poplin Road (SR #1508) and having North Carolina State Plane Coordinates of Northing: 478509.79 feet and Easting: 1530181.56 feet;

Thence with the aforesaid conservation easement area the following (16) courses and distances:

(1) N 40-49-10 E a distance of 119.88 feet to a 5/8" rebar set with an EEP cap (corner 1092);
(2) S 60-30-47 E a distance of 347.34 feet to a 5/8" rebar set with an EEP cap (corner 1093);
(3) N 19-36-49 E a distance of 413.02 feet to a 5/8" rebar set with an EEP cap (corner 1094);
(4) N 39-45-23 E a distance of 98.49 feet to a 5/8" rebar set with an EEP cap (corner 1095);
(5) N 17-56-25 E a distance of 131.47 feet to a 5/8" rebar set with an EEP cap (corner 1096);
(6) N 29-48-39 E a distance of 103.34 feet to a 5/8" rebar set with an EEP cap (corner 1097);
(7) S 85-06-22 E a distance of 125.65 feet to a 5/8" rebar set with an EEP cap (corner 1098);
(8) S 20-28-48 W a distance of 324.25 feet to a 5/8" rebar set with an EEP cap (corner 1099);
(9) S 30-18-50 W a distance of 160.93 feet to a 5/8" rebar set with an EEP cap (corner 1100);
(10) S 19-53-10 W a distance of 293.76 feet to a 5/8" rebar set with an EEP cap (corner 1101);
(11) S 09-24-20 W a distance of 143.52 feet to a 5/8" rebar set with an EEP cap (corner 1102);
(12) S 30-57-58 W a distance of 101.42 feet to a 5/8" rebar set with an EEP cap (corner 1103);
(13) N 79-42-50 W a distance of 168.90 feet to a 5/8" rebar set with an EEP cap (corner 1088);
(14) N 12-35-06 E a distance of 18.71 feet to a 5/8" rebar set with an EEP cap (corner 1089);
(15) N 23-42-22 E a distance of 114.14 feet to a 5/8" rebar set with an EEP cap (corner 1090);
(16) N 56-38-33 W a distance of 374.66 feet to the TRUE POINT OF BEGINNING.



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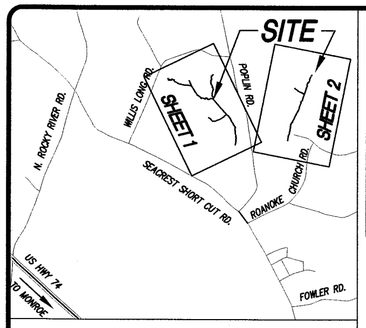


LOCATION MAP
N.T.S.

POINT TABLE		
POINT	NORTH	EAST
1001	477350.48	1529683.10
1002	477453.79	1529698.45
1003	477630.43	1529682.66
1004	478076.13	1529591.85
1005	478404.44	1529390.54
1006	478268.56	1529199.47
1007	478162.95	1528950.95
1008	478162.49	1528778.23
1009	478277.13	1528662.33
1010	478391.03	1528613.97
1011	478403.36	1528639.63
1012	478398.66	1528722.51
1013	478277.83	1528848.94
1014	478373.40	1529131.39
1015	478471.01	1529260.21

POINT TABLE		
POINT	NORTH	EAST
1016	478771.70	1529002.19
1017	478999.86	1528858.49
1018	479088.06	1528978.28
1019	478747.62	1529204.71
1020	478626.47	1529344.73
1021	478429.26	1529539.69
1022	478119.80	1529714.67
1023	477724.78	1529808.44
1024	477487.83	1529835.04
1025	477341.05	1529813.34
1026	479034.43	1528804.24
1027	479047.18	1528702.35
1028	479525.03	1528811.66
1029	479538.83	1528888.06
1030	479502.27	1528891.02

POINT TABLE		
POINT	NORTH	EAST
1031	479334.81	1528850.25
1032	479129.73	1528933.69
1033	479588.63	1528826.21
1034	479685.36	1528848.35
1035	479597.11	1528873.17
1036	479080.78	1528433.77
1037	479214.72	1528193.73
1038	479412.31	1528035.48
1039	479513.33	1527992.18
1040	479597.61	1528083.35
1041	479576.15	1528102.87
1042	479454.25	1528182.94
1043	479328.35	1528276.82
1044	479252.52	1528402.70
1045	479183.08	1528728.18

POINT TABLE		
POINT	NORTH	EAST
1046	479339.70	1528735.31
1047	479517.12	1528767.88
1048	479574.34	1528747.10
1049	479755.58	1528681.92
1050	479870.56	1528685.03
1051	480051.35	1528701.57
1052	480117.99	1528733.14
1053	479554.16	1527947.96
1054	479604.03	1527898.55
1055	479628.84	1527634.43
1056	479676.46	1527414.99
1057	479779.93	1527239.20
1058	479817.37	1527151.17
1059	479820.88	1527053.84
1060	479999.00	1526968.57

POINT TABLE		
POINT	NORTH	EAST
1060	479999.00	1526968.57
1061	479975.36	1527189.24
1062	479934.89	1527284.33
1063	479840.76	1527390.02
1064	479774.14	1527541.83
1065	479741.26	1527669.50
1066	479728.39	1527846.44
1067	479828.62	1527816.24
1068	479876.54	1527920.76
1069	479738.16	1527983.53
1070	479641.97	1528042.94

LEGEND

CE	CONSERVATION EASEMENT
IRF	IRON ROD FOUND
IPF	IRON PIPE FOUND
	CE CORNER
	COMPUTED POINT
E	OVERHEAD ELECTRIC LINE
	CALCULATED PROPERTY LINE
	CONSERVATION EASEMENT LINE
	TIE LINE

CONTROL POINT 2
IRON ROD SET
NC GRID NAD83/2007
N 478509.79
E 1530181.56
COMBINED FACTOR = 0.999853876

CONTROL POINT 1
IRON ROD SET
NC GRID NAD83/2007
N 478030.27
E 1530267.41

487.15' (GRID)
S10°09'01"E
487.22' (GROUND)

POPLIN RD - S.R. 1508
60'R/W PER PLAT CAB. F, FILE 537

TIE
S55°07'40"W
608.34'

NC GRID NAD83/2007
N 478119.86
E 1529714.74

N07°39'18"W
128.82'

S64°42'51"W
584.89'

N64°42'51"E 650.57'(TOTAL)
596.87'

12' NON-EXCLUSIVE ACCESS EASEMENT "SEE NOTE 8"

N09°41'07"W
60.91'

S09°41'07"E
79.67'

21.71'
12.36'
53.70'

NOW OR FORMERLY
THOMAS RAY POPLIN
AND WIFE
JUDY H. POPLIN
PID 08273001
D.B. 2079, PG 825
D.B. 2091, PG 318

NOW OR FORMERLY
LARRY T. GRIFFIN
AND
SHEILA A MULL
PID 08303015A
D.B. 6066, PG 189

NOW OR FORMERLY
BILLY F. AYCOTH, TRUSTEE
PID 08303014
D.B. 5304, PG 860

NOW OR FORMERLY
UNION ELECTRIC
MEMBERSHIP CORP
PID 08303015
D.B. 324, PG 519

NOW OR FORMERLY
ROBERT N. GRIER
PID 08303015D
D.B. 972, PG 759

NOW OR FORMERLY
CHERYL T. OWNBY
PID 08303015C
D.B. 1646, PG 247

NOW OR FORMERLY
FOREST HILLS
BAPTIST CHURCH
PID 08303015B

NOW OR FORMERLY
RONALD COLIN HOUGH
AND WIFE
PEGGY C. HOUGH
PID 08303012C
D.B. 333, PG 741

NOW OR FORMERLY
FRANK PHUNG
AND WIFE
SYLVIA PHUNG
PID 08303014C
D.B. 4187, PG 241

NOW OR FORMERLY
NORTH CAROLINA
DEPARTMENT OF
TRANSPORTATION
TURNPIKE AUTHORITY
PID 08303014A
D.B. 5732, PG 26

NOW OR FORMERLY
DARRIN J. FITCH
AND WIFE
SUSAN D. FITCH
PID 09253072A
D.B. 751, PG 860

CE AREA A
CE AREA B
CE AREA C
CE AREA D
CE AREA E
CE AREA F
CE AREA G

IRF
IPF

POINT 1068
NC GRID NAD83/2007
N 479876.33
E 1527921.09
TIE TO 1068 FROM CONTROL POINT 2
N58°50'43"W 2641.81' (GROUND)

IRF
NC GRID NAD83/2007
N 479120.02
E 1528719.20
TIE TO IRF FROM CONTROL POINT 2
N67°20'59"W 1584.80' (GROUND)

N89°10'25"E
1702.24'

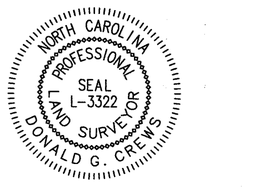
N28°51'02"E
1217.42'

N89°10'10"E
98.87'

60' NON-EXCLUSIVE ACCESS EASEMENT "SEE NOTE 8"

CONSERVATION EASEMENT LINE

NC GRID NAD83/2001



GRAPHIC SCALE
0 50 100 200 300 400 500
SCALE: 1"=200'

CERTIFICATE OF SURVEY AND ACCURACY

I, DONALD G. CREWS, CERTIFY THAT THIS MAP WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION AS NOTED HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DASHED LINES AND WERE DRAWN FROM DEED INFORMATION AS NOTED 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;

I FURTHER CERTIFY THAT THIS SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER AND SEAL THIS 11TH DAY OF March, A.D. 2014.

DONALD G. CREWS, NCPLS NO. L-3322

NOTES:

1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES IN U.S. SURVEY FEET UNLESS OTHERWISE NOTED.
2. THE AREA WAS CALCULATED BY THE COORDINATE METHOD.
3. THIS MAP WAS PREPARED WITHOUT THE BENEFIT OF A CERTIFIED TITLE REPORT AND THEREFORE THE PROPERTY SHOWN HEREON MAY BE SUBJECT TO RECORDED OR UNRECORDED RIGHT-OF-WAYS, EASEMENTS, RESTRICTIONS OF RECORD, OR OTHER ENCUMBRANCES NOT OBSERVED OR SHOWN HEREON.
4. NO DETERMINATION HAS BEEN MADE BY THE SURVEYOR AS TO THE FOLLOWING: FLOOD ZONES; WETLANDS; UNDERGROUND STORAGE FACILITIES; UNDERGROUND UTILITIES; GRAVES, CEMETERIES, OR BURIAL GROUNDS; HAZARDOUS WASTE DEPOSITS OR MATERIALS.
5. THIS MAP WAS PREPARED FOR EASEMENT ACQUISITION PURPOSES ONLY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY OF THE PROPERTY SHOWN HEREON. ALL PROPERTY LINES WERE CALCULATED USING FIELD LOCATED PROPERTY CORNERS, RECORDED DEEDS AND PLATS AS REFERENCED HEREON,
6. THE HORIZONTAL DATUM AND CONTROL POINTS FOR THIS MAP WERE TAKEN FROM A MAP PREPARED BY WK DICKSON ENTITLED "TOPOGRAPHIC SURVEY OF POPLIN RIDGE" DATED OCTOBER 2012. THE HORIZONTAL DATUM ON SAID MAP IS NC GRID (NAD83/2001) WITH A COMBINED FACTOR OF 0.999853876 SHOWN FOR CONTROL POINT #2.
7. #5 REBARS SET AT ALL CONSERVATION EASEMENT CORNERS UNLESS OTHERWISE NOTED.
8. NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS, AND REGRESS TO AND IN BETWEEN EASEMENT AREAS A THROUGH K CONVEYED TO THE STATE. ALL OTHER USES ARE RESERVED BY THE GRANTOR. SEE SECTION IIIA OF CONSERVATION EASEMENT.

LINE TABLE		
LINE	LENGTH	BEARING
L1	130.58	N85°51'38"W
L2	104.44	N08°26'48"E
L3	177.35	N05°06'21"W
L4	454.85	N11°30'59"W
L5	385.12	N31°30'53"W
L6	234.46	S54°34'49"W
L7	270.04	S86°58'39"W
L8	172.71	S89°50'32"W
L9	163.02	N45°18'48"W
L10	123.74	N23°00'18"W
L11	28.47	N64°19'38"E
L12	83.02	S86°45'13"E
L13	174.88	S46°17'47"E
L14	298.18	N71°18'18"E
L15	161.62	N52°50'57"E
L16	396.22	N40°37'56"W
L17	269.64	N32°12'16"W
L18	148.76	N53°38'14"E
L19	408.86	S33°37'43"E
L20	185.16	S49°08'22"E
L21	277.31	S44°40'14"E

LINE TABLE		
LINE	LENGTH	BEARING
L22	355.50	S29°29'08"E
L23	406.00	S13°21'10"E
L24	238.44	S06°24'26"E
L25	148.37	S08°24'45"W
L26	64.32	N57°29'27"W
L27	102.68	N82°52'06"W
L28	74.80	N12°51'02"E
L29	415.39	N12°53'25"E
L30	77.64	N79°45'33"E
L31	36.68	S04°37'11"E
L32	172.35	S13°40'53"W
L33	221.40	S22°08'19"E
L34	160.75	S53°38'14"W
L35	65.25	N12°53'25"E
L36	99.23	N12°53'25"E
L37	91.67	S15°42'41"E
L38	47.72	S79°45'33"W
L39	270.68	N82°52'06"W
L40	287.92	N82°08'59"E
L41	274.88	N60°50'18"W
L42	253.15	N38°41'32"W

LINE TABLE		
LINE	LENGTH	BEARING
L43	109.91	N23°12'05"W
L44	124.16	N47°14'57"E
L45	29.01	S42°17'09"E
L46	145.84	S33°18'05"E
L47	157.04	S36°42'31"E
L48	146.96	S58°55'38"E
L49	332.81	S77°57'25"E
L50	156.78	N02°38'24"E
L51	180.39	N10°24'15"E
L52	44.48	N79°45'33"E
L53	80.39	S79°45'33"W
L54	192.61	N19°46'47"W
L55	115.02	N01°32'53"E
L56	181.54	N05°13'46"E
L57	73.74	N25°20'56"E
L58	215.08	N89°01'25"E
L59	60.87'	S19°57'45"E
L60	60.15'	S14°19'54"E
L61	61.04'	S46°55'55"E
L62	60.00'	S42°20'08"E
L63	60.19	N47°17'19"W

LINE TABLE		
LINE	LENGTH	BEARING
L64	70.20	N44°43'58"W
L65	265.28	N84°38'05"W
L66	224.55	N77°45'24"W
L67	203.98	N59°31'00"W
L68	95.66	N66°57'46"W
L69	97.39	N87°56'02"W
L70	197.48	N25°34'53"W
L71	221.83	S83°53'07"E
L72	103.34	S86°56'37"E
L73	134.23	S45°28'22"E
L74	174.99	S67°37'16"E
L75	131.83	S75°33'34"E
L76	177.42	S85°50'18"E
L77	104.69	N16°46'04"W
L78	114.98	N65°22'28"E
L79	151.94	S24°23'54"E
L80	113.07	S31°42'01"E
L81	129.35	S47°14'57"W
L82	447.58	S12°53'25"W
L83	97.80	S25°34'53"E
L84	178.44	S25°34'53"E

CERTIFICATE OF OWNERSHIP AND DEDICATION

I (WE) HEREBY CERTIFY THAT I (WE) ARE THE OWNER OF THE PROPERTY AS SHOWN AND DESCRIBED HEREON, I (WE) ALSO HEREBY ACCEPT AND ADOPT THIS RECORDED PLAT AND CONSERVATION EASEMENT WITH MY (OUR) FREE CONSENT AND DEDICATE ALL EASEMENTS, RIGHT-OF-WAYS, AND ACCESS ROADS TO PUBLIC AND/OR PRIVATE USE AS NOTED ON SAID PLAT.

BILLY F. AYCOTH, TRUSTEE _____ DATE

THOMAS RAY POPLIN _____ DATE

JUDY H. POPLIN _____ DATE

FRANK PHUNG _____ DATE

SYLVIA PHUNG _____ DATE

CONSERVATION EASEMENT AREA

CE AREA A	8.73± AC.
CE AREA B	1.40± AC.
CE AREA C	0.05± AC.
CE AREA D	2.81± AC.
CE AREA E	2.29± AC.
CE AREA F	3.70± AC.
CE AREA G	0.23± AC.
CE AREA H	0.22± AC.
CE AREA I	1.95± AC.
CE AREA J	1.35± AC.
CE AREA K	4.44± AC.
TOTAL AREA	27.17± AC.

REV. NO.	DESCRIPTION	DATE
1	Added Poplin Deed Refer. & OH Electric	02/27/14
1	Revised S.P.O. FILE #	02/27/14

REVISIONS

PROJECT MANAGER: DGC
DRAWN BY: JRM
PROJECT DATE: OCTOBER 2013
PROJECT NUMBER: 2012014200WL
FILE NAME: Poplin Esmt

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NC LICENSE NO. F-0374

CONSERVATION EASEMENT SURVEY
FOR THE
STATE OF NORTH CAROLINA
NCEEP RFP # 16-004110
NCEEP PROJECT # 95359
NCEEP PROJECT NAME "POPLIN RIDGE STREAM RESTORATION PROJECT"

OWNERS:
BILLY F. AYCOTH, TRUSTEE (SPO 90-BA; PID# 08303014)
THOMAS RAY POPLIN AND WIFE JUDY H. POPLIN (SPO 90-BC; PID# 08273001)
FRANK PHUNG AND WIFE SYLVIA PHUNG (SPO 90-BB; PID# 08303014C)
MONROE TOWNSHIP & GOOSE CREEK TOWNSHIP
UNION COUNTY, NORTH CAROLINA

PLOT DATE=3/11/2014 2:52 PM R:\Projects\Environ Banc & Exchange\20120142000WL - Poplin Ridge Site Surveying Services\CADD\land 20120142.00.ra\Poplin Survey esmt\dwg\Poplin Esmt revised 2014-02-27.dwg

LEGEND

CE	CONSERVATION EASEMENT
IRF	IRON ROD FOUND
IPF	IRON PIPE FOUND
	CE CORNER
	COMPUTED POINT
E	OVERHEAD ELECTRIC LINE
	CALCULATED PROPERTY LINE
	CONSERVATION EASEMENT LINE
	TIE LINE

CERTIFICATE OF OWNERSHIP AND DEDICATION

I (WE) HEREBY CERTIFY THAT I (WE) ARE THE OWNER OF THE PROPERTY AS SHOWN AND DESCRIBED HEREON, I (WE) ALSO HEREBY ACCEPT AND ADOPT THIS RECORDED PLAT AND CONSERVATION EASEMENT WITH MY (OUR) FREE CONSENT AND DEDICATE ALL EASEMENTS, RIGHT-OF-WAYS, AND ACCESS ROADS TO PUBLIC AND/OR PRIVATE USE AS NOTED ON SAID PLAT.

KAREN S. HAMILTON DATE

TAMMY RENEE S. BAUCOM DATE

DON SCOTT SIMPSON DATE

DON S. SIMPSON DATE

ARLENE J. SIMPSON DATE

NOTES:

1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES IN U.S. SURVEY FEET UNLESS OTHERWISE NOTED.
2. THE AREA WAS CALCULATED BY THE COORDINATE METHOD.
3. THIS MAP WAS PREPARED WITHOUT THE BENEFIT OF A CERTIFIED TITLE REPORT AND THEREFORE THE PROPERTY SHOWN HEREON MAY BE SUBJECT TO RECORDED OR UNRECORDED RIGHT-OF-WAYS, EASEMENTS, RESTRICTIONS OF RECORD, OR OTHER ENCUMBRANCES NOT OBSERVED OR SHOWN HEREON.
4. NO DETERMINATION HAS BEEN MADE BY THE SURVEYOR AS TO THE FOLLOWING: FLOOD ZONES; WETLANDS; UNDERGROUND STORAGE FACILITIES; UNDERGROUND UTILITIES; GRAVES, CEMETERIES, OR BURIAL GROUNDS; HAZARDOUS WASTE DEPOSITS OR MATERIALS.
5. THIS MAP WAS PREPARED FOR EASEMENT ACQUISITION PURPOSES ONLY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY OF THE PROPERTY SHOWN HEREON. ALL PROPERTY LINES WERE CALCULATED USING FIELD LOCATED PROPERTY CORNERS, RECORDED DEEDS AND PLATS AS REFERENCED HEREON,
6. THE HORIZONTAL DATUM AND CONTROL POINTS FOR THIS MAP WERE TAKEN FROM A MAP PREPARED BY WK DICKSON ENTITLED "TOPOGRAPHIC SURVEY OF POPLIN RIDGE" DATED OCTOBER 2012. THE HORIZONTAL DATUM ON SAID MAP IS NC GRID (NAD83/2001) WITH A COMBINED FACTOR OF 0.999853876 SHOWN FOR CONTROL POINT #2.
7. #5 REBARS SET AT ALL CONSERVATION EASEMENT CORNERS UNLESS OTHERWISE NOTED.
8. NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS, AND REGRESS TO AND IN BETWEEN EASEMENT AREAS A THROUGH K CONVEYED TO THE STATE. ALL OTHER USES ARE RESERVED BY THE GRANTOR. SEE SECTION IIIA OF CONSERVATION EASEMENT.

CONSERVATION EASEMENT AREA

CE AREA A	8.73± AC.
CE AREA B	1.40± AC.
CE AREA C	0.05± AC.
CE AREA D	2.81± AC.
CE AREA E	2.29± AC.
CE AREA F	3.70± AC.
CE AREA G	0.23± AC.
CE AREA H	0.17± AC.
CE AREA I	1.95± AC.
CE AREA J	1.35± AC.
CE AREA K	4.44± AC.
TOTAL AREA	27.12± AC.

POINT TABLE

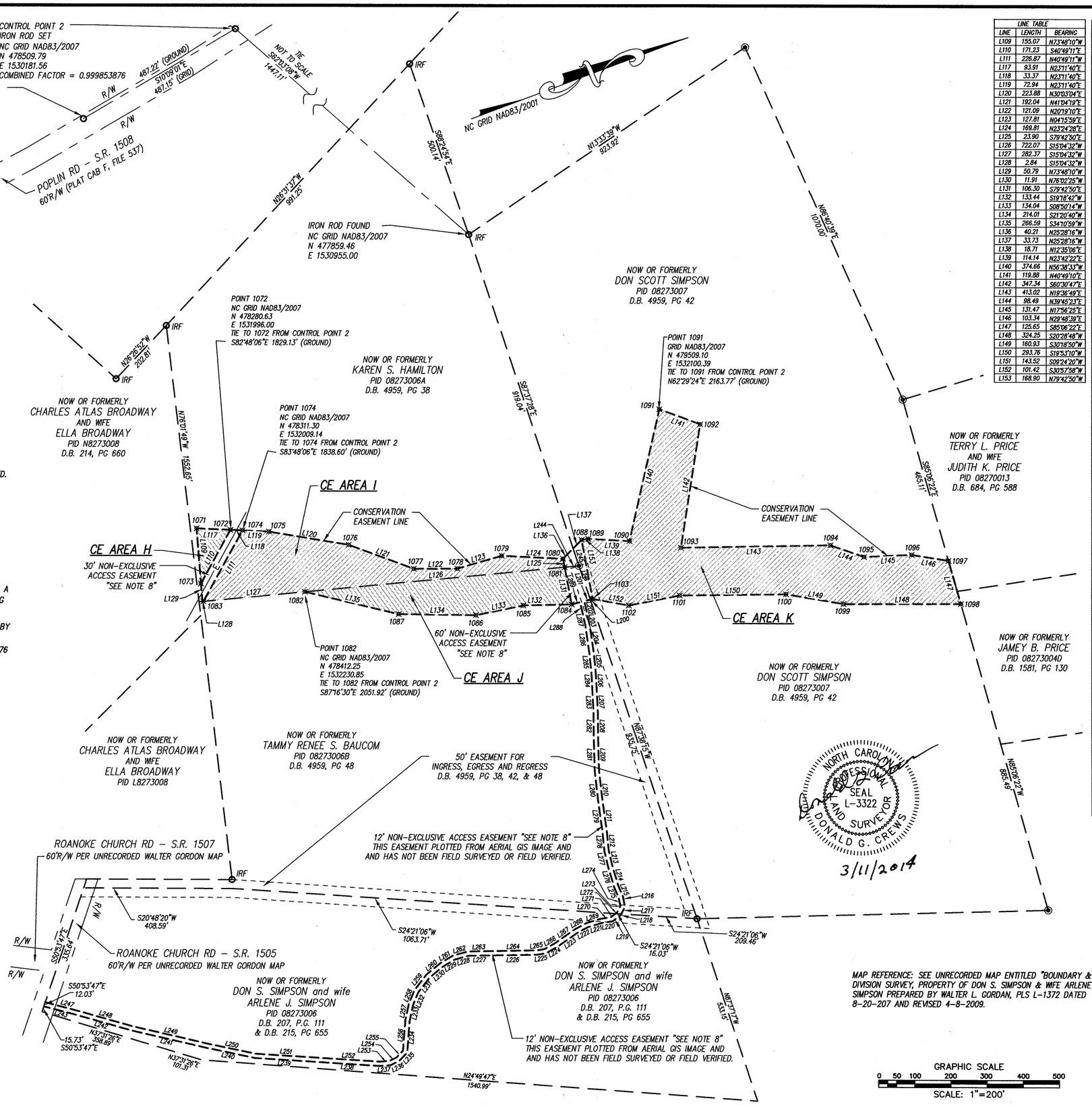
POINT	NORTH	EAST
1071	478194.27	1531959.28
1072	478280.60	1531996.27
1073	478151.02	1532108.19
1074	478311.27	1532009.41
1075	478378.32	1532038.14
1076	478572.10	1532150.25
1077	478716.88	1532276.42
1078	478830.44	1532318.47
1079	478957.89	1532327.98
1080	479113.72	1532395.44
1081	479109.45	1532418.96
1082	478412.24	1532231.15
1083	478139.59	1532157.71
1084	479090.47	1532523.55
1085	478964.54	1532478.42
1086	478832.10	1532458.83
1087	478632.77	1532380.93
1088	479180.47	1532363.64
1089	479198.73	1532367.72
1090	479303.23	1532413.61
1091	479509.24	1532100.67
1092	479599.96	1532179.03
1093	479428.99	1532481.38
1094	479818.05	1532620.02
1095	479893.77	1532683.01
1096	480018.85	1532723.50
1097	480108.51	1532774.88
1098	480097.79	1532900.07
1099	479794.04	1532786.62
1100	479655.11	1532705.39
1101	479378.87	1532605.47
1102	479237.28	1532582.01
1103	479150.31	1532529.83

LINE TABLE

LINE	LENGTH	BEARING
L109	155.07	N73°48'10"W
L110	171.23	S40°49'11"E
L111	226.87	N40°49'11"W
L117	93.91	N23°11'40"E
L118	33.37	N23°11'40"E
L119	72.94	N23°11'40"E
L120	223.88	N30°03'04"E
L121	192.04	N41°04'19"E
L122	121.09	N20°19'10"E
L123	127.81	N04°15'59"E
L124	169.81	N23°24'28"E
L125	23.90	S79°42'50"E
L126	722.07	S15°04'32"W
L127	282.37	S15°04'32"W
L128	2.84	S15°04'32"W
L129	50.79	N73°48'10"W
L130	11.91	N76°02'25"W
L131	106.30	S79°42'50"E
L132	133.44	S19°18'42"W
L133	134.04	S08°50'14"W
L134	214.01	S21°20'40"W
L135	266.59	S34°10'59"W
L136	40.21	N25°28'16"W
L137	33.73	N25°28'16"W
L138	18.71	N12°35'06"E
L139	114.14	N23°42'22"E
L140	374.66	N56°38'33"W
L141	119.88	N40°49'10"E
L142	347.34	S80°30'47"E
L143	413.02	N19°36'49"E
L144	98.49	N39°45'23"E
L145	131.47	N17°56'25"E
L146	103.34	N29°48'39"E
L147	125.65	S85°06'22"E
L148	324.25	S20°28'48"W
L149	160.93	S30°18'50"W
L150	293.76	S19°53'10"W
L151	143.52	S09°24'20"W
L152	101.42	S30°57'58"W
L153	168.90	N79°42'50"W

LINE TABLE

LINE	LENGTH	BEARING
L200	6.57	S05°59'34"W
L201	17.13	S05°59'34"W
L202	12.36	S80°51'38"E
L203	54.73	S81°48'13"E
L204	78.81	S77°38'26"E
L205	50.87	S75°14'16"E
L206	55.11	S72°37'11"E
L207	62.66	S72°11'17"E
L208	70.97	S69°50'39"E
L209	88.16	S70°50'49"E
L210	83.05	S75°53'30"E
L211	88.82	S77°16'35"E
L212	51.93	S74°41'26"E
L213	44.58	S82°29'35"E
L214	57.98	S85°42'17"E
L215	32.39	N87°48'23"E
L216	30.14	S80°00'32"E
L217	21.62	S41°31'00"E
L218	2.81	S41°31'00"E
L219	28.56	S18°30'47"E
L220	31.20	S11°51'01"W
L221	38.88	S03°58'11"W
L222	33.17	S07°29'45"E
L223	67.23	S14°25'42"E
L224	36.56	S09°34'56"E
L225	26.17	S10°53'36"W
L226	130.41	S19°45'47"W
L227	58.69	S19°45'51"W
L228	40.09	S04°49'13"W
L229	39.34	S10°13'28"E
L230	46.78	S19°05'13"E
L231	51.07	S31°55'11"E
L232	38.85	S47°11'21"E
L233	45.13	S57°20'18"E
L234	88.41	S64°54'41"E
L235	32.16	S25°21'41"E
L236	26.62	S05°48'01"E
L237	28.52	S16°13'41"W
L238	178.63	S24°12'11"W
L239	168.28	S24°15'22"W
L240	138.87	S32°33'50"W
L241	208.58	S33°46'51"W
L242	162.94	S36°27'32"W
L243	88.88	S35°11'31"W
L244	39.70	S15°04'32"W
L245	51.18	S87°30'08"E
L246	99.94	S87°41'50"E
L247	88.19	N35°11'31"E
L248	162.79	N36°27'32"E
L249	208.17	N33°46'51"E
L250	137.87	N32°33'50"E
L251	168.41	N24°15'22"E
L252	177.78	N24°12'11"E
L253	25.35	N16°13'41"E
L254	22.21	N05°48'01"W
L255	25.78	N25°21'41"W
L256	84.89	N64°54'41"W
L257	46.99	N57°20'18"W
L258	41.53	N47°11'21"W
L259	54.03	N31°55'11"W
L260	48.06	N19°05'13"W
L261	41.85	N10°13'28"W
L262	43.24	N04°49'13"E
L263	60.27	N19°45'51"E
L264	129.48	N19°45'47"E
L265	23.07	N10°53'36"E
L266	33.89	N09°34'56"W
L267	67.45	N14°25'42"W
L268	35.10	N07°29'45"W
L269	40.91	N03°58'11"E
L270	28.77	N11°51'01"E
L271	16.14	N18°30'47"W
L272	6.72	N18°30'47"W
L273	17.80	N41°31'00"W
L274	24.67	N80°00'32"W
L275	31.79	S87°48'23"W
L276	59.00	N85°42'17"W
L277	45.74	N82°29'35"W
L278	52.47	N74°41'26"W
L279	88.69	N77°16'35"W
L280	83.72	N75°53'30"W
L281	88.79	N70°50'49"W
L282	70.83	N69°50'39"W
L283	62.37	N72°11'17"W
L284	54.79	N72°37'11"W
L285	50.34	N75°14'16"W
L286	78.12	N77°38'26"W
L287	54.39	N81°48'13"W
L288	11.80	N80°51'38"W
L289	24.45	S05°59'34"W



REV. NO.	DESCRIPTION	DATE
1	Revised S.P.O. FILE #	02/27/14

REVISIONS

PROJECT MANAGER: DGC
DRAWN BY: JRM
PROJECT DATE: OCTOBER 2013
PROJECT NUMBER: 2012014200WL
FILE NAME: Poplin Esmt

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WILMINGTON, NC 28401
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Office Locations: North Carolina
South Carolina
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NC LICENSE NO. F-0374

CONSERVATION EASEMENT SURVEY
FOR THE
STATE OF NORTH CAROLINA
NCEEP RFP # 16-004110
NCEEP PROJECT # 95359
NCEEP PROJECT NAME "POPLIN RIDGE STREAM RESTORATION PROJECT"

OWNERS:
KAREN S. HAMILTON AND HUSBAND CARLTON HAMILITON (SPO 90-AY; PID# 08273006A)
TAMMY RENEE S. BAUCOM AND HUSBAND GREG BAUCOM (SPO 90-AX; PID# 08273006B)
DON SCOTT SIMPSON (SPO 90-AZ; PID# 08273007)
DON S. SIMPSON AND WIFE ARLENE J. SIMPSON (SPO 90-BE; PID# 08273006)
MONROE TOWNSHIP & GOOSE CREEK TOWNSHIP
UNION COUNTY, NORTH CAROLINA

PLOT DATE=3/11/2014 2:55 PM R:\Projects\Environ Banc & Exchange\20120142000WL - Poplin Ridge Site Surveying Services\CADD\and 20120142.00.ra\Poplin Survey esmt\dwg\Poplin Esmt revised 2014-02-27.dwg

14.4 Appendix B – Baseline Information Data

Poplin Ridge USACE Routine Wetland Data Forms
Poplin Ridge NCDWQ Stream Determination Data Forms
Reference Reach NCDWQ Stream Determination Data Form
Poplin Ridge Stream Forms Summary Table
USACE Stream Quality Assessment Worksheet Form
DWQ Stream Habitat Evaluation Form
Aquatic Habitat Assessment Fish Cover Table
Channel Stability Assessment Form
EDR Report
Environmental Screening and Resource Agency Correspondence
Poplin Ridge CE
Farmland Conversion Impact Rating (Form AD 1006)
FEMA Floodplain Checklist
Poplin Ridge Correspondence

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Poplin Ridge Stream Restoration City/County: Union Sampling Date: 2/27/13

Applicant/Owner: EBX State: NC Sampling Point: A/B Wet

Investigator(s): B. Hockett Section, Township, Range: Monroe

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0%

Subregion (LRR or MLRA): LRR P Lat: 35.058077 Long: -80.561590 Datum: NAD 83

Soil Map Unit Name: Chawacla - ChA NWI classification: PUBHh

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:

Site is adjacent to cultivated fields and upstream from an in-line pond.

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)
- ☐ True Aquatic Plants (B14)
- ☐ 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)
- ☑ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches): +1
Water Table Present?	Yes ☑	No ☐	Depth (inches): - 1
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): - 1

Wetland Hydrology Present? Yes ☑ No ☐

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: A/B Wet

Tree Stratum (Plot size: 30 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	30 %	YES	FAC
2. Salix nigra	5 %	NO	OBL
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
9.		-	-
10.		-	-
	= Total Cover		
Herb Stratum (Plot size: 30 m)			
1. Scirpus cyperinus	15 %	YES	OBL
2. Panicum sp.	2 %	NO	FACU
3. Microstegium vimineum	2 %	NO	FAC
4. Juncus effusus	5%	NO	FACW
5.		-	-
6.		-	-
7.		-	-
8.		-	-
9.		-	-
10.		-	-
11.		-	-
12.		-	-
	= Total Cover		
Woody Vine Stratum (Plot size:)			
1. Rubus argutus	5%	YES	FACU
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
	= 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: 3 (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:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: A/B Wet

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
0-8	10 YR 5/2	95	2.5 YR 6/8	5	C	M	CL	
8-15	10 YR 7/1	85	7.5 YR 6/8	10	C	M	CL	
---	---	---	N 2.5	5	C	M	---	
15-25	7.5 YR 6/8	60	10 YR 7/1	35	C	M	CL	
---	---	---	N 2.5	5	C	M	---	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked 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)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☑ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Poplin Ridge Stream Restoration City/County: Union Sampling Date: 2/27/13

Applicant/Owner: EBX State: NC Sampling Point: A/B Upland

Investigator(s): B. Hockett Section, Township, Range: Monroe

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 1%

Subregion (LRR or MLRA): LRR P Lat: 35.057952 Long: -80.561532 Datum: NAD 83

Soil Map Unit Name: Chewacla - ChA NWI classification: NA

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:

Sample area is located within a cultivated ag field.

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)
- ☐ True Aquatic Plants (B14)
- ☐ 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)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ 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:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: A/B Upland

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
9.		-	-
10.		-	-
	= Total Cover		
Herb Stratum (Plot size: 30 m)			
1. Glycine max	75	YES	NI
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
9.		-	-
10.		-	-
11.		-	-
12.		-	-
	= Total Cover		
Woody Vine Stratum (Plot size:)			
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
	= Total Cover		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (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:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)

Data Point was located in a harvested soybean field.

SOIL

Sampling Point: A/B Upland

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
0-18	7.5 YR 4/4	90	10 R 4/8	10	MS	M	Silt Loam	Cobble ~ 1/2" diameter present
18 -	---	---	---	---	---	---	Bedrock	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked 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)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 18 inches

Hydric Soil Present? Yes ☐ No ☑

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Poplin Ridge Stream Restoration City/County: Union Sampling Date: 2/27/13

Applicant/Owner: EBX State: NC Sampling Point: A/B Upland 2

Investigator(s): B. Hockett Section, Township, Range: Monroe

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 1%

Subregion (LRR or MLRA): LRR P Lat: 35.057059 Long: -80.562385 Datum: NAD 83

Soil Map Unit Name: Chewacla - ChA NWI classification: NA

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:

Data Point was located in a harvested soybean field adjacent to in-line pond.

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)
- ☐ True Aquatic Plants (B14)
- ☐ 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)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ 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:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: A/B Upland 2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
9.		-	-
10.		-	-
	= Total Cover		
Herb Stratum (Plot size: 30 m)			
1. Glycine max	50	YES	NI
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
7.		-	-
8.		-	-
9.		-	-
10.		-	-
11.		-	-
12.		-	-
	= Total Cover		
Woody Vine Stratum (Plot size:)			
1.		-	-
2.		-	-
3.		-	-
4.		-	-
5.		-	-
6.		-	-
	= Total Cover		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (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:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)

Data Point was located in a harvested soybean field.

SOIL

Sampling Point: A/B 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 Features %	Type[1]	Loc[2]	Texture	Remarks
0-15	5 YR 6/8	90	5 YR 4/6	10	MS	M	Silt Loam	Cobble ~ 1/4" diameter present
15-20	7.5 YR 5/6	85	5 YR 4/6	15	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked 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)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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:

NC DWQ Stream Identification Form Version 4.11 — UT 1

Date: 11/12/11	Project/Site: Poplin Ridge	Latitude:
Evaluator: G. Lankford	County: Union	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 20)	Absent	Weak	Moderate	Strong
1* 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)	

*artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)				
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 = 10.5)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland 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	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11 — UT 1 A

Date: 11/12/11	Project/Site: Poplin Ridge	Latitude:
Evaluator: G. Lankford	County: Union	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22.5	Stream Determination (circle one) Ephemeral (Intermittent) Perennial	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 16)	Absent	Weak	Moderate	Strong
1* 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	

*artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 0.5)				
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)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland 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	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NCDWQ Stream Classification Forms

NC DWQ Stream Identification Form Version 4.11

UT 1 B

Date: 11/12/11	Project/Site: Poplar Ridge	Latitude:
Evaluator: G. Lankford	County: Union	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 19.5)	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 = 3.5)				
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 = 7.0)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland 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	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

UT 1 C

Date: 11/12/11	Project/Site: Poplar Ridge	Latitude:
Evaluator: G. Lankford	County: Union	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 19.0)	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 = 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?	No = (0)		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland 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	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

UT2

NC DWQ Stream Identification Form Version 4.11

Date: 9/21/11	Project/Site: Poplin Ridge	Latitude:
Evaluator: A. Steele	County: Union	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 33.5	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 19.5)	Absent	Weak	Moderate	Strong
1* 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	(0.5)
11. Second or greater order channel	No = 0		Yes = 3	

*artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
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 = 7.5)				
18. Fibrous roots in streambed	3	2	(1)	0
19. Rooted upland 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	FACW = 0.75; (OBL = 1.5) Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: cross section 1, photos 78-81, UT2

Sketch:

UT2A

NC DWQ Stream Identification Form Version 4.11

Date: 9/21/11	Project/Site: Poplin Ridge	Latitude:
Evaluator: A. Steele	County: Union	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22.5	Stream Determination (circle one) Ephemeral (Intermittent) Perennial	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 14)	Absent	Weak	Moderate	Strong
1* 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	

*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 = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland 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	FACW = 0.75; OBL = 1.5 (Other = 0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: cross section 4, photos 115-118, trib, UT 1

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 12-17-2012	**Project/Site:** Poplin Ridge Reference	**Latitude:**
Evaluator: AFM / BSH	**County:** Union	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 40+	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 22.5)	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 = 11.5)				
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)					
18. Fibrous roots in streambed		(3)	2	1	0
19. Rooted upland 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	—	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Poplin Ridge Stream Form Summary Table

Stream Reach	USACE Form	NC DWQ	Stability Assessment Form	
	Stream Quality Assessment Worksheet	DWQ Stream Habitat Evaluation Form	Score	Rating
UT1-R1 (Pres)	41	58	76	Fair
UT1-R1 (Enh)	45	38	66	Good
UT1-R2	42	52	78	Fair
UT1-R3	32	40	87	Fair
UT1-R4	32	27	117	Poor
UT1-A	41	36	72	Fair
UT1-B (Pres)	53	67	58	Good
UT1-B (Enh)	41	53	82	Fair
UT1-C	48	61	62	Good
UT2-R1	62	56	65	Good
UT2-R2	25	1	132	Poor
UT2-R3	31	37	101	Poor
UT2-R4	31	27	113	Poor
UT2-A	26	25	86	Fair
Reference Site	71	83	37	Good

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name:_____ **2.** Evaluator's name:_____

3. Date of evaluation:_____ **4.** Time of evaluation:_____

5. Name of stream:_____ **6.** River basin:_____

7. Approximate drainage area:_____ **8.** Stream order:_____

9. Length of reach evaluated:_____ **10.** County:_____

11. Site coordinates (if known): prefer in decimal degrees. **12.** Subdivision name (if any):_____

Latitude (ex. 34.872312): _____ Longitude (ex. –77.556611):_____

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):_____

_____

14. Proposed channel work (if any):_____

15. Recent weather conditions:_____

16. Site conditions at time of visit:_____

17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat

___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)

18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area:_____

19. Does channel appear on USGS quad map? YES NO **20.** Does channel appear on USDA Soil Survey? YES NO

21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial ___% Agricultural

___% Forested ___% Cleared / Logged ___% Other (_____)

22. Bankfull width:_____ **23**. Bank height (from bed to top of bank):_____

24. Channel slope down center of stream: ___Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)

25. Channel sinuosity: ____Straight ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse):_____ **Comments:**_____

_____

_____

_____

_____

Evaluator's Signature_____ **Date**_____

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						

* These characteristics are not assessed in coastal streams.

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE**_____

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream_____Location/road: _____(Road Name_____)County_____

Date_____**CC#**_____Basin_____Subbasin_____

Observer(s)_____ Type of Study: ☐ Fish ☐Benthos ☐ Basinwide ☐Special Study (Describe) _____

Latitude _____Longitude _____Ecoregion: ☐ MT ☐ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature_____^{0}C DO _____mg/l Conductivity (corr.) _____µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: _____%Forest _____%Residential _____%Active Pasture _____% Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe:_____

Watershed land use : ☐Forest ☐Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream_____ Channel (at top of bank)_____ **Stream Depth**: (m) Avg_____Max ____
☐ Width variable ☐ Large river >25m wide
Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m)_____

Bank Angle: _____ ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)
☐ Channelized Ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☐N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☐Normal ☐Low
Turbidity: ☐Clear ☐ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☐ YES ☐NO Details_____
Channel Flow Status
Useful especially under abnormal or low flow conditions.
A. Water reaches base of both lower banks, minimal channel substrate exposed ..... ☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed..... ☐
C. Water fills 25-75% of available channel, many logs/snags exposed..... ☐
D. Root mats out of water..... ☐
E. Very little water in channel, mostly present as standing pools..... ☐

Weather Conditions:_____**Photos:** ☐N ☐Y ☐ Digital ☐35mm

Remarks:_____
_____

I. Channel Modification

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal____

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

____Rocks ____Macrophytes ____Sticks and leafpacks ____Snags and logs ____Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	15	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks_____ Subtotal____

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____Subtotal____

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

A. Pools present	Score
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal____

☐ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____

Page Total____

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal_____

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total_____

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks_____Subtotal____

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

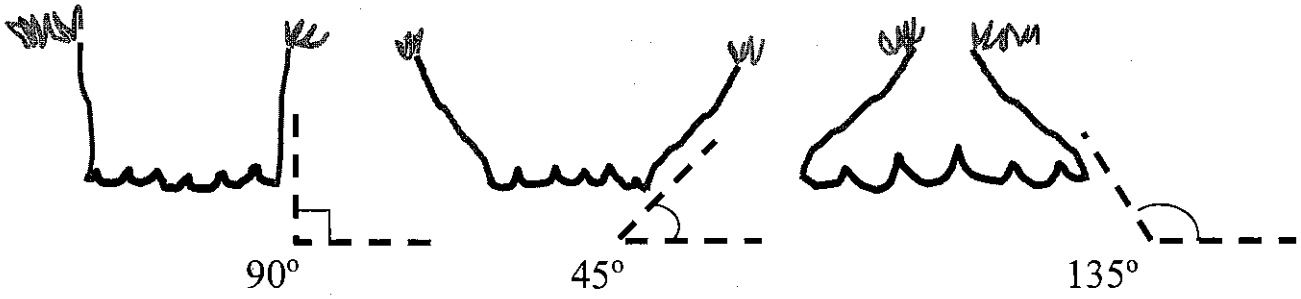
Remarks_____ Total_____

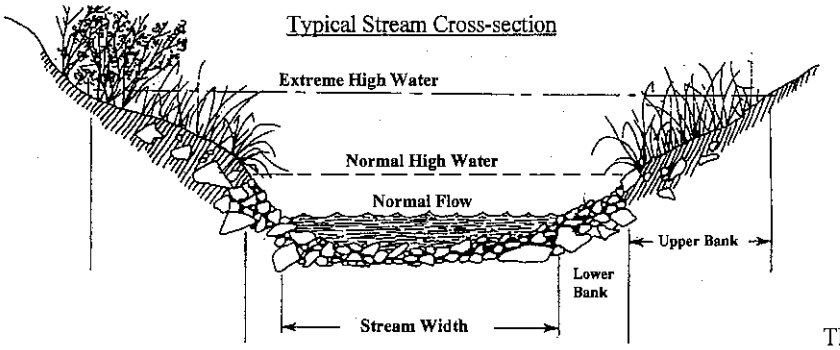
Page Total_____

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE**_____

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:_____

	Reference Reach		UT1-R2		UT1-R4		UT1-B Enh.		UT2-R4	
Transect	Total Fish Cover (ft^2)	Percent Coverage	Total Fish Cover (ft^2)	Percent Coverage	Total Fish Cover (ft^2)	Percent Coverage	Total Fish Cover (ft^2)	Percent Coverage	Total Fish Cover (ft^2)	Percent Coverage
1	4.0	7	11.9	22	16.9	21	2.3	12	6.0	10
2	28.0	47	2.6	9	24.5	35	12.5	25	32.0	80
3	6.9	9	8.6	31	9.0	30	1.5	30	22.0	55
4	0.0	0	21.5	86	5.2	13	6.8	15	30.0	60
5	0.0	0	14.7	37	3.6	11	14.0	35	54.0	90
6	2.0	7	28.8	82	5.0	11	12.3	35	27.0	90
7	1.2	1	16.2	68	8.6	17	1.9	11	22.2	74
8	29.0	41	34.1	79	8.8	18	2.5	10	15.0	50
9	5.2	10	26.0	87	10.9	22	8.8	22	40.0	80
10	0.0	0	40.5	90	3.1	6	16.0	40	28.0	80
Overall Fish Coverage	12%		59%		18%		23%		67%	
Pool Fish Coverage	17%		56%		14%		18%		90%	
Riffle Fish Coverage	2%		20%		11%		30%		78%	
Run Fish Coverage	24%		81%		22%		15%		54%	
Glide Fish Coverage	9%		---		---		35%		---	

CHANNEL STABILITY ASSESSMENT FORM

Stability Indicator	Excellent (1 -3)	Good (4 - 6)	Fair (7 - 9)	Poor (10 - 12)	Score
1. Watershed and flood plain activity and characteristics	Stable, forested, undisturbed watershed	Occasional minor disturbances in the watershed, including cattle activity (grazing and/or access to stream), construction, logging, or other minor deforestation. Limited agricultural activities	Frequent disturbances in the watershed, including cattle activity, landslides, channel sand or gravel mining, logging, farming, or construction of buildings, roads, or other infrastructure. Urbanization over significant portion of watershed	Continual disturbances in the watershed. Significant cattle activity, landslides, channel sand or gravel mining, logging, farming, or construction of buildings, roads, or other infrastructure. Highly urbanized or rapidly urbanizing watershed	
2. Flow habit	Perennial stream with no flashy behavior	Perennial stream or ephemeral first-order stream with slightly increased rate of flooding	Perennial or intermittent stream with flashy behavior	Extremely flashy; flash floods prevalent mode of discharge; ephemeral stream other than first-order stream	
3. Channel pattern	Straight to meandering with low radius of curvature; primarily suspended load	Meandering, moderate radius of curvature; mix of suspended and bed loads; well-maintained engineered channel	Meandering with some braiding; tortuous meandering; primarily bed load; poorly maintained engineered channel	Braided; primarily bed load; engineered channel that is maintained	
3. Channel pattern (revised)	No evidence of channelization. Meandering, stable channel or straight (step-pool system, narrow valley), stable channel.	Appears to have previously been channelized. Stream is relatively stable. Channel has some meanders due to previous channel adjustment.	Appears to have previously been channelized. Stream is actively adjusting (meandering); localized areas of instability and/or erosion around bends. Straightened, stable channel.	Appears to have previously been channelized. Stream is actively adjusting (laterally and/or vertically) with few bends. Straight, unstable reach.	
4. Entrenchment/ channel confinement	Active flood plain exists at top of banks; no sign of undercutting infrastructure; no levees	Active flood plain abandoned, but is currently rebuilding; minimal channel confinement; infrastructure not exposed; levees are low and set well back from the river	Moderate confinement in valley or channel walls; some exposure of infrastructure; terraces exist; flood plain abandoned; levees are moderate in size and have minimal setback from the river	Knickpoints visible downstream; exposed water lines or other infrastructure; channel-width-to-top-of-banks ration small; deeply confined; no active flood plain; levees are high and along the channel edge	
5. Bed materia Fs = approximate portion of sand in the bed	Assorted sized tightly packed, overlapping, and possibly imbricated. Most material > 4 mm. Fs < 20%	Moderately packed with some overlapping. Very small amounts of material < 4 mm. 20 < Fs < 50%	Loose assortment with no apparent overlap. Small to medium amounts of material < 4 mm. 50 < Fs < 70%	Very loose assortment with no packing. Large amounts of material < 4 mm. Fs > 70%	
6. Bar development	For S < 0.02 and w/y > 12, bars are mature, narrow relative to stream width at low flow, well-vegetated, and composed of coarse gravel to cobbles. For S > 0.02 and w/y are < 12, no bars are evident	For S < 0.02 and w/y > 12, bars may have vegetation and/or be composed of coarse gravel to cobbles, but minimal recent growth of bar evident by lack of vegetation on portions of the bar. For S > 0.02 and w/y <12, no bars are evident	For S < 0.02 and w/y > 12, bar widths tend to be wide and composed of newly deposited coarse sand to small cobbles and/or may be sparsely vegetated. Bars forming for S > 0.02 and w/y < 12	Bar widths are generally greater than 1/2 the stream width at low flow. Bars are composed of extensive deposits of fine particles up to coarse gravel with little to no vegetation. No bars for S < 0.02 and w/y > 12	
7. Obstructions, including bedrock outcrops, armor layer, LWD jams, grade control, bridge bed paving, revetments, dikes or vanes, riprap	Rare or not present	Occasional, causing cross currents and minor bank and bottom erosion	Moderately frequent and occasionally unstable obstructions, cause noticeable erosion of the channel. Considerable sediment accumulation behind obstructions	Frequent and often unstable, causing a continual shift of sediment and flow. Traps are easily filled, causing channel to migrate and/or widen	
8. Bank soil texture and coherence	Clay and silty clay; cohesive material	Clay loam to sandy clay loam; minor amounts of noncohesive or unconsolidated mixtures; layers may exist, but are cohesive materials	Sandy clay to sandy loam; unconsolidated mixtures of glacial or other materials; small layers and lenses of noncohesive or unconsolidated mixtures	Loamy sand to sand; noncohesive material; unconsolidated mixtures of glacial or other materials; layers of lenses that include noncohesive sands and gravels	
9. Average bank slope angle (where 90° is a vertical bank)	Bank slopes < 3H:1V (18°) for noncohesive or unconsolidated materials to < 1:1 (45°) in clays on both sides	Bank slopes up to 2H:1V (27°) in noncohesive or unconsolidated materials to 0.8:1 (50°) in clays on one or occasionally both banks	Bank slopes to 1H:1V (45°) in noncohesive or unconsolidated materials to 0.6:1 (60°) in clays common on one or both banks	Bank slopes over 45° in noncohesive or unconsolidated materials or over 60° in clays common on one or both banks	
10. Vegetative or engineered bank protection	Wide band of woody vegetation with at least 90% density and cover. Primarily hard wood, leafy, deciduous trees with mature, healthy, and diverse vegetation located on the bank. Woody vegetation oriented vertically. In absence of vegetation, both banks are lined or heavily armored	Medium band of woody vegetation with 70-90% plant density and cover. A majority of hard wood, leafy, deciduous trees with maturing, diverse vegetation located on the bank. Wood vegetation oriented 80-90% from horizontal with minimal root exposure. Partial lining or armoring of one or both banks	Small band of woody vegetation with 50-70% plant density and cover. A majority of soft wood, piney, coniferous trees with young or old vegetation lacking in diversity located on or near the top of bank. Woody vegetation oriented at 70-80% from horizontal, often with evident root exposure. No lining of banks, but some armoring may be in place on one bank	Woody vegetation band may vary depending on age and health with less than 50% plant density and cover. Primarily soft wood, piney, coniferous trees with very young, old and dying, and/or monostand vegetation located off of the bank. Woody vegetation oriented at less than 70% from horizontal with extensive root exposure. No lining or armoring of banks	
11. Bank cutting	Little or none evident. Infrequent raw banks, insignificant percentage of total bank	Some intermittently along channel bends and at prominent constrictions. Raw banks comprise minor portion of bank in vertical direction	Significant and frequent on both banks. Raw banks comprise large portion of bank in vertical direction. Root mat overhangs	Almost continuous cuts on both banks, some extending over most of the banks. Undercutting and sod-root overhangs	
12. Mass wasting or bank failure	No or little evidence of potential or very small amounts of mass wasting. Uniform channel width over the entire reach	Evidence of infrequent and/or minor mass wasting. Mostly healed over with vegetation. Relatively constant channel width and minimal scalloping of banks	Evidence of frequent and/or significant occurrences of mass wasting that can be aggravated by higher flows, which may cause undercutting and mass wasting of unstable banks. Channel width quite irregular, and scalloping of banks is evident	Frequent and extensive mass wasting. The potential for bank failure, as evidenced by tension cracks, massive undercuttings, and bank slumping is considerable. Channel width is highly irregular, and banks are scalloped	
13. Upstream distance to bridge from meander impact point and alignment	More than 35 m; bridge is well-aligned with river flow	20-35 m; bridge is aligned with flow	10-20 m; bridge is skewed to flow, or flow alignment is otherwise not centered beneath bridge	Less than 10 m; bridge is poorly aligned with flow	

H = horizontal, V = vertical, Fs = fraction of sand, S = slope, w/y = width-to-depth ratio

Total Score _____

EDR Report

Poplin Ridge
Poplin Ridge/Secrest Short Cut Road
Monroe, NC 28110

Inquiry Number: 3337526.10s
June 05, 2012

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

TABLE OF CONTENTS

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

POPLIN RIDGE/SECREST SHORT CUT ROAD
MONROE, NC 28110

COORDINATES

Latitude (North):	35.0548000 - 35° 3' 17.28''
Longitude (West):	80.5729000 - 80° 34' 22.44''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	538948.6
UTM Y (Meters):	3879005.8
Elevation:	588 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	35080-A5 BAKERS, NC
Most Recent Revision:	1987

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	2009, 2010
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

LUST TRUST ---- State Trust Fund Database
LAST ---- Leaking Aboveground Storage Tanks
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

INDIAN VCP ---- Voluntary Cleanup Priority Listing
VCP ---- Responsible Party Voluntary Action Sites

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
SWRCY ---- Recycling Center Listing
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
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 EPA	Coal Combustion Residues Surface Impoundments List
EPA WATCH LIST	EPA WATCH LIST
COAL ASH DOE	Sleam-Electric Plan Operation Data
2020 CORRECTIVE ACTION	2020 Corrective Action Program List
FINANCIAL ASSURANCE	Financial Assurance Information Listing
COAL ASH	Coal Ash Disposal Sites

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

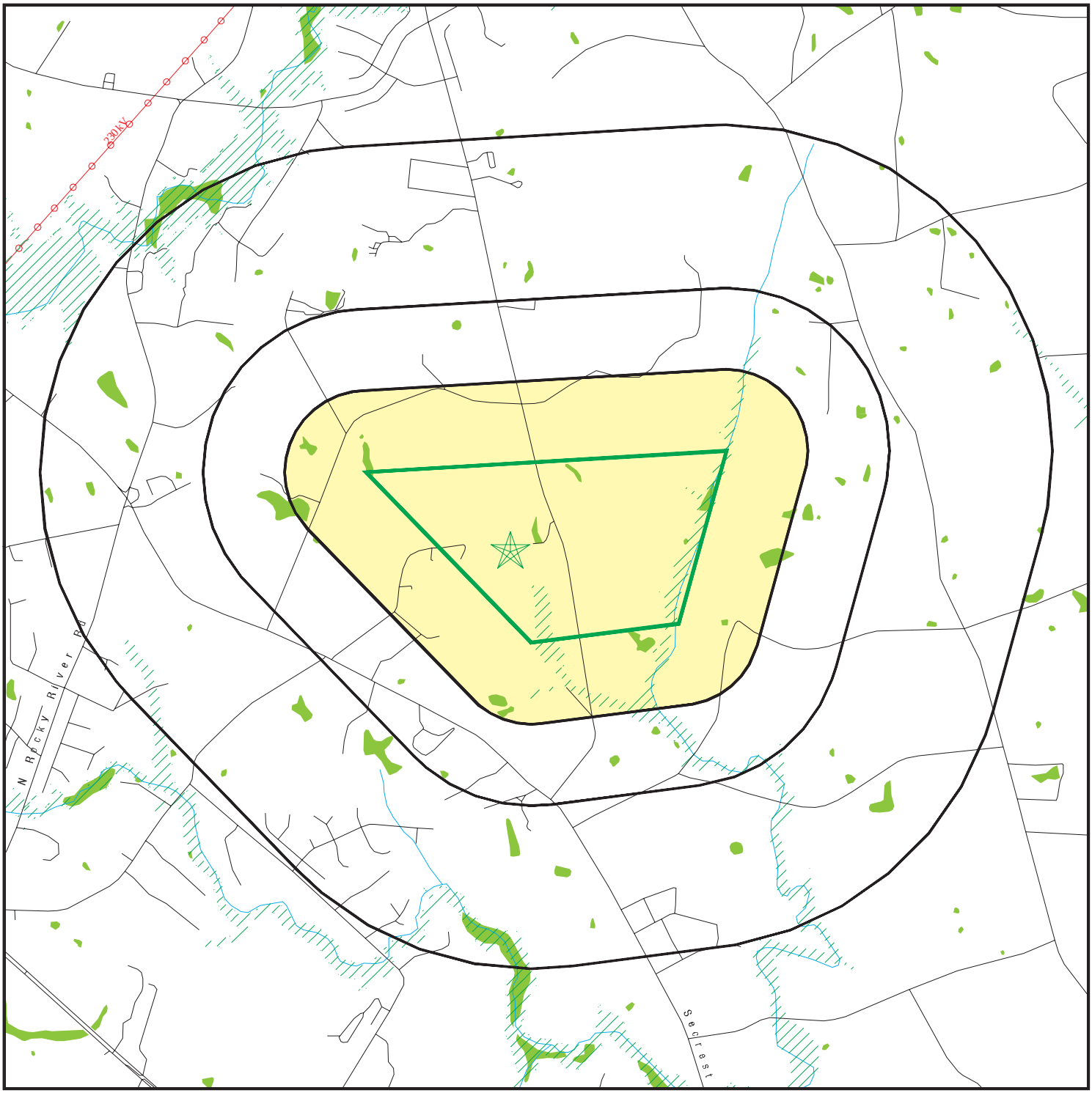
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 40 records.

Site Name	Database(s)
USB RECYCLING.COM	SWRCY
CITY OF MONROE ASPHALT PLANT (FORM	IMD,LAST
MOUNTAINTOP RV & MARINE	LAST
STOUT INTERNATIONAL OF NC, INC	HWS
SCOVILL INC/SECURITY PRODUCTS	VCP,HWS
SOMETHING OLD, SOMETHING NEW	IMD,LUST
COOK GROCERY STORE	LUST TRUST,LUST
WOODS GOODS-DOT	IMD,LUST
GREY'S GROCERY	LUST
YALE NORTON	IMD,LUST
BOREN BRICK - 5000 H.O.	IMD,LUST
MONROE MALL	IMD,LUST
ROY WALTERS PROPERTY/NCDOT#10	IMD,LUST
BARRY HELMS RESIDENCE	IMD,LUST
MOUNTAIN TOP RV & MARINE	LUST
CHARLOTTE PLASTICS - MONROE	IMD,LUST
TELEDYNE EAST (FORMER STOUT INTERN	IMD,LUST
LAKE LEE GROCERY-NCDOT	IMD,LUST
NEWELL HELMS RESIDENCE	LUST
CROWN NC - 632	LUST TRUST
DALE YOUNTS SERVICE STATION	UST
QUIKTRIP 1054	UST
WILKERSON GROCERY	UST
GREY'S GROCERY	UST
LAKE LEE SERVICE & GROCERY	UST
GIMCO INTERNATIONAL, INC.	UST
CATAWBA OIL COMPANY, INC.	UST
MILLS GULF SERVICE	UST
HELMS PROPERTY	UST
BOREN CLAY PRODUCTS	UST
BOREN CLAY PRODUCTS	UST
601 S TRUCK STOP (DIXIE LAND)	UST
TARGET STORE #2074	RCRA-LQG
M & P BODY SHOP	RCRA-NLR
TIRE KINGDOM #165	RCRA-CESQG
COOK GROCERY STORE	IMD
GREY'S GROCERY	IMD
BOREN BRICK CO.	IMD
BOREN BRICK-MONROE	IMD
NEWELL HELMS RESIDENCE	IMD

OVERVIEW MAP - 3337526.10s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites

0 1/4 1/2 1 Miles

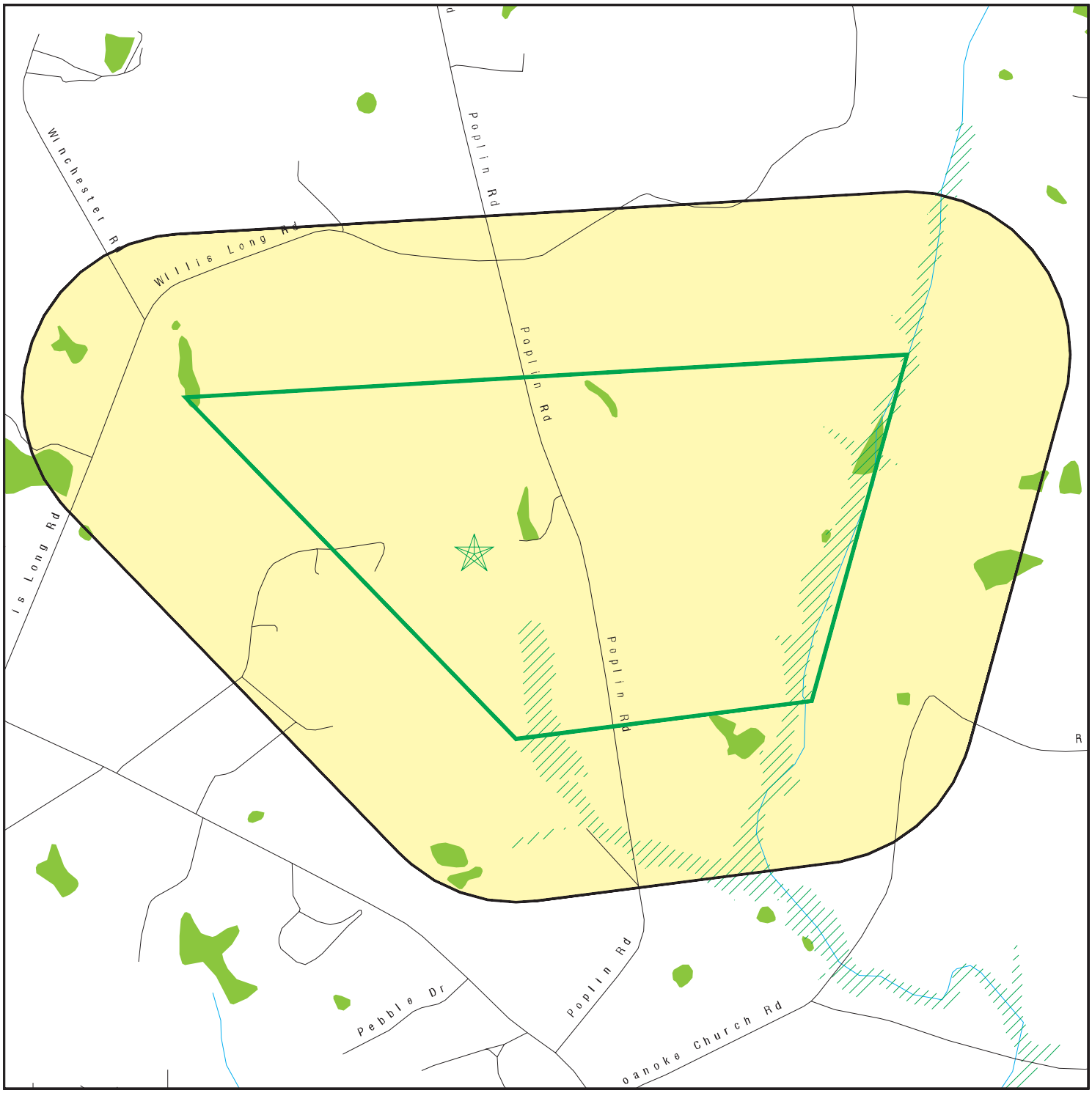
- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

N

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: Poplin Ridge	CLIENT: WK Dickson
ADDRESS: Poplin Ridge/Secrest Short Cut Road Monroe NC 28110	CONTACT: George Lankford INQUIRY #: 3337526.10s
LAT/LONG: 35.0548 / 80.5729	DATE: June 05, 2012 12:07 pm

DETAIL MAP - 3337526.10s



- 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 from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

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SITE NAME: Poplin Ridge	CLIENT: WK Dickson
ADDRESS: Poplin Ridge/Secrest Short Cut Road Monroe NC 28110	CONTACT: George Lankford INQUIRY #: 3337526.10s
LAT/LONG: 35.0548 / 80.5729	DATE: June 05, 2012 12:09 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	1.000		0	0	0	0	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST TRUST	0.500		0	0	0	NR	NR	0
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen	0.250		0	0	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
2020 CORRECTIVE ACTION	0.250		0	0	NR	NR	NR	0
FINANCIAL ASSURANCE	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
EDR PROPRIETARY RECORDS								
EDR Proprietary Records								
Manufactured Gas Plants	1.000		0	0	0	0	NR	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

Count: 40 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
MONROE	1010323115	TARGET STORE #2074	2901 WEST HWY 74	28110	RCRA-LQG
MONROE	1010565441	M & P BODY SHOP	3213 HWY 74 W	28110	RCRA-NLR
MONROE	1014917385	TIRE KINGDOM #165	3842 W HWY 74	28110	RCRA-CESQG
MONROE	S102089551	BOREN BRICK-MONROE	HWY. 74 EAST		IMD
MONROE	S102089714	LAKE LEE GROCERY-NCDOT	1700 BLOCK PAGELAND HWY	28110	IMD,LUST
MONROE	S102328460	CHARLOTTE PLASTICS - MONROE	4210 OLD CHAR. HWY	28110	IMD,LUST
MONROE	S103554548	SCOVILL INC/SECURITY PRODUCTS	HWY 74 E		VCP,HWS
MONROE	S103718030	BOREN BRICK CO.	HWY 74 E		IMD
MONROE	S104157189	NEWELL HELMS RESIDENCE	US HIGHWAY 601		IMD
MONROE	S104157200	BARRY HELMS RESIDENCE	734 CONCORD HIGHWAY		IMD,LUST
MONROE	S105219283	CROWN NC - 632	1828 OLD CHARLOTTE HIGHWAY		LUST TRUST
MONROE	S105702968	MONROE MALL	HWY 74		IMD,LUST
MONROE	S105702984	YALE NORTON	HWY 74 EAST		IMD,LUST
MONROE	S105764673	COOK GROCERY STORE	3516 HWY. 218 EAST		IMD
MONROE	S105764713	WOODS GOODS-DOT	HWY 601 S. @ WHITE STORE RD	28110	IMD,LUST
MONROE	S105894628	SOMETHING OLD, SOMETHING NEW	HWY 200		IMD,LUST
MONROE	S106074734	GREY'S GROCERY	HWY 601 @ OLD STEEL RD		IMD
MONROE	S106204406	BOREN BRICK - 5000 H.O.	HWY 74 EAST		IMD,LUST
MONROE	S106349501	CITY OF MONROE ASPHALT PLANT (FORM	HWY 74 & SUTHERLAND AVE.	28110	IMD,LAST
MONROE	S106495575	COOK GROCERY STORE	3516 HWY. 218 EAST	28110	LUST TRUST,LUST
MONROE	S106799529	TELEDYNE EAST (FORMER STOUT INTERN	2600 HWY 74 EAST	28110	IMD,LUST
MONROE	S106799558	ROY WALTERS PROPERTY/NCDOT#10	5400 BLOCK PAGELAND HWY		IMD,LUST
MONROE	S108631710	STOUT INTERNATIONAL OF NC, INC	HIGHWAY 74 EAST		HWS
MONROE	S109164436	MOUNTAIN TOP RV & MARINE	4000 WEST HWY 74	28110	LUST
MONROE	S109504277	GREY'S GROCERY	HWY 601 @ OLD STILL RD	28110	LUST
MONROE	S109504286	NEWELL HELMS RESIDENCE	APPROX. 2220 US HWY 601	28110	LUST
MONROE	S110629276	MOUNTAINTOP RV & MARINE	4000 HIGHWAY 74 W.	28110	LAST
MONROE	S111445319	USB RECYCLING.COM	3301 HWY 74 EAST	28110	SWRCY
INDIAN TRAIL	U001190948	DALE YOUNTS SERVICE STATION	HIGHWAY 74	28110	UST
MONROE	U001191137	LAKE LEE SERVICE & GROCERY	HWY 601 S.	28110	UST
MONROE	U001191238	BOREN CLAY PRODUCTS	CHARLOTTE HIGHWAY	28110	UST
MONROE	U001191292	CATAWBA OIL COMPANY, INC.	HIGHWAY 74 & WHEELER STREET	28110	UST
MONROE	U001191396	601 S TRUCK STOP (DIXIE LAND)	5003 PAGELAND HIGHWAY US 601 S	28110	UST
MONROE	U001191621	GREY'S GROCERY	HIGHWAY 601 NORTH	28110	UST
MONROE	U001192016	MILLS GULF SERVICE	HWY 74 E	28110	UST
MONROE	U001204225	BOREN CLAY PRODUCTS	BRICK YARK RD HWY 74E POB 5012	28110	UST
MONROE	U003134201	WILKERSON GROCERY	ROUTE 6	28110	UST
MONROE	U003142910	HELMS PROPERTY	HIGHWAY 74 & BAKERS X-ROADS	28110	UST
MONROE	U003295472	GIMCO INTERNATIONAL, INC.	HIGHWAY 74 EAST	28110	UST
INDIAN TRAIL	U004187934	QUIKTRIP 1054	5650 WEST HIGHWAY 174	28110	UST

Poplin Ridge
Poplin Ridge/Secrest Short Cut Road
Monroe, NC 28110

Inquiry Number: 3337526.11
June 05, 2012

EDR Historical Topographic Map Report

EDR® Environmental Data Resources Inc

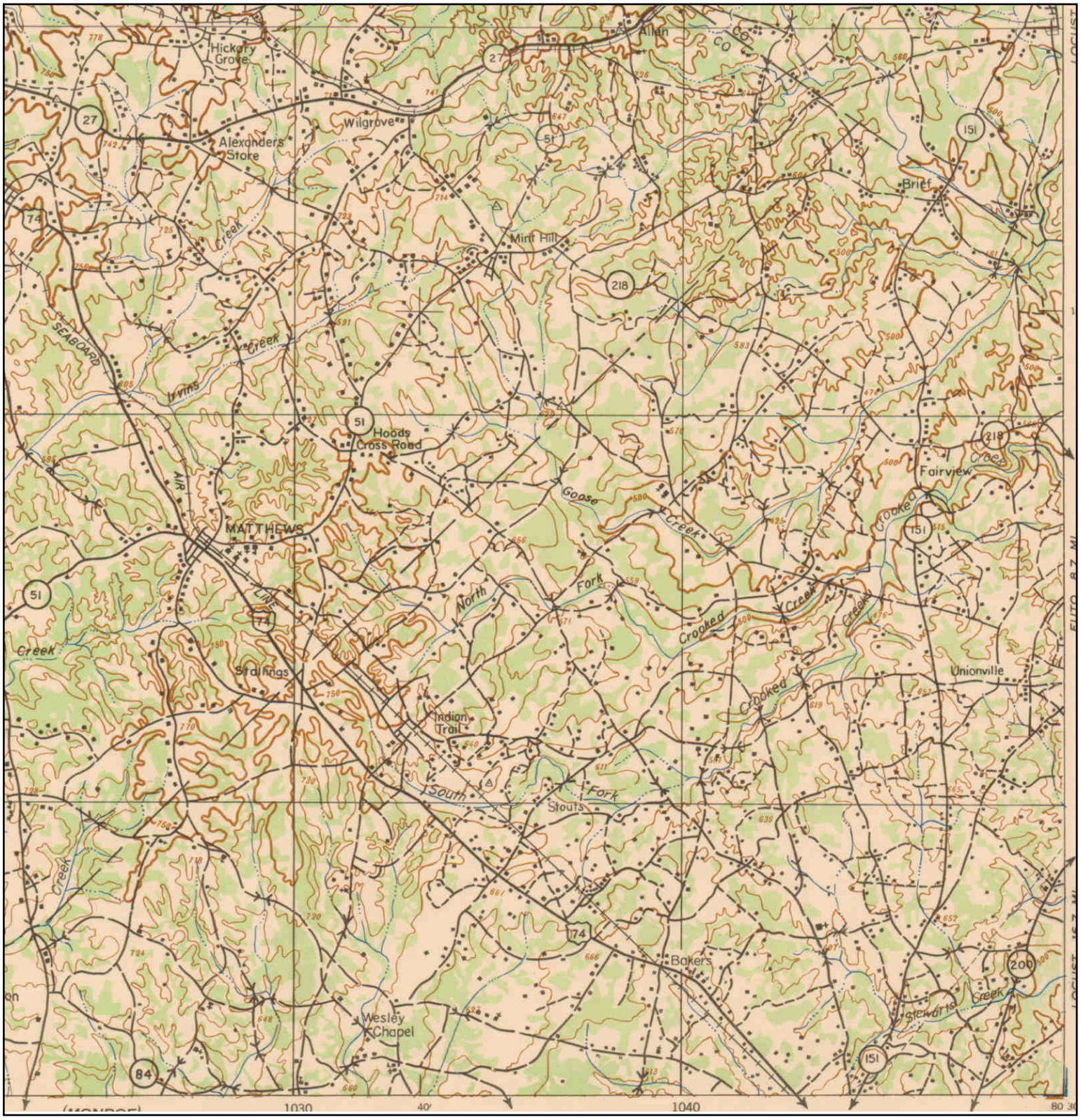
440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

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.

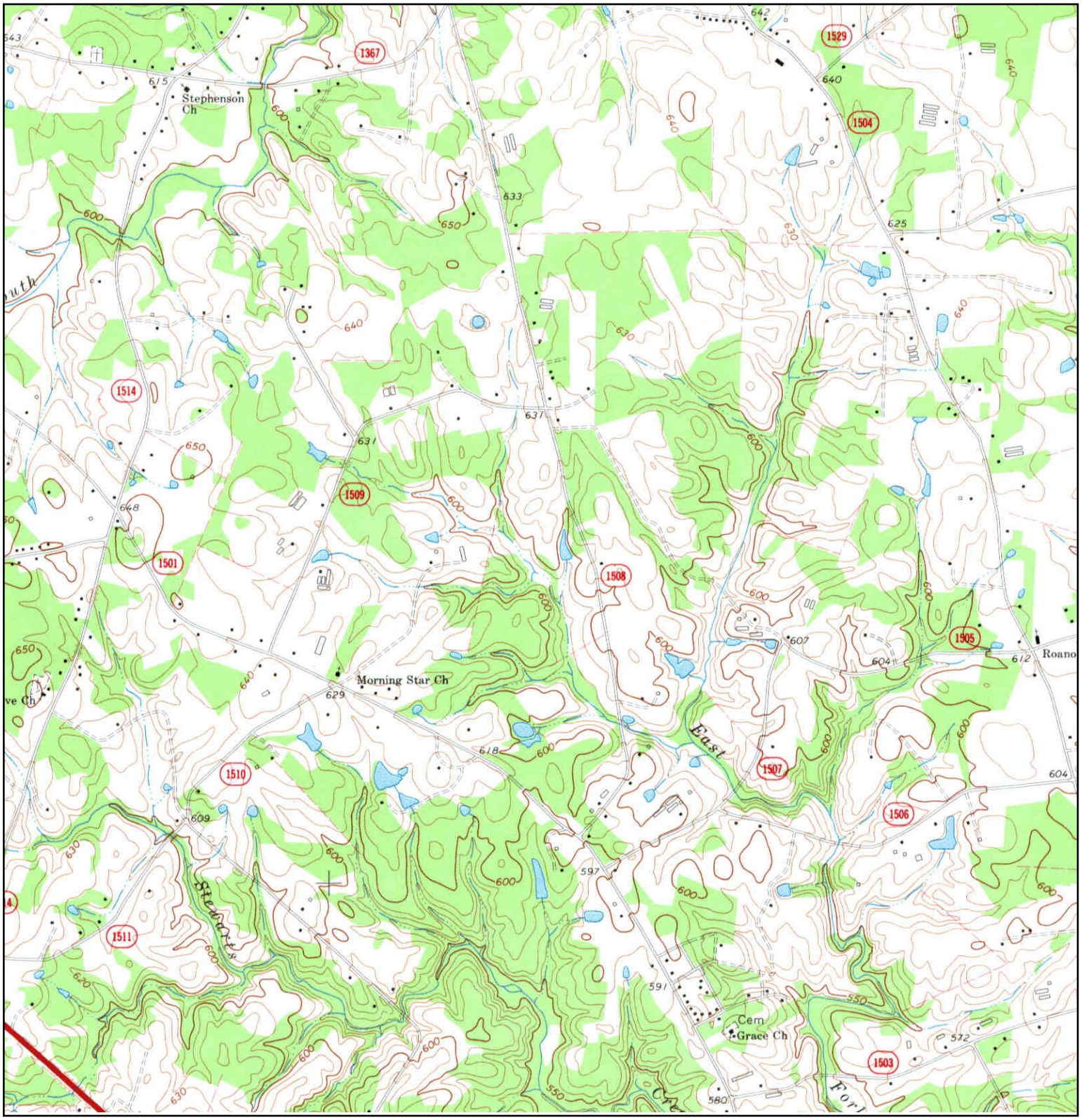
Historical Topographic Map



Unsurveyed Area on the Topographic Map

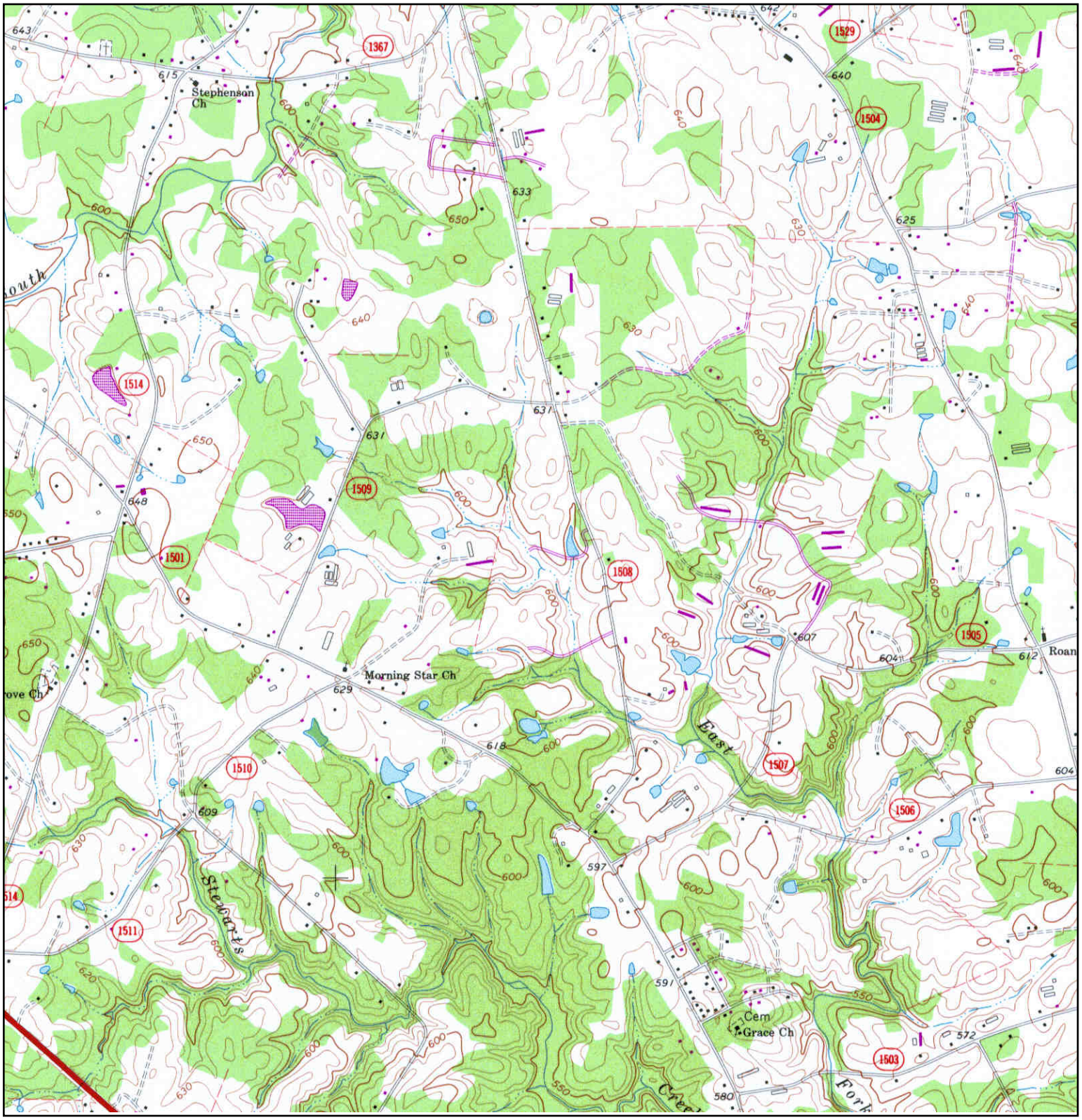
N	TARGET QUAD NAME: CHARLOTTE MAP YEAR: 1942 SERIES: 30 SCALE: 1:125000	SITE NAME: Poplin Ridge ADDRESS: Poplin Ridge/Secrest Short Cut Road Monroe, NC 28110 LAT/LONG: 35.0548 / -80.5729	CLIENT: WK Dickson CONTACT: George Lankford INQUIRY#: 3337526.11 RESEARCH DATE: 06/05/2012

Historical Topographic Map



N	TARGET QUAD NAME: BAKERS MAP YEAR: 1971 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Poplin Ridge ADDRESS: Poplin Ridge/Secrest Short Cut Road Monroe, NC 28110 LAT/LONG: 35.0548 / -80.5729	CLIENT: WK Dickson CONTACT: George Lankford INQUIRY#: 3337526.11 RESEARCH DATE: 06/05/2012

Historical Topographic Map



N	TARGET QUAD					
	NAME:	BAKERS	SITE NAME:	Poplin Ridge	CLIENT:	WK Dickson
	MAP YEAR:	1980	ADDRESS:	Poplin Ridge/Secrest Short Cut Road	CONTACT:	George Lankford
	PHOTOREVISED FROM :	1971		Monroe, NC 28110	INQUIRY#:	3337526.11
	SERIES:	7.5	LAT/LONG:	35.0548 / -80.5729	RESEARCH DATE:	06/05/2012
	SCALE:	1:24000				

Historical Topographic Map

N			
	TARGET QUAD NAME: BAKERS MAP YEAR: 1987 PHOTOREVISED FROM :1971 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Poplin Ridge ADDRESS: Poplin Ridge/Secrest Short Cut Road Monroe, NC 28110 LAT/LONG: 35.0548 / -80.5729	CLIENT: WK Dickson CONTACT: George Lankford INQUIRY#: 3337526.11 RESEARCH DATE: 06/05/2012

Poplin Ridge
Poplin Ridge/Secrest Short Cut Road
Monroe, NC 28110

Inquiry Number: 3337526.12
June 06, 2012

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 June 06, 2012

Target Property:

Poplin Ridge/Secrest Short Cut Road

Monroe, NC 28110

Year	***Scale***	***Details***	***Source***
1961	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-A5, Bakers, NC;/Flight Date: July 29, 1961	EDR
1961	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-A5, Bakers, NC;/Flight Date: July 29, 1961	EDR
1969	Aerial Photograph. Scale: 1"=500'	Panel #: 35080-A5, Bakers, NC;/Flight Date: March 15, 1969	EDR
1969	Aerial Photograph. Scale: 1"=500'	Panel #: 35080-A5, Bakers, NC;/Flight Date: March 15, 1969	EDR
1976	Aerial Photograph. Scale: 1"=1000'	Panel #: 35080-A5, Bakers, NC;/Flight Date: March 24, 1976	EDR
1983	Aerial Photograph. Scale: 1"=1000'	Panel #: 35080-A5, Bakers, NC;/Flight Date: March 02, 1983	EDR
1993	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-A5, Bakers, NC;/Flight Date: January 08, 1993	EDR
1993	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-A5, Bakers, NC;/Flight Date: January 08, 1993	EDR
1998	Aerial Photograph. Scale: 1"=750'	Panel #: 35080-A5, Bakers, NC;/Flight Date: March 13, 1998	EDR


INQUIRY #: 3337526.12
YEAR: 1961
= 750'
N

INQUIRY #: 3337526.12

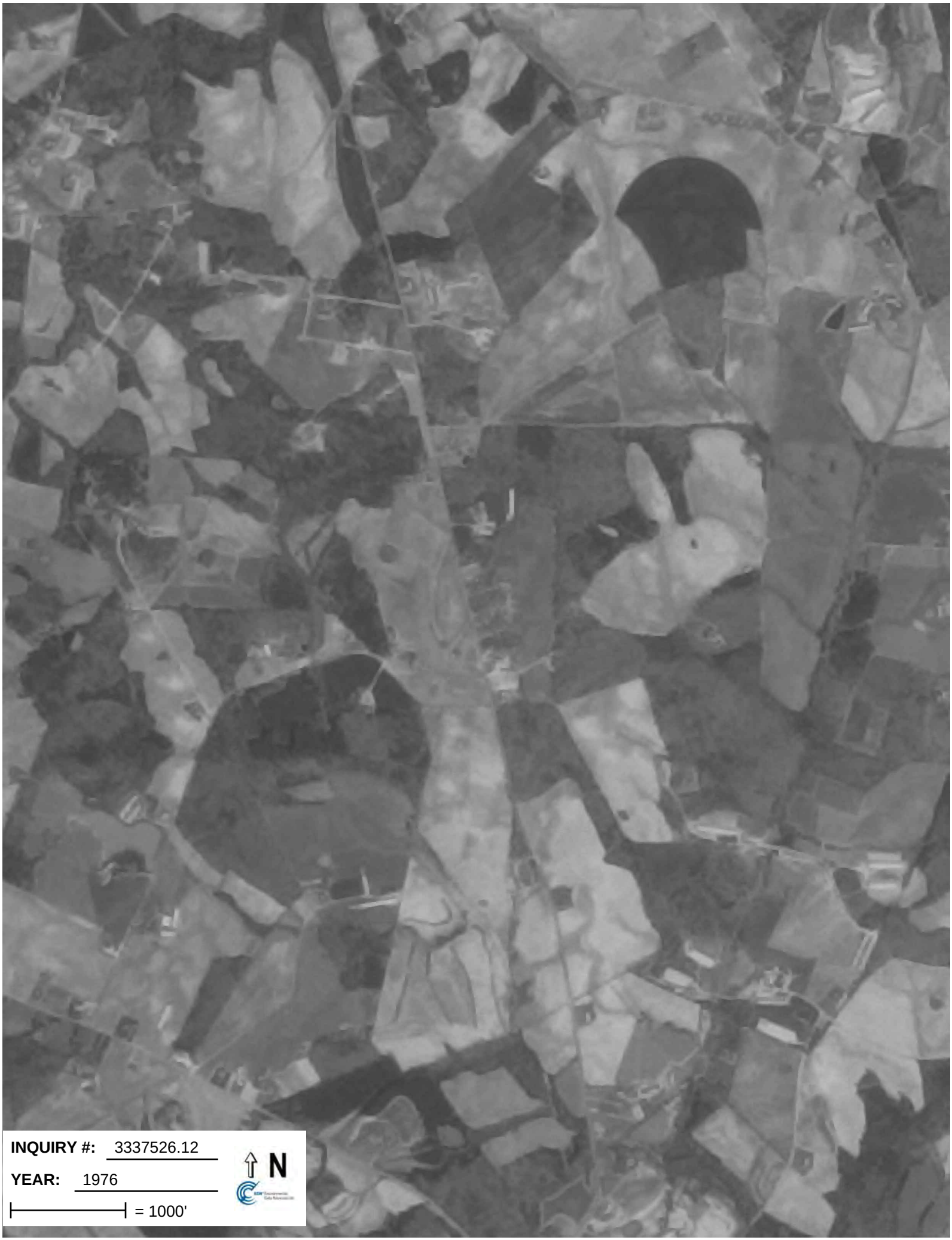
YEAR: 1961

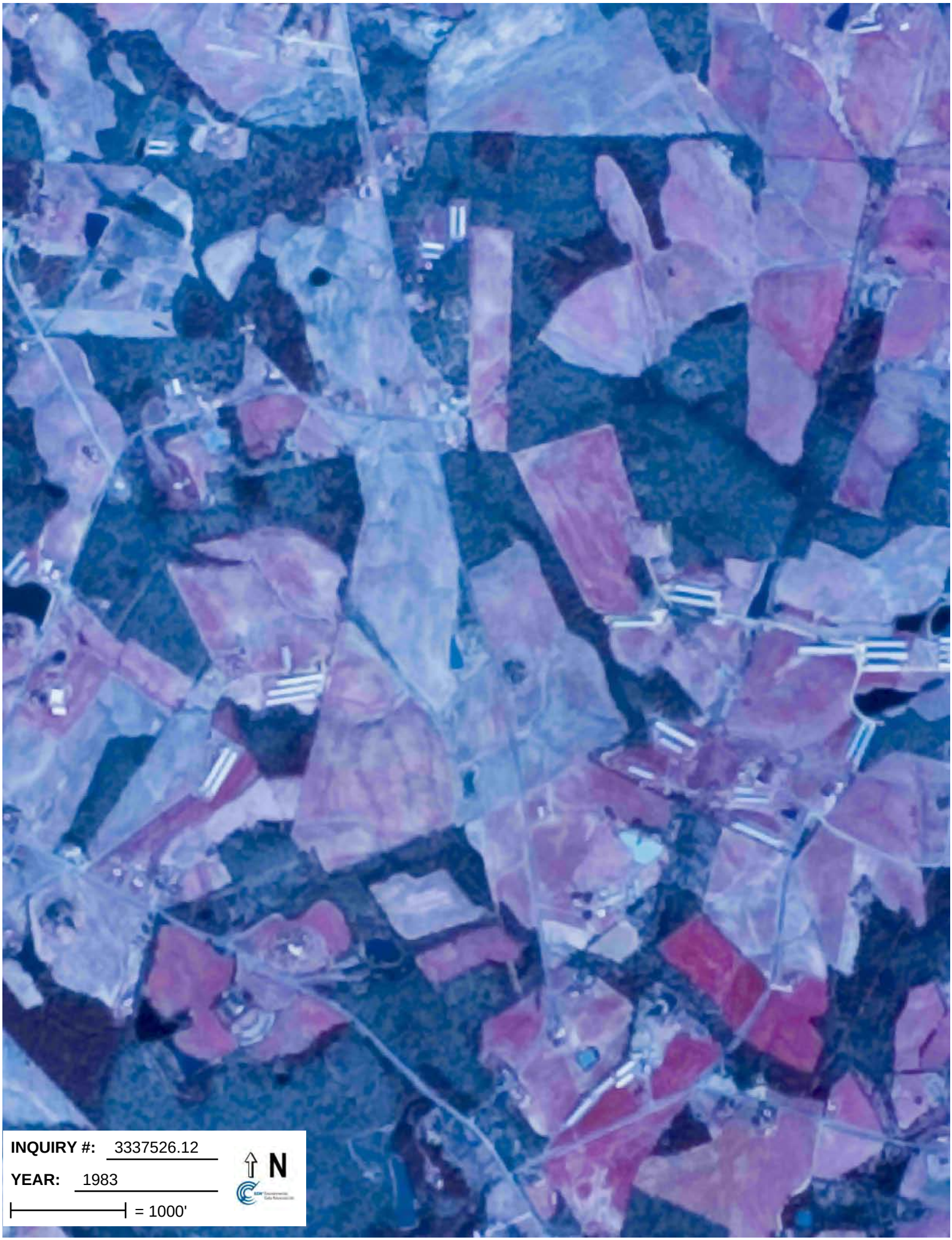
= 750'

N


INQUIRY #: 3337526.12
YEAR: 1969
= 500'
N


INQUIRY #: 3337526.12
YEAR: 1969
= 500'
N


INQUIRY #: 3337526.12
YEAR: 1976
= 1000'
N


INQUIRY #: 3337526.12
YEAR: 1983
= 1000'
N


INQUIRY #: 3337526.12
YEAR: 1993
= 750'
N


INQUIRY #: 3337526.12
YEAR: 1993
= 750'
N


INQUIRY #: 3337526.12
YEAR: 1998
= 750'
N

August 14, 2012

Mr. Martin Hovis
Environmental Banc and Exchange
909 Capability Drive, Suite 3100
Raleigh, North Carolina 27606

Subject: Categorical Exclusion Form for
Poplin Ridge Stream Restoration Site
Yadkin River Basin – CU# 03040105
Union County, North Carolina
Contract No. 004672

Dear Mr. Hovis:

Attached please find the approved Categorical Exclusion Form for the subject full delivery project. Please include a copy of the Categorical Exclusion Form in your Mitigation Plan.

If you have any questions, or wish to discuss this matter further, please contact me at any time. I can be reached at (828) 273-1673, or email me at paul.wiesner@ncdenr.gov

Sincerely,

Paul Wiesner
Western Project Manager
N.C. Ecosystem Enhancement Program
www.nceep.net
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801
(828)273-1673 Mobile
paul.wiesner@ncdenr.gov

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:	Poplin Ridge Stream Mitigation Project
County Name:	Union
EEP Number:	
Project Sponsor:	Environmental Banc & Exchange, LLC
Project Contact Name:	Martin Hovis
Project Contact Address:	909 Capability Drive, Suite 3100, Raleigh, NC 27606
Project Contact E-mail:	Martin@EBXUSA.com
EEP Project Manager:	

Project Description

The mitigation project at the Poplin Ridge Site will involve stream restoration along the unnamed tributaries to East Fork Stewart's Creek in the Yadkin River basin. Stream buffers throughout the project area will be restored and protected in perpetuity. Priority Level I restoration is proposed on five reaches, Enhancement II is proposed on two reaches, Enhancement I is proposed on five reaches, and preservation is proposed on two reaches. This will result in ecological improvements, including habitat restoration and a decrease in non-point source pollution from agricultural practices.

For Official Use Only

Reviewed By:

8/14/2012
Date

EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

8-14-12
Date

For Division Administrator FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☑ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☑ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☑ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☑ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☑ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☑ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☑ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A

USDA FORM AD-1006

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
530 West Innes Street
Salisbury, North Carolina 28144

Kristin May, Resource Soil Scientist
Phone: (704) 637-2400 x 104
E-mail: Kristin.may@nc.usda.gov

June 18, 2012

WK Dickson & Co., Inc.
ATTN: Daniel Ingram
720 Corporate Center Drive
Raleigh, NC 27607

Dear Mr. Ingram;

The following information is in response to your request for information on Prime, Unique and Statewide Importance Farmlands related to the proposed Poplin Ridge Site EEP stream mitigation project located in Union County.

Projects are subject to the Farmland Protection Policy Act (FPPA) requirements if they irreversibly convert farmland, either directly or indirectly, to a nonagricultural use and are completed or funded by 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 does not have to be currently in crops. It can be forest land, pastureland, cropland, or other land. Farmland does not include land previously converted to urban development or water storage. Urban development is land that has been identified as urbanized area on the Census Bureau Map or as urban-built-up on the USDA Important Farmland Maps.

The area in question meets one or more of the above criteria for Farmland. Enclosed is the Farmland Conversion Impact Rating form (AD1006 / NRCS-CPA-106) with PARTS II, IV and V completed by NRCS.

If you have any questions, please feel free to contact me.

Sincerely,

Kristin J May

Kristin May
Resource Soil Scientist

cc.
Mark Ferguson, District Conservationist, NRCS, Monroe

Projects and Activities Subject to FPPA

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.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 5/31/12
Name Of Project Poplin Ridge EEP Stream Mitigation Site	Federal Agency Involved FHWA - EEP
Proposed Land Use Stream Mitigation Site	County And State Union, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 6/5/12

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 none	Average Farm Size 156
Major Crop(s) Corn	Farmable Land In Govt. Jurisdiction Acres: 384, 651 % 94	Amount Of Farmland As Defined in FPPA Acres: 291, 581 % 77	
Name Of Land Evaluation System Used Union - CALES	Name Of Local Site Assessment System	Date Land Evaluation Returned By NRCS 6/18/12	

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	25.7			
B. Total Acres To Be Converted Indirectly	4.2			
C. Total Acres In Site	29.9	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	10.7			
B. Total Acres Statewide And Local Important Farmland	9.1			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	46.3			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	83	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use		15			
2. Perimeter In Nonurban Use		10			
3. Percent Of Site Being Farmed		18			
4. Protection Provided By State And Local Government		0			
5. Distance From Urban Builtup Area		15			
6. Distance To Urban Support Services		10			
7. Size Of Present Farm Unit Compared To Average		0			
8. Creation Of Nonfarmable Farmland		0			
9. Availability Of Farm Support Services		5			
10. On-Farm Investments		20			
11. Effects Of Conversion On Farm Support Services		0			
12. Compatibility With Existing Agricultural Use		0			
TOTAL SITE ASSESSMENT POINTS	160	93	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	83	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	93	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	176	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

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:	Poplin Ridge Stream Restoration Project
Name if streams or features:	Unnamed Tributaries to East Fork Stewarts Creek
County:	Union County, NC
Name of river basin:	Yadkin River Basin
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Union County
DFIRM panel number for entire site:	Firm Panel 5427, 5437 Map Number: 3710542700J, 3710543700J Effective Date: October 16, 2008
Consultant name:	WK Dickson & Co., Inc. Ward Marotti – Project Manager
Phone number:	(919 782-0495
Address:	720 Corporate Center Drive Raleigh, NC 27607

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500".

WK Dickson is designing the Poplin Ridge Stream Restoration Project in Union County, NC to provide stream mitigation units (SMUs) in the Yadkin River Basin for the NC Ecosystem Enhancement Program (NCEEP). Stream restoration and stream enhancement activities involving channel and floodplain grading are proposed on approximately 8,783 linear feet of East Fork Stewarts Creek and East Fork Stewarts Creek Tributary 1. Preservation is proposed on approximately 1,312 linear feet of unnamed tributaries. Channel and/or floodplain grading is proposed along two streams located in a Special Flood Hazard Area.

Typical stream restoration improvements entail constructing a new channel that conveys the bankfull flow on the floodplain adjacent to the existing channel. The existing stream crossings located within the SFHA will be removed and replaced at their current locations. In addition, the pond located 500 feet upstream of FEMA cross section 145 (along East Fork Stewarts Creek) will be permanently removed by lowering the culverts at the embankment and providing positive drainage through this stream reach.

Stream reaches and are summarized below according to their mitigation type.

Reach	Mitigation Type	Total Length (LF)
UT1-1	Preservation and Enhancement Level I	1,258
UT1-2	Priority 1 Restoration	1,171
UT1-3	Priority 1 Restoration	901
UT1-4	Enhancement Level I	1,210
UT1-A	Enhancement Level I	217
UT1-B	Preservation and Enhancement Level I	1,075
UT1-C	Enhancement Level I	871
UT2-1	Enhancement Level II	490
UT2-2	Priority 1 Restoration	857
UT2-3	Priority 1 Restoration	521
UT2-4	Priority 1 Restoration	1061
UT2-A	Enhancement Level II	463

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: Lee Jenson
Phone Number: (704) 283-3565
Email: LJenson@co.union.nc.us

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
- ☐ Other Requirements

List other requirements:

Comments:

Name: _____ Signature: _____

Title: _____ Date: _____

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

20 June 2012

Mr. Daniel Ingram
W.K. Dickson & Co., Inc.
720 Corporate Center Drive
Raleigh, NC 27607

Subject: Project Scoping for Poplin Ridge Site EEP Stream Mitigation Project in Union County.

Dear Mr. Ingram:

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. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The project site is located on East Fork Stewarts Creek and its unnamed tributaries in the Yadkin-Pee Dee River basin. According to the information provided, the stream channels have been straightened and channelized, and several sections are significantly degraded. The site is surrounded by cultivated land and forest. The purpose of the project is to restore the stream channels to provide in-kind mitigation for unavoidable stream impacts.

Stream 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 comment on this project. If we can provide further assistance, please contact our office at (336) 449-7625 or shari.bryant@ncwildlife.org.

Sincerely,

Shari L. Bryant
Piedmont Region Coordinator
Habitat Conservation Program

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

North Carolina Department of Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, 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

June 18, 2012

Daniel Ingram
WK Dickson & Company, Inc.
720 Corporate Center Drive
Raleigh, NC 27607
dingram@wkdickson.com

Re: Poplin Ridge Stream Mitigation Project, Union County, ER 12-0984

Dear Mr. Ingram:

Thank you for your letter of June 7, 2012, 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 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 Ramona M. Bartos

WK DICKSON
community infrastructure consultants

June 7, 2012

Mr. Pete Benjamin
US Fish and Wildlife Service
Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

Subject: Project Scoping for Poplin Ridge Site EEP stream mitigation project in Union County.

Dear Mr. Benjamin,

The Poplin Ridge Site has been identified by NC Ecosystem Enhancement Program to provide compensatory mitigation for unavoidable stream impacts. This site is currently cultivated land and forests surrounding tributaries to Stewarts Creek. The stream channels have been straightened and channelized.

We have obtained an updated species list for Union County from the FWS web site (http://www.fws.gov/endangered/). The threatened or endangered species for this county are the Carolina heelsplitter (*Lasmigona decorate*), Schweinitz's sunflower (*Helianthus schweinitzii*), and Michaux's sumac (*Rhus michauxii*). We have determined that no suitable habitat for these species exists within the proposed project boundary.

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 stream restoration project on the subject property. Maps showing the location and approximate limits of the conservation easement are enclosed.

We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address below. Please feel free to contact me at dingram@wkdickson.com with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

W.K. Dickson & Co., Inc.
Daniel Ingram

Enclosures

720 Corporate Center Drive
Raleigh, NC 27607
Tel. 919.782.0495
Fax 919.782.9672
www.wkdickson.com

14.5 Appendix C – Mitigation Work Plan Data and Analyses

Poplin Ridge Morphological Parameters
Poplin Ridge Existing Conditions Cross Section Charts
Reference Reach Existing Cross Section and Profile Charts
Poplin Ridge Stable Channel Hydraulic Design Output
HEC-RAS Data Output

Poplin Ridge UT1 Morphological Parameters

	Reference Reach		Existing[1]									Design			
			UT1-R1	UT1-R1	UT1-R2	UT1-R3	UT1-R4	UT1-A	UT1-B	UT1-B	UT1-C	UT1-R2		UT1-R3	
			Pres.	Enh. I	Rest.	Rest.	Enh. I	Enh. I	Pres.	Enh. I	Enh. I	Rest.		Rest.	
Feature	Riffle	Pool	Riffle	Riffle	Riffle	Riffle	Riffle	Riffle	Riffle	Riffle	Riffle	Riffle	Pool	Riffle	Pool
Drainage Area (ac)	426	426	136	136	248	384	728	88	120	120	250	248		384	
NC Regional Curve Discharge (cfs)	69		31	31	47	64	100	22	28	28	47	47		64	
Design/Approx. Bankfull Discharge (cfs)	50		22	22	35	55	65	20	15	30	50	35		52	
Dimension															
BF Width (ft)	13.7	15.0	7.9	7.5	9.9	12.8	17.5	6.9	11.2	6.0	10.0	11.8	12.8	13.6	14.8
Floodprone Width (ft)	>50	NA	>50	>50	>50	>50	>50	>50	>50	>50	>40	>50	NA	>50	NA
BF Cross Sectional Area (ft^2)	18.1	23.4	10.1	10.4	14.2	22.2	21.9	6.8	6.1	5.5	10.0	14.5	19.9	20.3	26.9
BF Mean Depth (ft)	1.3	1.6	1.3	1.4	1.4	1.7	1.2	1.0	0.5	0.9	1.0	1.2	1.6	1.5	1.8
BF Max Depth (ft)	1.7	2.7	2.0	1.8	2.0	2.4	2.3	1.4	1.0	1.1	1.3	1.8	2.4	2.1	2.8
Width/Depth Ratio	10.4	9.7	6.2	5.4	7.0	7.4	14.0	6.9	20.4	6.6	10.0	9.6	8.2	9.1	8.1
Entrenchment Ratio	>2.2	NA	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	NA	>2.2	NA
Wetted Perimeter (ft)	14.9	16.8	10.4	9.1	11.6	14.5	19.0	8.2	11.8	7.5	11.1	12.6	14	14.7	16.2
Hydraulic Radius (ft)	1.2	1.4	1.0	1.1	1.2	1.5	1.2	0.8	0.5	0.7	0.9	1.1	1.4	1.4	1.7
Substrate															
D16 (mm)	2.8		0.062	0.062	0.062	2	3	0.062	2	3	2	2		2	
D50 (mm)	11.0		0.062	16.0	2	8	25	0.1	29	12	11	8		8	
D84 (mm)	16.0		0.062	63.0	7	25	51	0.4	60	27	45	25		25	
Pattern															
	Min	**Max**	**Med**	---	---	---	---	---	---	---	---	**Min**	**Max**	**Min**	**Max**
Channel Beltwidth (ft)	26.3	55.5	37.3	---	---	---	---	---	---	---	---	38	57	44	65
Radius of Curvature (ft)	13.5	103.3	41.2	---	---	---	---	---	---	---	---	18	89	20	103
Radius of Curvature Ratio	1.0	7.6	3.0	---	---	---	---	---	---	---	---	1.5	7.6	1.5	7.6
Meander Wavelength (ft)	49.4	66.0	59.7	---	---	---	---	---	---	---	---	38	57	44	65
Meander Width Ratio	3.6	4.8	4.4	---	---	---	---	---	---	---	---	3.2	4.8	3.2	4.8
Profile															
	Min	**Max**	**Med**	---	---	---	---	---	---	---	---	**Min**	**Max**	**Min**	**Max**
Riffle Length (ft)	6	18	9	---	---	---	---	---	---	---	---	5	16	6	18
Riffle Slope (%)	1.1	3.4	2.3	---	---	---	---	---	---	---	---	1.1	3.4	1.1	3.4
Run Length (ft)	7	15	8	---	---	---	---	---	---	---	---	6	13	7	15
Run Slope (%)	4.8	11.5	8.2	---	---	---	---	---	---	---	---	4.8	11.5	4.8	11.5
Glide Length (ft)	5	13	9	---	---	---	---	---	---	---	---	4	11	5	13
Glide Slope (%)	4.8	9.2	7.0	---	---	---	---	---	---	---	---	4.8	9.2	4.8	9.2
Pool Length (ft)	5	42	15	---	---	---	---	---	---	---	---	4	36	5	42
Pool Slope (%)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool-to-Pool Spacing (ft)	18.0	64.0	30.0	---	---	---	---	---	---	---	---	16	55	18	64
Additional Reach Parameters															
Valley Length (ft)	279		622	534	1173	731	1294	264	573	434	908	---		---	
Channel Length (ft)	318		716	541	1197	738	1340	270	618	449	921	---		---	
Sinuosity	1.14		1.2	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.1		1.1	
Water Surface Slope (ft/ft)	0.0048		NA	NA	NA	0.003	0.004	NA	NA	NA	NA	---		---	
Channel Slope (ft/ft)	0.0047		0.0048	0.011	0.007	0.004	0.005	0.012	0.012	0.018	0.008	0.0059		0.0046	
Rosgen Classification	E4		E4	E4	E4	E4	C4	E4	C4	E4	E4	E4		E4	

[1] Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

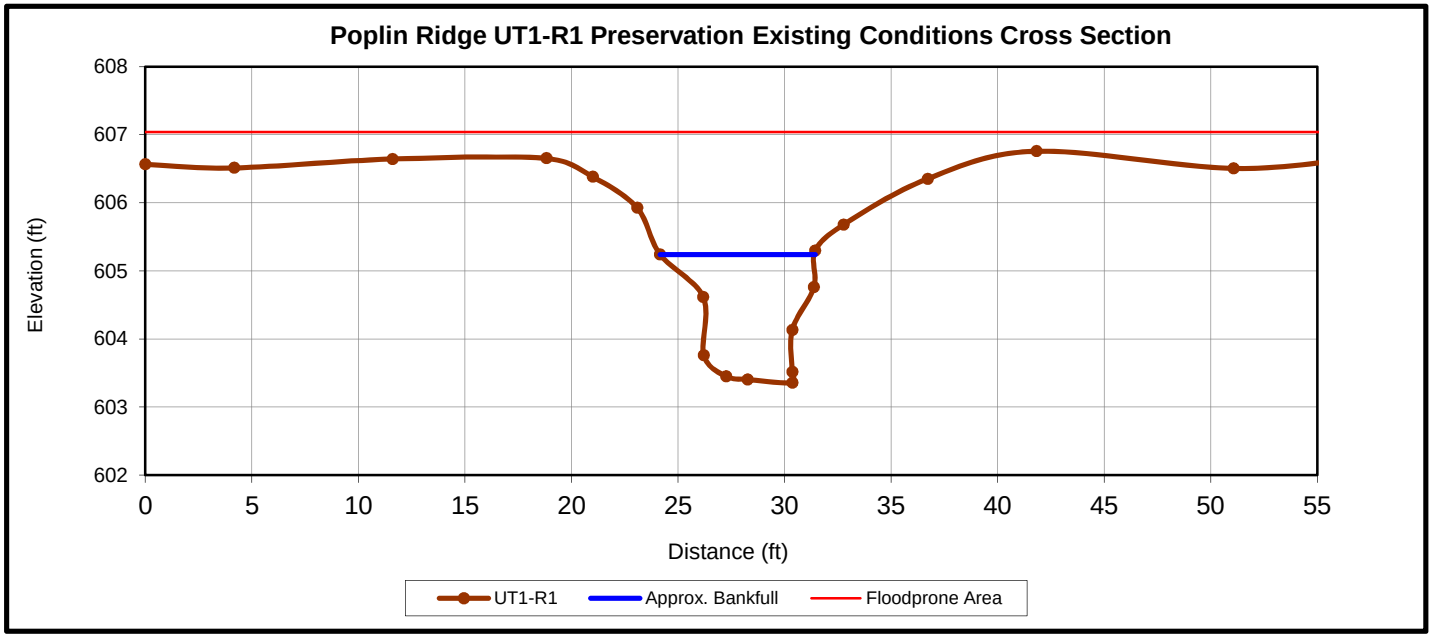
Poplin Ridge UT2 Morphological Parameters

	Reference Reach		Existing[1]					Design			
			UT2-R1	UT2-R2	UT2-R3	UT2-R4	UT2-A	UT1-R2		UT1-R3/R4	
			Enh. II	Rest.	Rest.	Rest.	Enh. II	Rest.		Rest.	
Feature	Riffle	Pool	Riffle	Pond	Riffle	Riffle	Riffle	Riffle	Pool	Riffle	Pool
Drainage Area (ac)	426	426	634	723	742	864	51	723		864	
NC Regional Curve Discharge (cfs)	69							100		113	
Design/Approx. Bankfull Discharge (cfs)	50		---	---	---	---	---	52		70	
Dimension											
BF Width (ft)	13.6	15.0	25.6	---	16.2	12.1	6.1	17.2	18.6	18.2	19.6
Floodprone Width (ft)	>50	NA	>50	---	>50	>50	>50	>50	NA	>50	NA
BF Cross Sectional Area (ft^2)	18.1	23.4	19.6	---	22.4	12.6	3.0	31.5	42	34.8	47.6
BF Mean Depth (ft)	1.3	1.6	0.8	---	1.4	1.0	0.5	1.8	2.3	1.9	2.4
BF Max Depth (ft)	1.7	2.7	1.7	---	2.6	1.6	1.2	2.5	3.5	2.6	3.8
Width/Depth Ratio	10.4	9.7	33.5	---	11.8	11.6	12.2	9.4	8.2	9.5	8.1
Entrenchment Ratio	>2.2	NA	>2.2	---	>2.2	>2.2	>2.2	>2.2	NA	>2.2	NA
Wetted Perimeter (ft)	14.9	16.8	26.2	---	17.9	13.1	7.0	18.5	20.3	19.5	21.5
Hydraulic Radius (ft)	1.2	1.4	0.7	---	1.3	1.0	0.4	1.7	2.1	1.8	2.2
Substrate											
D16 (mm)	2.8		0.062	---	0.062	1.5	0.062	1.5		1.5	
D50 (mm)	11.0		0.062	---	0.062	7.8	0.062	7.8		7.8	
D84 (mm)	16.0		0.72	---	4.8	15.0	0.57	15		15	
Pattern											
	Min	**Max**	**Med**	---	---	---	---	---	**Min**	**Max**	**Min**	**Max**
Channel Beltwidth (ft)	26	56	37	---	---	---	---	---	55	83	58	87
Radius of Curvature (ft)	13	103	41	---	---	---	---	---	26	131	27	138
Radius of Curvature Ratio	1.0	7.6	3.0	---	---	---	---	---	1.5	7.6	1.5	7.6
Meander Wavelength (ft)	49	66	60	---	---	---	---	---	55	83	58	87
Meander Width Ratio	1.9	4.1	2.7	---	---	---	---	---	3.2	4.8	3.2	4.8
Profile											
	Min	**Max**	**Med**	---	---	---	---	---	**Min**	**Max**	**Min**	**Max**
Riffle Length (ft)	6	18	9						8	23	8	24
Riffle Slope (%)	1.1	3.4	2.3	---	---	---	---	---	1.1	3.4	1.1	3.4
Run Length (ft)	7	15	8						9	19	9	20
Run Slope (%)	4.8	11.5	8.2	---	---	---	---	---	4.8	11.5	4.8	11.5
Glide Length (ft)	5	13	9						6	16	7	17
Glide Slope (%)	4.8	9.2	7.0	---	---	---	---	---	4.8	9.2	4.8	9.2
Pool Length (ft)	5	42	15						6	53	7	56
Pool Slope (%)	---	---	---	---	---	---	---	---	---	---	---	---
Pool-to-Pool Spacing (ft)	18.0	64.0	30.0	---	---	---	---	---	23	81	24	86
Additional Reach Parameters											
Valley Length (ft)	279		410	641	779	1015	427	---		---	
Channel Length (ft)	318		443	641	781	1032	437	---		---	
Sinuosity	1.14		1.1	1.0	1.0	1.0	1.0	1.1		1.1	
Water Surface Slope (ft/ft)	0.0048		NA	NA	NA	0.0027	NA	---		---	
Channel Slope (ft/ft)	0.0047		0.0027	0.001	0.0057	0.0031	0.013	0.0029		0.0028	
Rosgen Classification	E4		C4c	NA	E4	E4	C4	E4		E4	

[1] Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

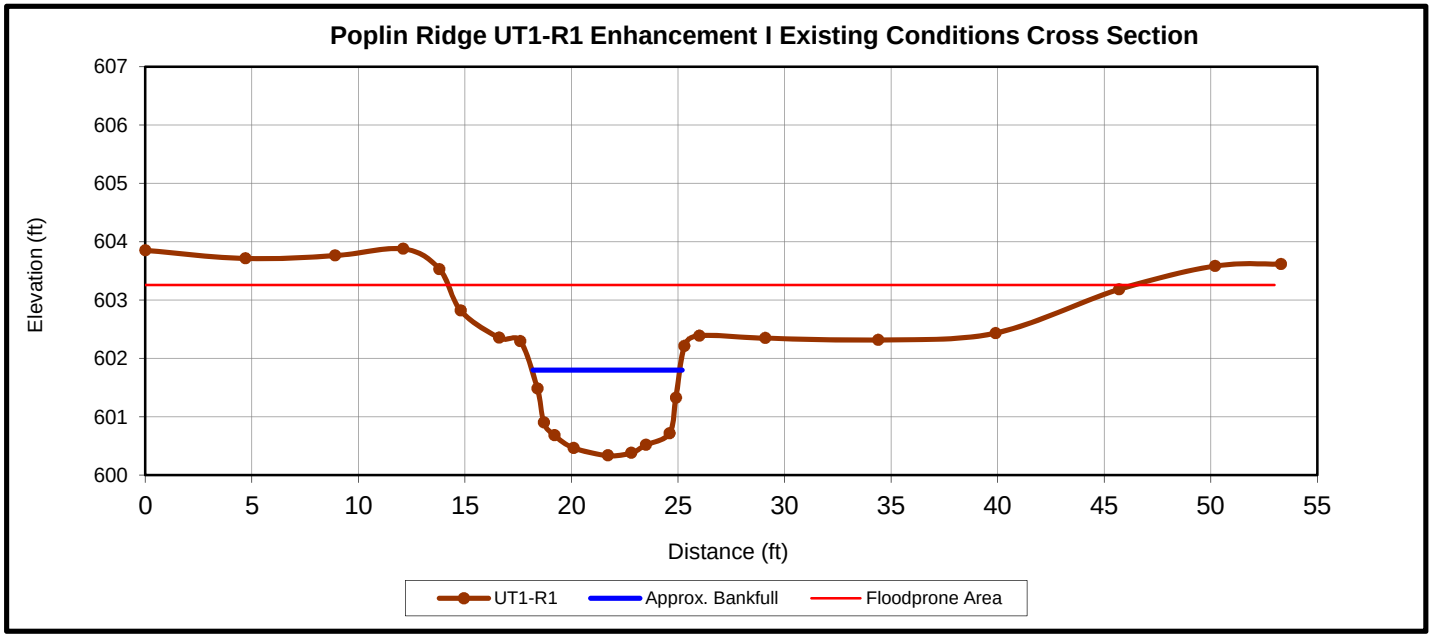
Upstream

Downstream



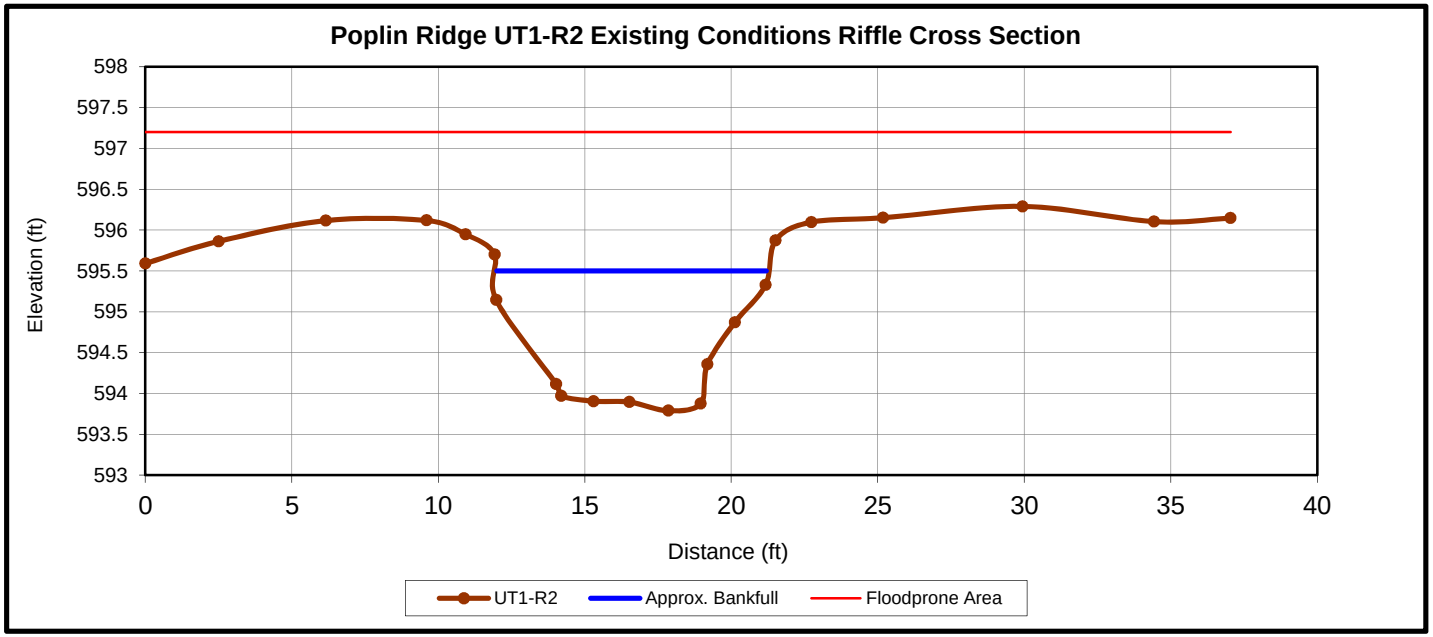
Upstream

Downstream



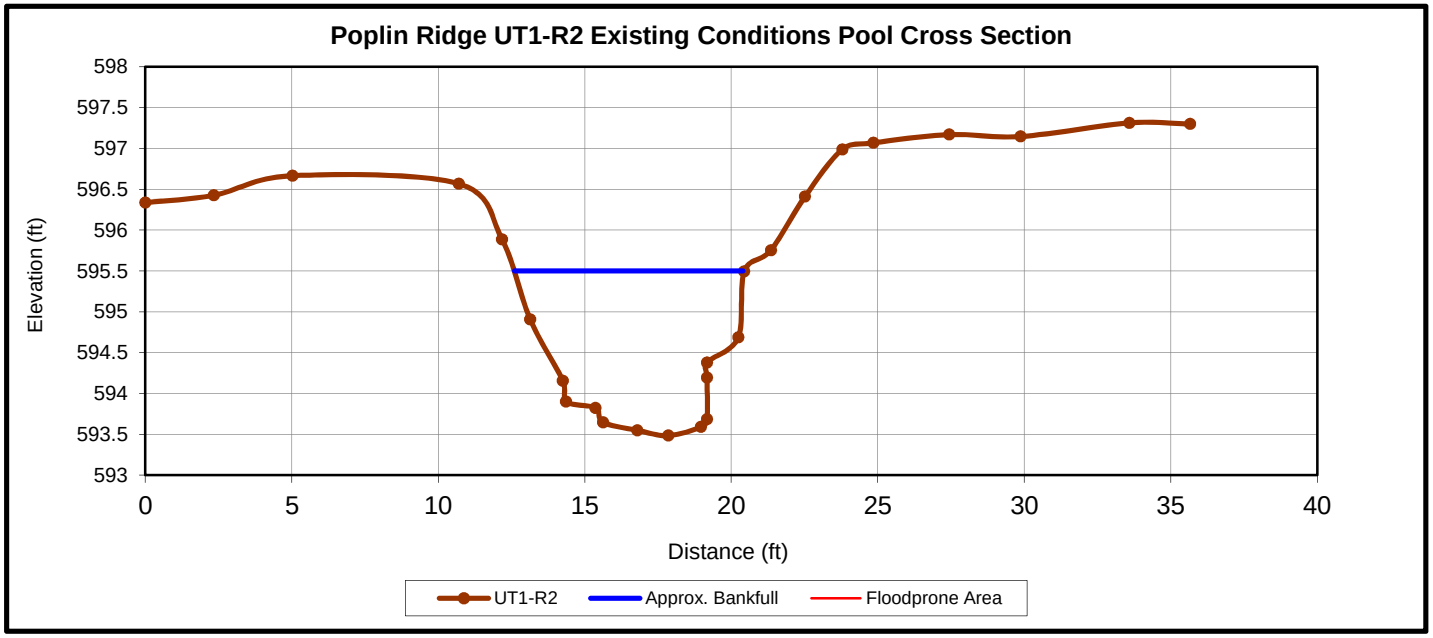
Upstream

Downstream



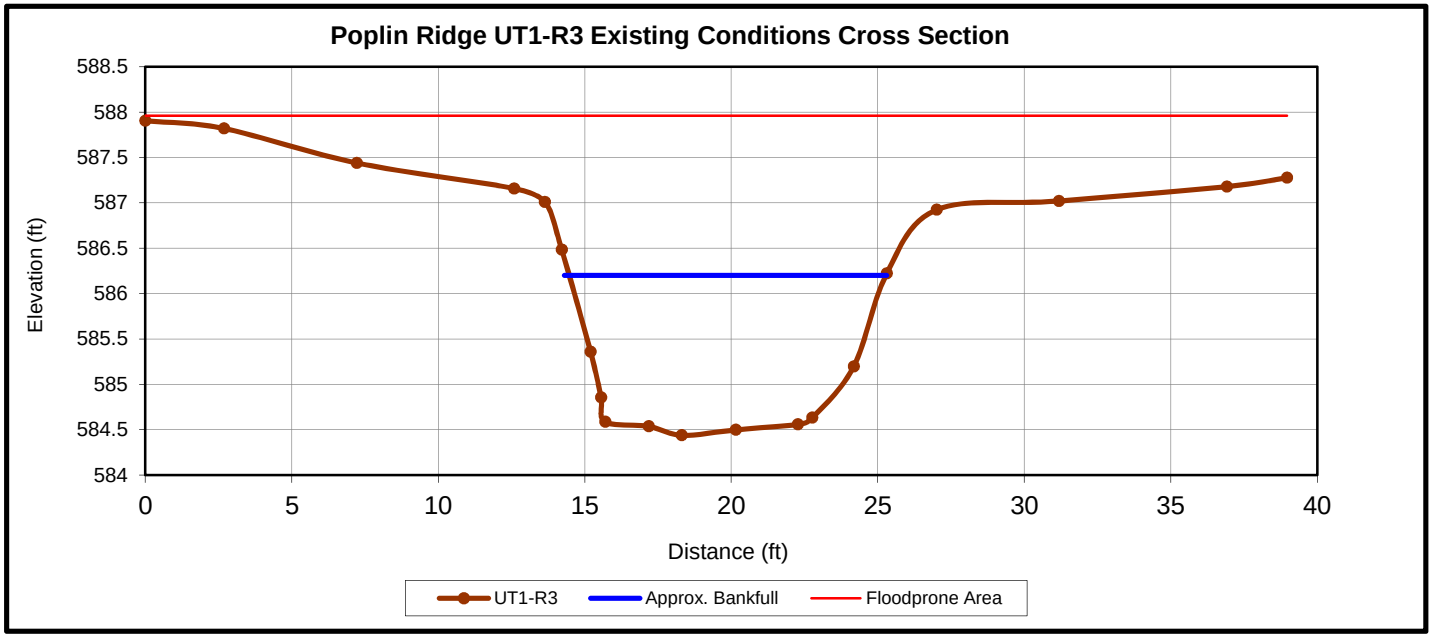
Upstream

Downstream



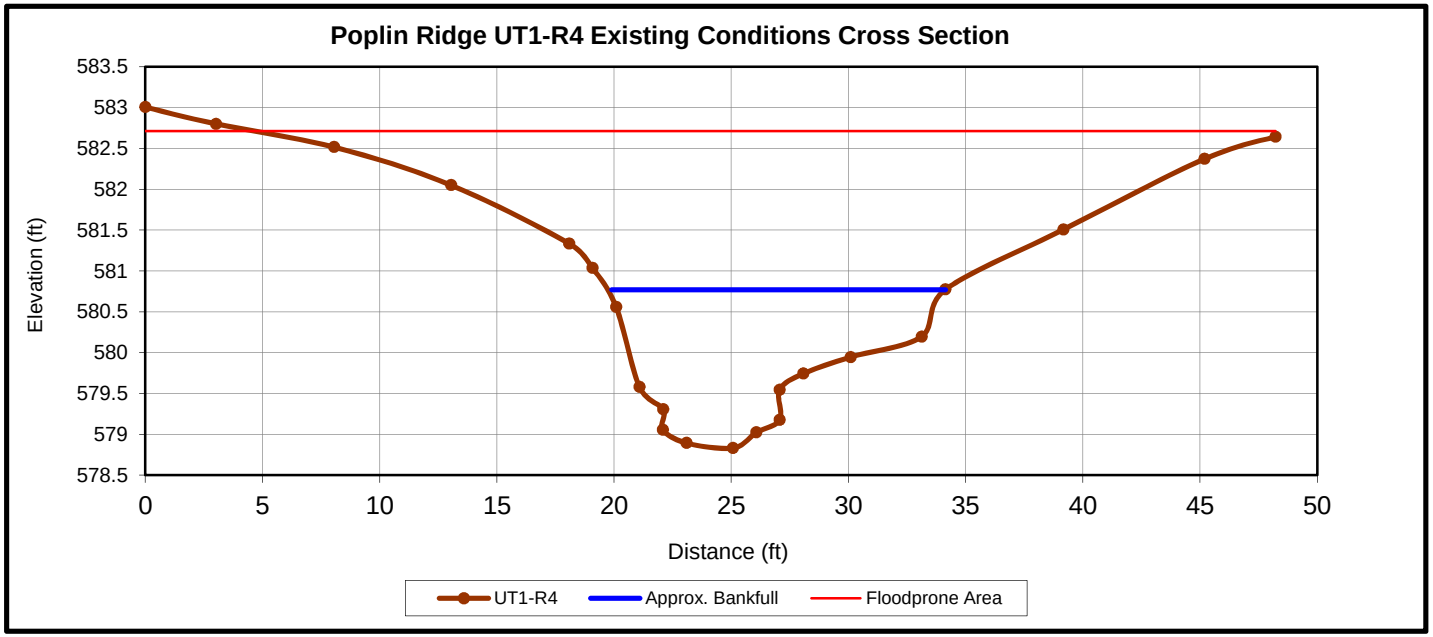
Upstream

Downstream



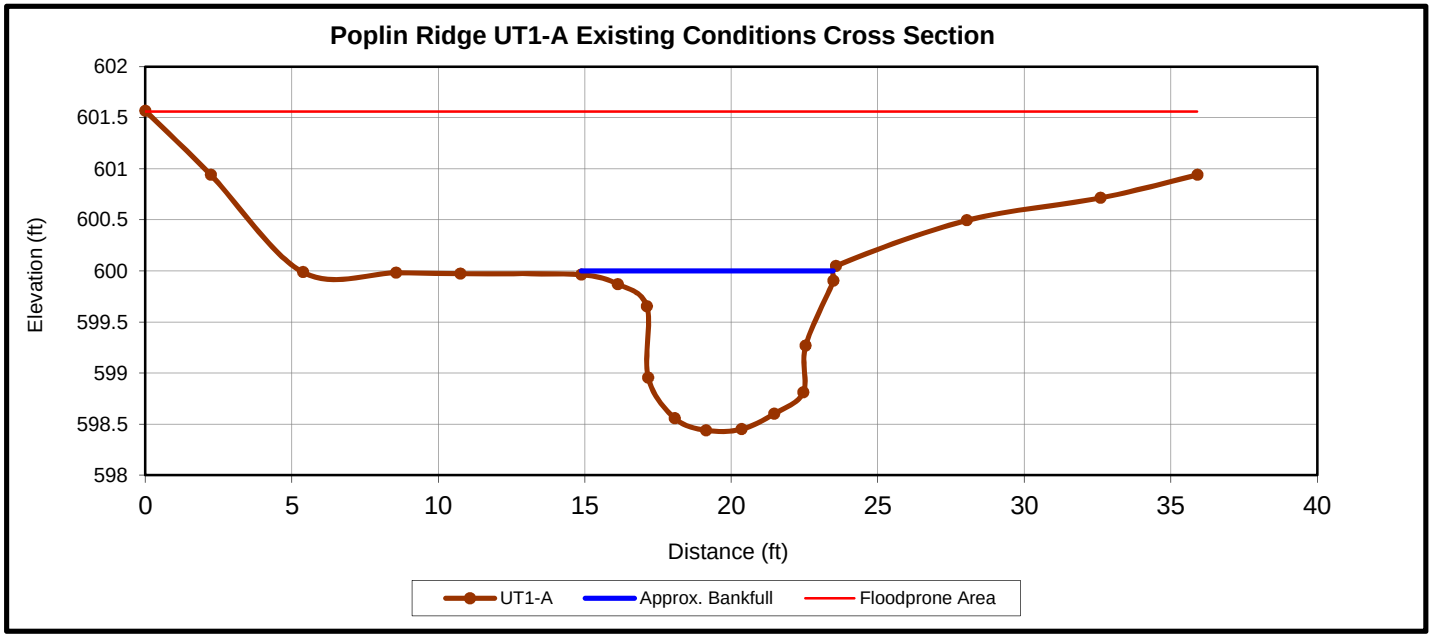
Upstream

Downstream



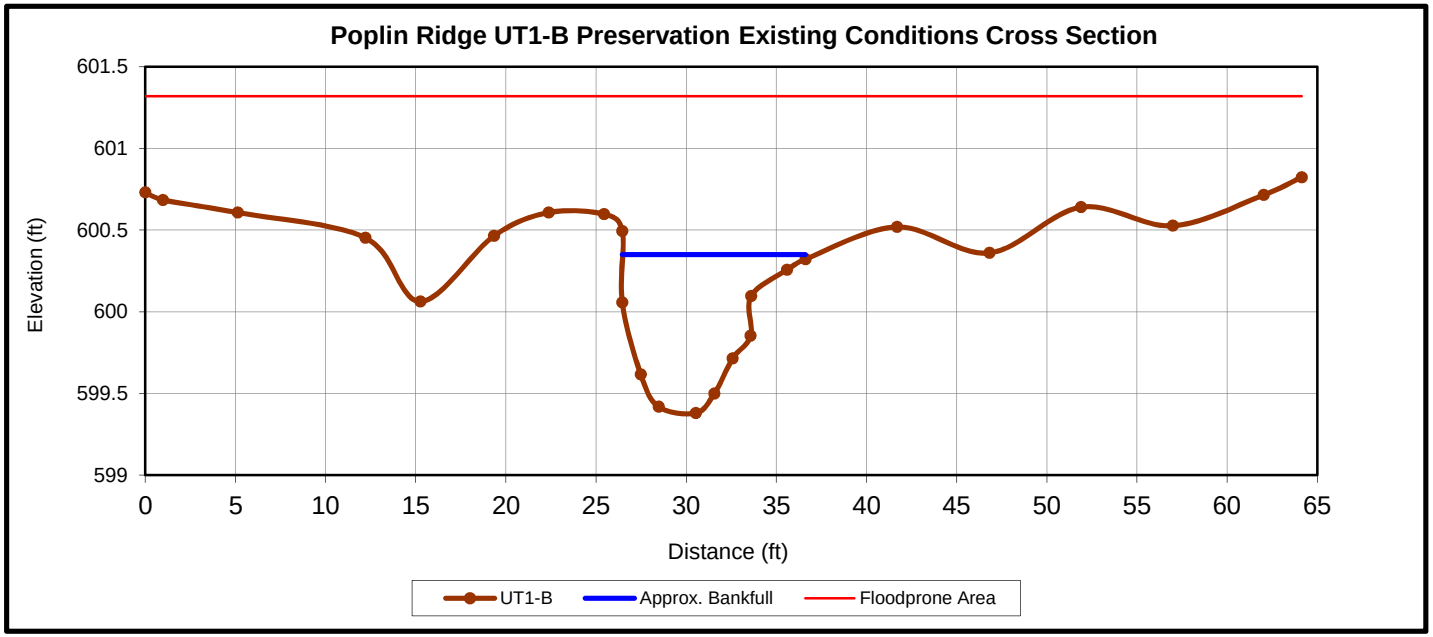
Upstream

Downstream



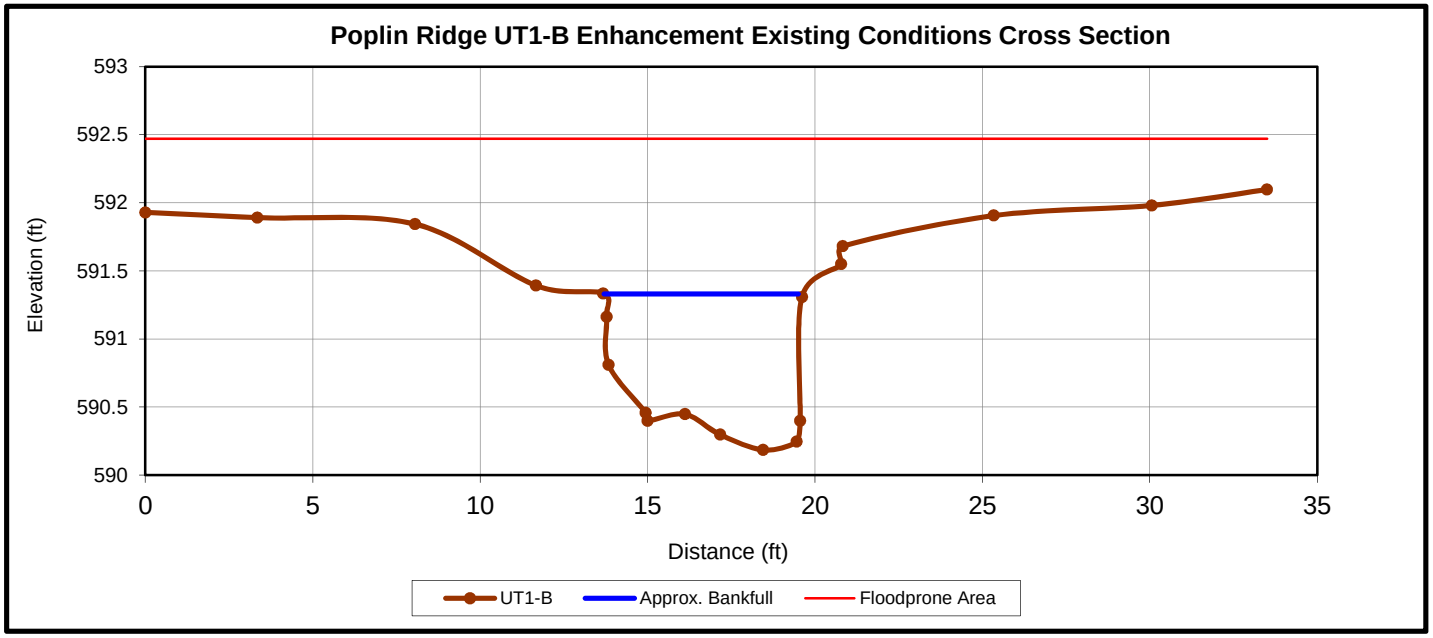
Upstream

Downstream



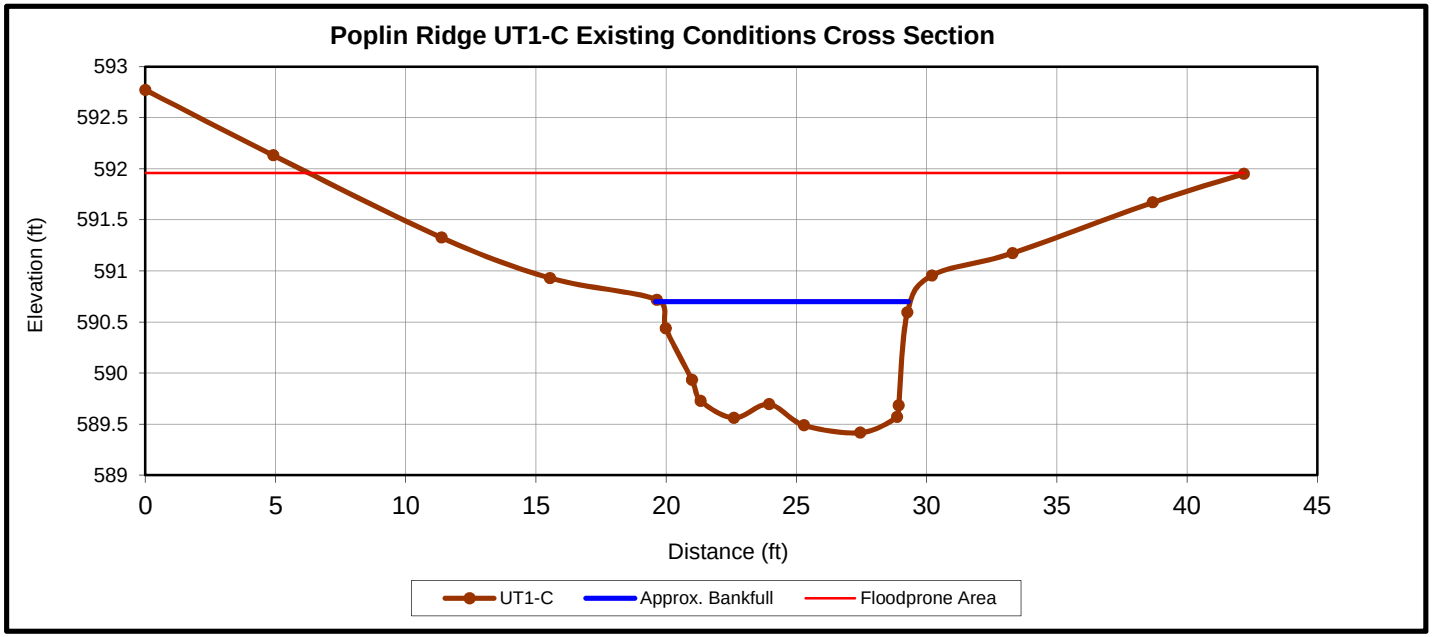
Upstream

Downstream



Upstream

Downstream



Upstream

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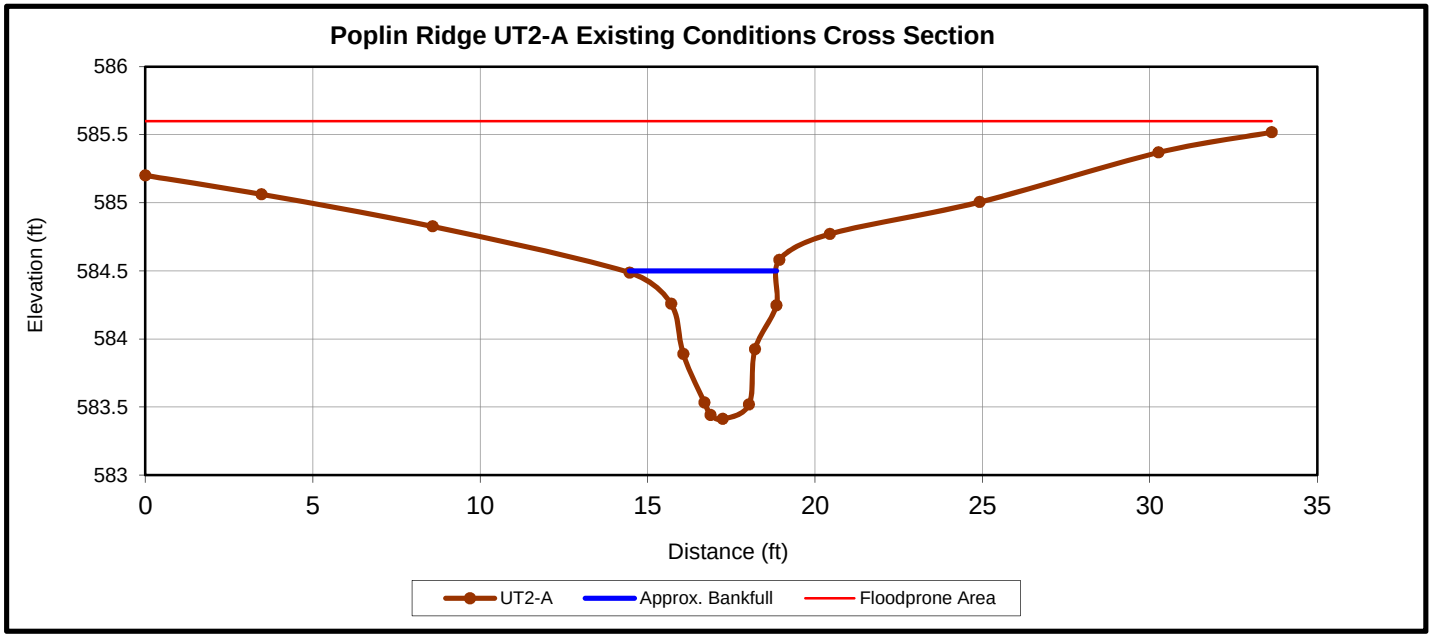

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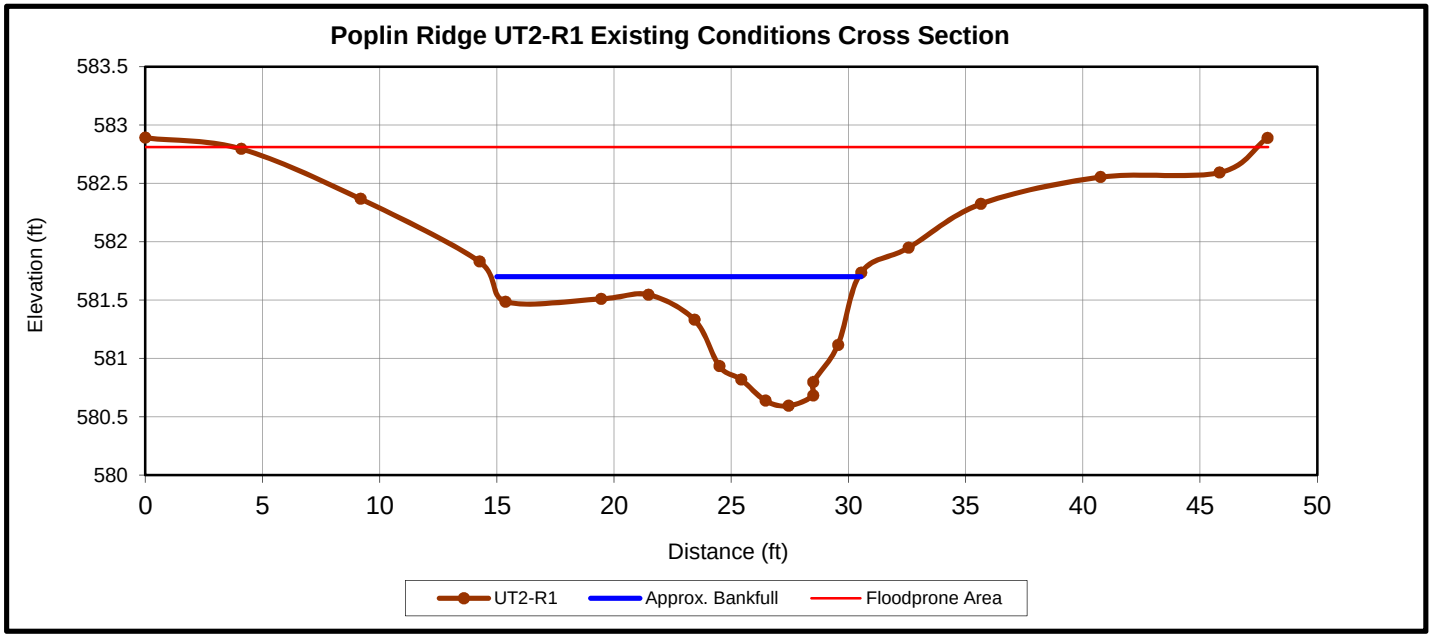

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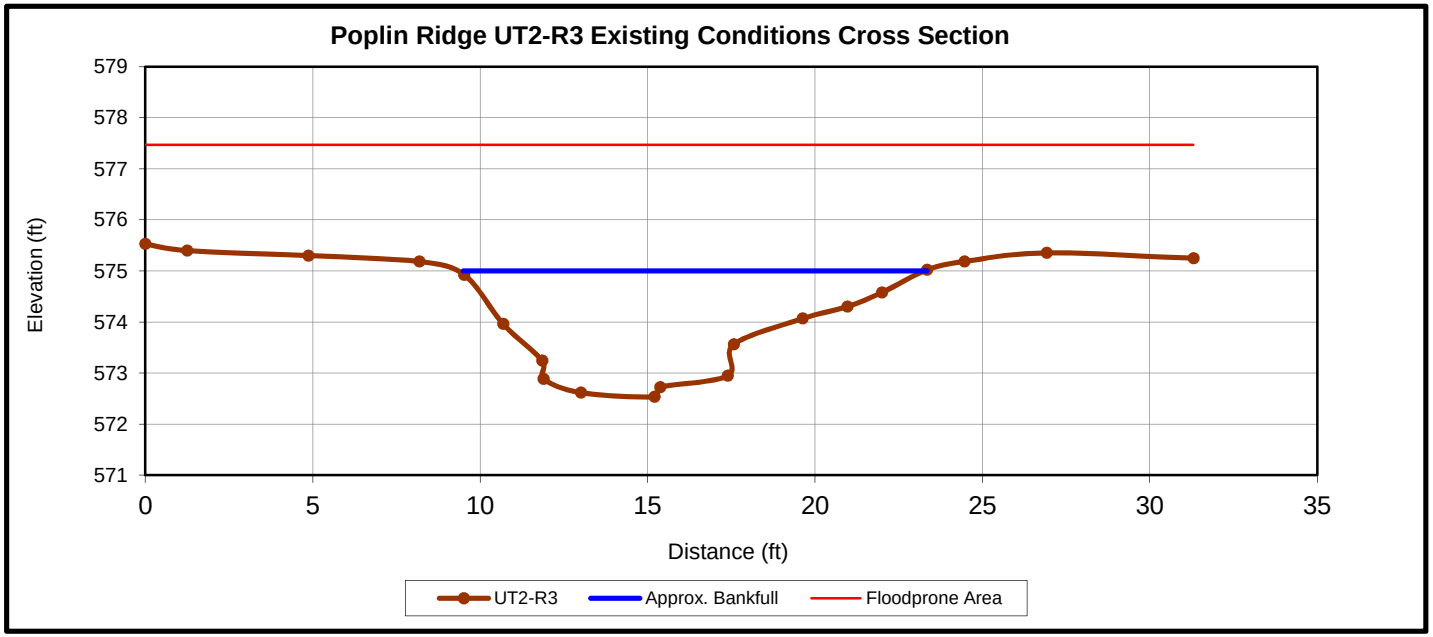
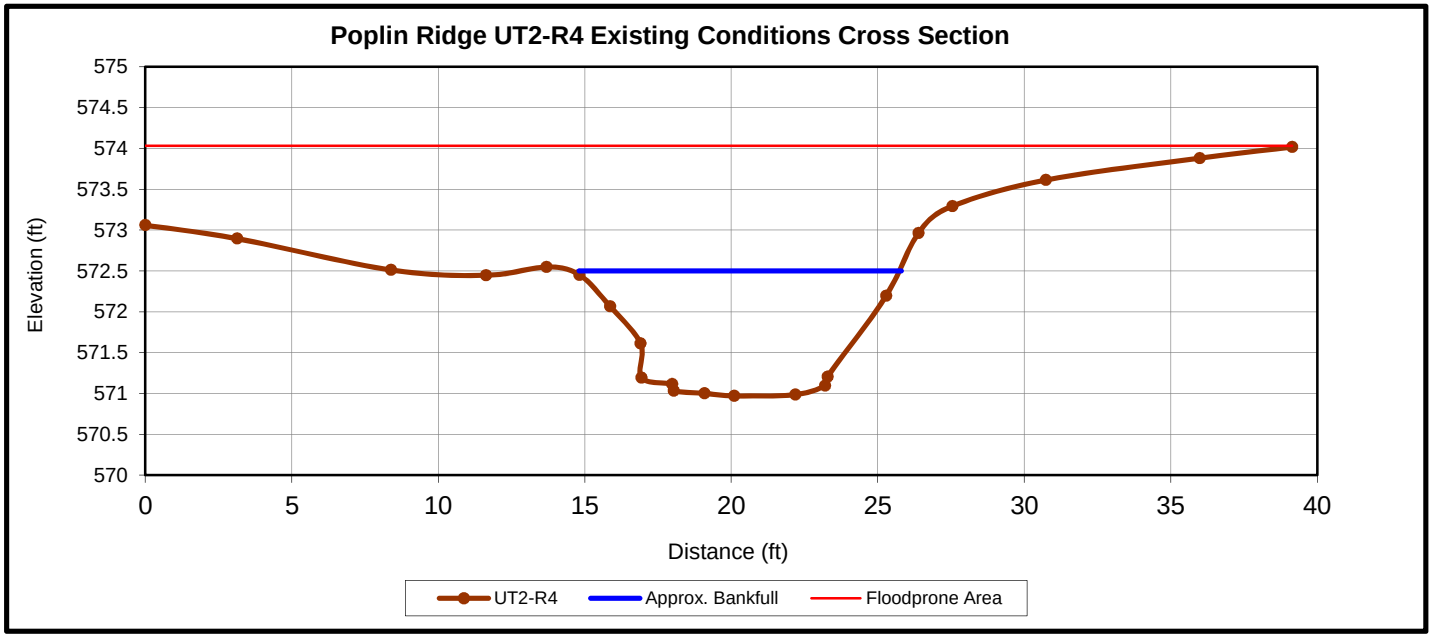


Upstream

Downstream



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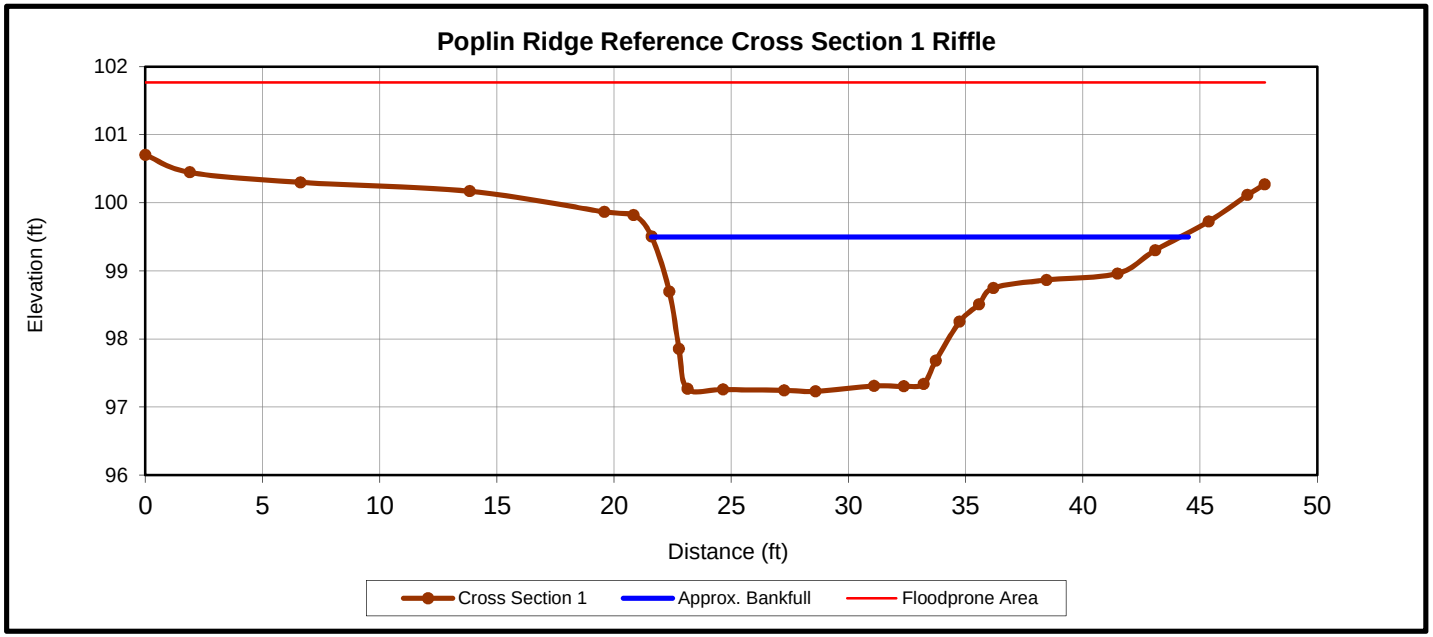
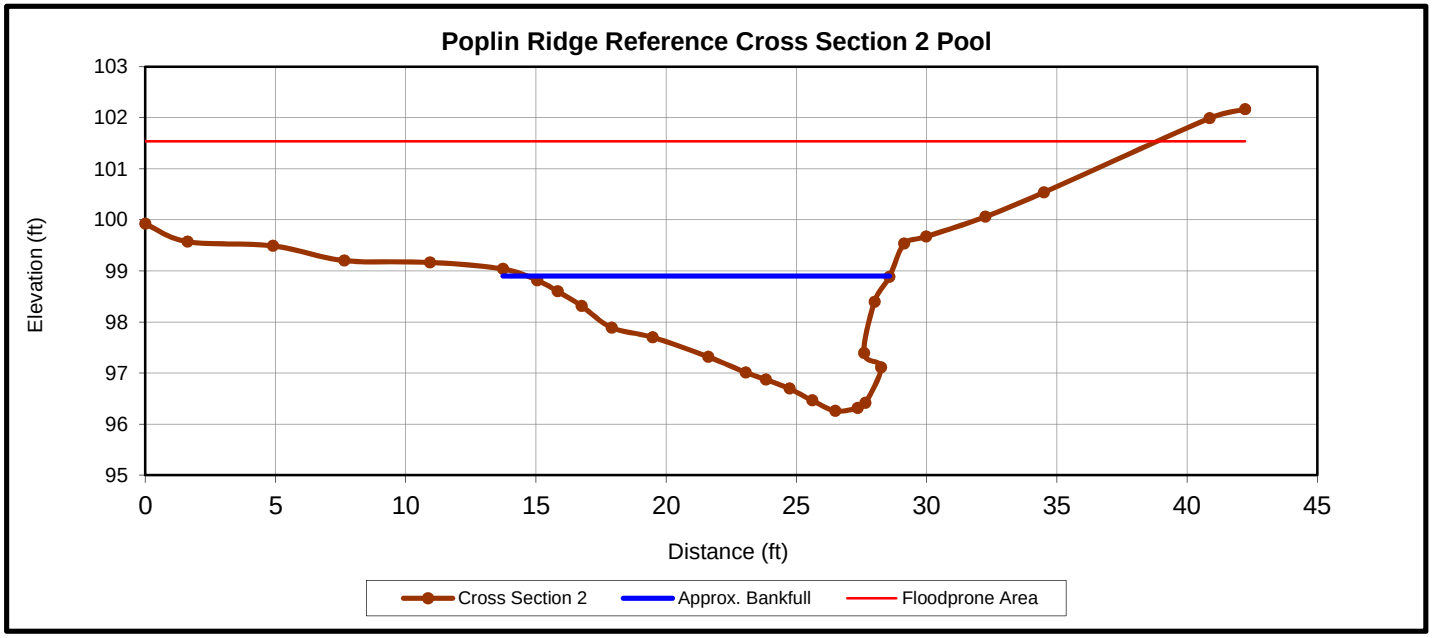


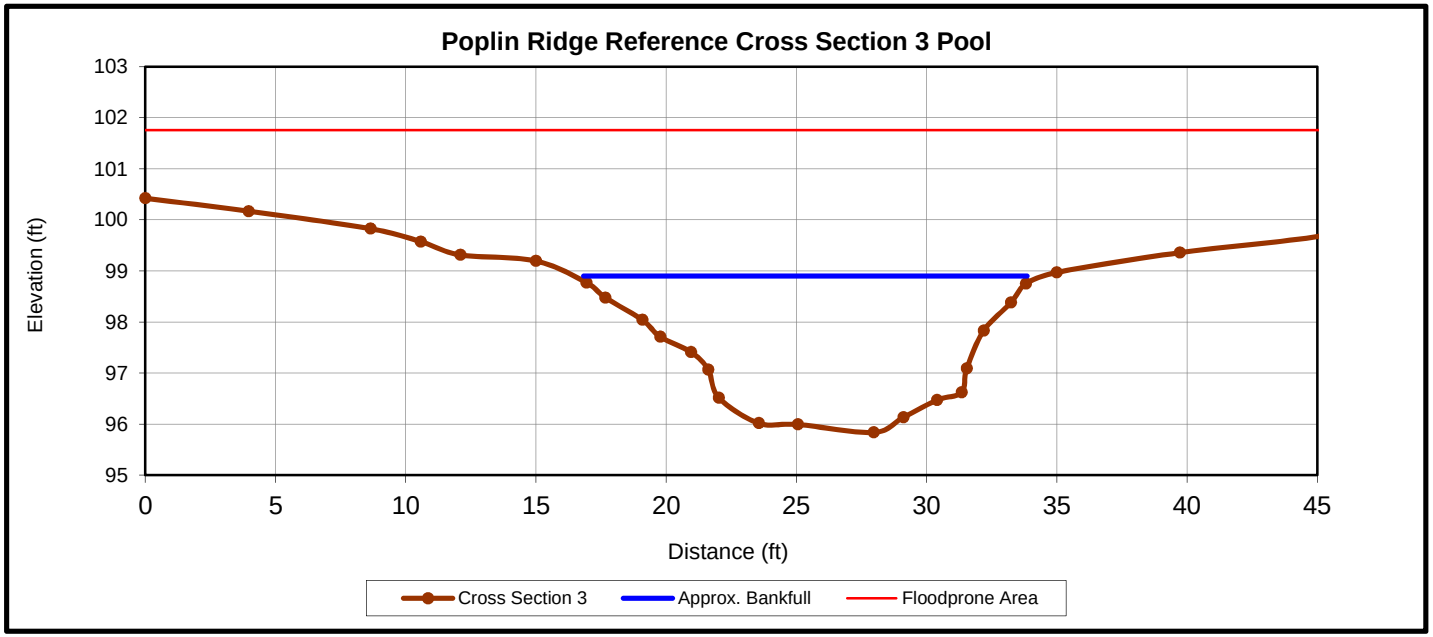
Upstream

Downstream



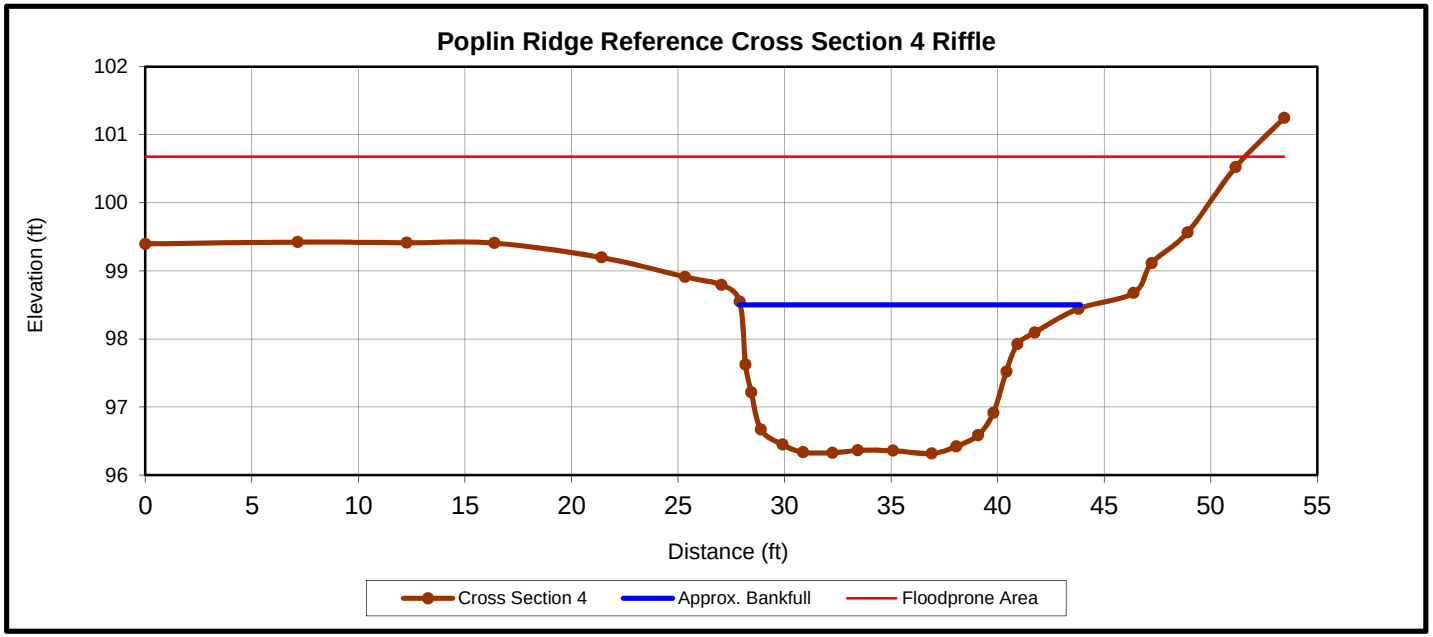
Upstream

Downstream



Upstream

Downstream



Poplin Ridge Reach UT1-2

Hydraulic Design Data

Stable Channel Design Results - Copeland Method

d84(mm) = 7.1, D50(mm) = 2.3, D16(mm) = .062

Temperature (F)	55
Specific Gravity of Sediments	2.65
Unit Weight of Water (lb/cu ft)	62.385
Viscosity (sq ft/s)	1.32E-05
Discharge (cfs)	36

Upstream Channel

Sediment Concentration (ppm)	234.84	
Base Width (ft)	6	
Channel Slope (ft/ft)	0.006	
	Left	Right
Side Slope	1.5	1.5
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Stable Channel

Median Channel Width (ft)	12	
Valley Slope(ft/ft)	0.008	
	Left	Right
Side Slope	1.7	1.7
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Computed Stable Channels

Bottom Width	Depth	Energy Slope	Comp n-Value	Hyd Radius	Velocity	Froude Number	Shear Stress	Regime
1	2.6	0.01174	0.0754	1.26	2.47	0.27	1.94	Upper
2	2.5	0.008271	0.0719	1.32	2.25	0.25	1.31	Upper
4	2.2	0.005801	0.0654	1.35	2.12	0.25	0.79	Upper
5	2	0.00508	0.0608	1.32	2.08	0.26	0.65	Upper
6	1.9	0.006392	0.0664	1.28	2.13	0.28	0.74	Lower
7	1.7	0.00603	0.0631	1.24	2.1	0.28	0.65	Lower
8	1.6	0.005825	0.0608	1.19	2.08	0.29	0.58	Lower
10	1.4	0.005499	0.0578	1.12	2.06	0.31	0.48	Lower
11	1.3	0.005415	0.0564	1.08	2.05	0.31	0.45	Lower
12	1.3	0.005335	0.0556	1.05	2.04	0.32	0.42	Lower
13	1.2	0.005331	0.0539	1.01	2.02	0.33	0.39	Lower
14	1.1	0.00532	0.0534	0.98	2.01	0.33	0.37	Lower
16	1	0.005379	0.0509	0.9	1.98	0.35	0.34	Lower
17	1	0.005379	0.0505	0.87	1.97	0.35	0.33	Lower
18	0.9	0.005411	0.0496	0.84	1.96	0.36	0.32	Lower
19	0.9	0.005491	0.0495	0.82	1.95	0.36	0.31	Lower
20	0.9	0.005476	0.0492	0.8	1.94	0.37	0.30	Lower
22	0.8	0.005618	0.0476	0.74	1.91	0.38	0.28	Lower
23	0.8	0.00566	0.0474	0.73	1.9	0.38	0.27	Lower
24	0.8	0.005722	0.0469	0.7	1.89	0.38	0.27	Lower
*******Solution for Minimum Stream Power*******								
4.9	2	0.007341	0.0696	1.3	2.17	0.27	0.92	Lower

Poplin Ridge Reach UT1-3

Hydraulic Design Data

Stable Channel Design Results - Copeland Method

d84(mm) = 25, D50(mm) = 7.8, D16(mm) = 1.5

Temperature (F)	55
Specific Gravity of Sediments	2.65
Unit Weight of Water (lb/cu ft)	62.385
Viscosity (sq ft/s)	1.32E-05
Discharge (cfs)	52

Upstream Channel

Sediment Concentration (ppm)	13.19	
Base Width (ft)	7	
Channel Slope (ft/ft)	0.005	
	Left	Right
Side Slope	1.9	1.9
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Stable Channel

Median Channel Width (ft)	14.5	
Valley Slope(ft/ft)	0.008	
	Left	Right
Side Slope	1.7	1.7
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Computed Stable Channels

Bottom Width	Depth	Energy Slope	Comp n-Value	Hyd Radius	Velocity	Froude Number	Shear Stress	Regime
1	3.4	0.007258	0.077	1.6	2.26	0.22	1.54	Upper
3	3	0.005965	0.0719	1.62	2.2	0.23	1.1	Lower
4	2.7	0.005585	0.069	1.6	2.19	0.23	0.95	Lower
6	2.4	0.004974	0.0643	1.55	2.19	0.25	0.73	Lower
7	2.2	0.004812	0.0617	1.51	2.2	0.26	0.66	Lower
9	1.9	0.004536	0.0574	1.42	2.2	0.28	0.54	Lower
10	1.8	0.00441	0.0558	1.38	2.21	0.29	0.5	Lower
12	1.6	0.004291	0.0522	1.29	2.21	0.31	0.43	Lower
13	1.5	0.004254	0.0507	1.24	2.21	0.32	0.4	Lower
14	1.4	0.004244	0.0494	1.2	2.21	0.32	0.38	Lower
16	1.3	0.004178	0.0467	1.11	2.21	0.34	0.34	Lower
17	1.2	0.004148	0.0457	1.08	2.21	0.35	0.32	Lower
19	1.1	0.004217	0.0441	1.01	2.2	0.36	0.3	Lower
20	1.1	0.004229	0.0434	0.98	2.2	0.37	0.29	Lower
22	1	0.004304	0.042	0.92	2.19	0.38	0.27	Lower
23	1	0.00431	0.0417	0.89	2.18	0.39	0.26	Lower
25	0.9	0.004422	0.0404	0.84	2.17	0.4	0.25	Lower
26	0.9	0.004465	0.04	0.81	2.17	0.41	0.24	Lower
28	0.8	0.004575	0.0394	0.77	2.16	0.42	0.23	Lower
29	0.8	0.004624	0.0391	0.76	2.15	0.43	0.23	Lower
*******Solution for Minimum Stream Power*******								
17.2	1.2	0.004183	0.0456	1.07	2.2	0.35	0.32	Lower

Poplin Ridge Reach UT2-3

Hydraulic Design Data

Stable Channel Design Results - Copeland Method

d84(mm) = 15, D50(mm) = 7.8, D16(mm) = 1.5

Temperature (F)	55
Specific Gravity of Sediments	2.65
Unit Weight of Water (lb/cu ft)	62.385
Viscosity (sq ft/s)	1.32E-05
Discharge (cfs)	65

Upstream Channel

Sediment Concentration (ppm)	1.42	
Base Width (ft)	8	
Channel Slope (ft/ft)	0.003	
	Left	Right
Side Slope	1.7	1.7
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Stable Channel

Median Channel Width (ft)	16	
Valley Slope(ft/ft)	0.006	
	Left	Right
Side Slope	1.7	1.7
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Computed Stable Channels

Bottom Width	Depth	Energy Slope	Comp n-Value	Hyd Radius	Velocity	Froude Number	Shear Stress	Regime
2	3.8	0.004245	0.0754	1.91	1.98	0.18	1.02	Lower
3	3.6	0.004062	0.0728	1.9	1.99	0.19	0.91	Lower
5	3.1	0.003729	0.0682	1.86	2.02	0.2	0.73	Lower
6	2.9	0.003583	0.0661	1.84	2.03	0.21	0.65	Lower
8	2.6	0.003375	0.0614	1.75	2.05	0.23	0.54	Lower
10	2.3	0.003216	0.0575	1.66	2.06	0.24	0.46	Lower
11	2.1	0.00315	0.0557	1.62	2.07	0.25	0.42	Lower
13	1.9	0.003062	0.0525	1.52	2.07	0.26	0.37	Lower
14	1.8	0.003026	0.0512	1.48	2.08	0.27	0.35	Lower
16	1.7	0.003021	0.0481	1.37	2.08	0.28	0.31	Lower
18	1.5	0.003003	0.0462	1.29	2.08	0.3	0.28	Lower
19	1.5	0.002949	0.045	1.26	2.09	0.31	0.27	Lower
21	1.3	0.002947	0.0437	1.19	2.09	0.32	0.25	Lower
22	1.3	0.00297	0.0427	1.15	2.08	0.32	0.24	Lower
24	1.2	0.003007	0.0414	1.09	2.08	0.33	0.23	Lower
26	1.1	0.003084	0.0401	1.02	2.07	0.34	0.22	Lower
27	1.1	0.003086	0.0399	1	2.07	0.35	0.21	Lower
29	1	0.00317	0.0387	0.94	2.06	0.36	0.2	Lower
30	1	0.00317	0.0386	0.93	2.06	0.36	0.2	Lower
32	0.9	0.003239	0.0382	0.89	2.06	0.37	0.19	Lower

*******Solution for Minimum Stream Power*******

20.1	1.4	0.002937	0.0444	1.22	2.09	0.31	0.25	Lower

Poplin Ridge Reach UT2-4

Hydraulic Design Data

Stable Channel Design Results - Copeland Method

d84(mm) = 15, D50(mm) = 7.8, D16(mm) = 1.5

Temperature (F)	55
Specific Gravity of Sediments	2.65
Unit Weight of Water (lb/cu ft)	62.385
Viscosity (sq ft/s)	1.32E-05
Discharge (cfs)	74

Upstream Channel

Sediment Concentration (ppm)	0	
Base Width (ft)	9	
Channel Slope (ft/ft)	0.0025	
	Left	Right
Side Slope	1.8	1.8
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Stable Channel

Median Channel Width (ft)	17	
Valley Slope(ft/ft)	0.003	
	Left	Right
Side Slope	1.7	1.7
Roughness Eq	Manning	Manning
Roughness Value	0.08	0.08

Computed Stable Channels

Bottom Width	Depth	Energy Slope	Comp n-Value	Hyd Radius	Velocity	Froude Number	Shear Stress	Regime
2	4.1	0.004009	0.0756	2.03	2	0.17	1.03	Lower
3	3.9	0.003824	0.0737	2.03	2.01	0.18	0.92	Lower
5	3.4	0.003545	0.0688	1.99	2.03	0.19	0.75	Lower
7	3	0.003347	0.0638	1.9	2.05	0.21	0.62	Lower
8	2.8	0.003216	0.0624	1.88	2.06	0.22	0.56	Lower
10	2.5	0.003079	0.0583	1.79	2.07	0.23	0.48	Lower
12	2.2	0.002963	0.0549	1.69	2.08	0.25	0.41	Lower
14	2	0.002886	0.052	1.6	2.09	0.26	0.36	Lower
15	1.9	0.002862	0.0507	1.55	2.09	0.27	0.34	Lower
17	1.8	0.002819	0.0484	1.47	2.1	0.28	0.31	Lower
19	1.6	0.002804	0.0466	1.39	2.1	0.29	0.28	Lower
20	1.6	0.002762	0.0454	1.35	2.1	0.3	0.27	Lower
22	1.4	0.002783	0.0435	1.27	2.1	0.31	0.25	Lower
24	1.3	0.002809	0.0424	1.2	2.1	0.32	0.23	Lower
26	1.3	0.002848	0.041	1.14	2.1	0.33	0.22	Lower
27	1.2	0.002873	0.0404	1.1	2.09	0.33	0.22	Lower
29	1.1	0.002916	0.0397	1.05	2.09	0.34	0.21	Lower
31	1.1	0.002969	0.0388	1	2.08	0.35	0.20	Lower
32	1.1	0.002987	0.0386	0.98	2.08	0.36	0.20	Lower
34	1	0.003053	0.0381	0.94	2.08	0.37	0.19	Lower
*******Solution for Minimum Stream Power*******								
20.7	1.5	0.002768	0.0447	1.32	2.1	0.3	0.26	Lower

Poplin Ridge Site UT1 (HEC-RAS Output)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Power Total (lb/ft s)	Shear Chan (lb/sq ft)
UT1-R2	3524	Design Q	36	593.77	595.57		595.66	0.0061	2.38	16.33	25.40	0.53	0.46
UT1-R2	3524	2-Yr Q	85	593.77	596.21		596.34	0.0061	3.12	47.65	76.27	0.42	0.68
UT1-R2	3524	10-Yr Q	222	593.77	597.13		597.25	0.0048	3.61	133.25	102.22	0.65	0.80
UT1-R2	3524	50-Yr Q	374	593.77	597.81		597.94	0.0045	4.06	207.55	120.31	0.88	0.94
UT1-R2	3524	100-Yr Q	442	593.77	598.05		598.19	0.0045	4.23	238.35	128.55	0.96	1.00
UT1-R2	3380	Design Q	36	592.92	595.17		595.20	0.0018	1.58	34.72	58.31	0.07	0.18
UT1-R2	3380	2-Yr Q	85	592.92	595.84		595.88	0.0018	1.97	90.00	94.48	0.10	0.25
UT1-R2	3380	10-Yr Q	222	592.92	596.70		596.77	0.0023	2.76	178.21	111.91	0.29	0.45
UT1-R2	3380	50-Yr Q	374	592.92	597.35		597.43	0.0027	3.34	256.93	132.75	0.47	0.62
UT1-R2	3380	100-Yr Q	442	592.92	597.59		597.67	0.0028	3.53	289.58	139.09	0.54	0.68
UT1-R2	3255	Design Q	36	592.92	594.74		594.83	0.0058	2.33	16.92	26.91	0.47	0.44
UT1-R2	3255	2-Yr Q	85	592.92	595.38		595.50	0.0057	3.06	49.35	77.93	0.39	0.65
UT1-R2	3255	10-Yr Q	222	592.92	596.18		596.32	0.0059	3.90	122.83	100.41	0.81	0.95
UT1-R2	3255	50-Yr Q	374	592.92	596.78		596.94	0.0059	4.45	187.18	114.54	1.19	1.16
UT1-R2	3255	100-Yr Q	442	592.92	597.01		597.18	0.0059	4.66	214.36	122.18	1.32	1.24
UT1-R2	3094	Design Q	36	591.97	593.76		593.85	0.0064	2.41	16.04	24.62	0.57	0.47
UT1-R2	3094	2-Yr Q	85	591.97	594.39		594.53	0.0064	3.18	46.25	74.57	0.45	0.71
UT1-R2	3094	10-Yr Q	222	591.97	595.22		595.36	0.0060	3.92	122.10	100.28	0.82	0.96
UT1-R2	3094	50-Yr Q	374	591.97	595.83		595.99	0.0059	4.47	186.64	114.39	1.20	1.16
UT1-R2	3094	100-Yr Q	442	591.97	596.06		596.23	0.0059	4.67	213.91	122.06	1.32	1.24
UT1-R2	2899	Design Q	36	590.82	592.71		592.79	0.0047	2.18	19.06	31.81	0.33	0.38
UT1-R2	2899	2-Yr Q	85	590.82	593.37		593.47	0.0045	2.81	56.69	84.67	0.28	0.54
UT1-R2	2899	10-Yr Q	222	590.82	594.09		594.23	0.0057	3.86	124.29	100.67	0.78	0.92
UT1-R2	2899	50-Yr Q	374	590.82	594.68		594.84	0.0059	4.45	187.33	114.58	1.18	1.15
UT1-R2	2899	100-Yr Q	442	590.82	594.92		595.09	0.0058	4.63	215.66	122.53	1.29	1.22
UT1-R2	2712	Design Q	36	589.72	591.26		591.41	0.0130	3.02	11.94	11.74	2.37	0.79
UT1-R2	2712	2-Yr Q	85	589.72	591.86	591.47	592.11	0.0132	4.10	29.11	48.61	1.42	1.25
UT1-R2	2712	10-Yr Q	222	589.72	592.91		593.07	0.0068	4.11	115.75	99.16	0.94	1.06
UT1-R2	2712	50-Yr Q	374	589.72	593.68		593.82	0.0051	4.23	198.07	117.66	1.01	1.03
UT1-R2	2712	100-Yr Q	442	589.72	593.96		594.10	0.0048	4.33	232.64	127.06	1.03	1.05
UT1-R2	2444	Design Q	36	588.14	590.48		590.50	0.0014	1.46	40.05	66.33	0.05	0.15
UT1-R2	2444	2-Yr Q	85	588.14	591.19		591.22	0.0013	1.76	102.01	96.69	0.07	0.20
UT1-R2	2444	10-Yr Q	222	588.14	592.30		592.34	0.0013	2.26	222.77	124.45	0.15	0.29
UT1-R2	2444	50-Yr Q	374	588.14	593.09		593.14	0.0014	2.64	330.62	146.66	0.22	0.37
UT1-R2	2444	100-Yr Q	442	588.14	593.38		593.43	0.0014	2.79	373.29	154.14	0.26	0.40
UT1-R3	2282	Design Q	52	587.98	589.99		590.07	0.0047	2.33	25.38	32.17	0.46	0.41
UT1-R3	2282	2-Yr Q	113	587.98	590.69		590.81	0.0046	3.00	58.13	61.59	0.52	0.60
UT1-R3	2282	10-Yr Q	290	587.98	591.76		591.93	0.0046	3.93	146.79	100.20	0.83	0.90
UT1-R3	2282	50-Yr Q	487	587.98	592.53		592.72	0.0046	4.54	232.12	123.43	1.13	1.12
UT1-R3	2282	100-Yr Q	573	587.98	592.80		593.00	0.0046	4.74	266.88	131.70	1.25	1.20
UT1-R3	2115	Design Q	52	587.21	589.22		589.30	0.0046	2.32	25.50	32.32	0.46	0.41
UT1-R3	2115	2-Yr Q	113	587.21	589.91		590.04	0.0046	3.01	57.95	61.46	0.53	0.60
UT1-R3	2115	10-Yr Q	290	587.21	590.99		591.16	0.0046	3.93	146.79	100.20	0.83	0.90
UT1-R3	2115	50-Yr Q	487	587.21	591.76		591.95	0.0046	4.54	231.98	123.39	1.14	1.12
UT1-R3	2115	100-Yr Q	573	587.21	592.03		592.23	0.0046	4.75	266.55	131.62	1.26	1.20
UT1-R3	1957	Design Q	52	586.48	588.49		588.57	0.0047	2.33	25.34	32.12	0.47	0.41

Poplin Ridge Site UT1 (HEC-RAS Output)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Power Total (lb/ft s)	Shear Chan (lb/sq ft)
UT1-R3	1957	2-Yr Q	113	586.48	589.19		589.31	0.0046	2.99	58.40	61.77	0.52	0.60
UT1-R3	1957	10-Yr Q	290	586.48	590.27		590.43	0.0046	3.92	147.36	100.37	0.82	0.90
UT1-R3	1957	50-Yr Q	487	586.48	591.02		591.21	0.0047	4.55	231.17	123.19	1.15	1.13
UT1-R3	1957	100-Yr Q	573	586.48	591.29		591.49	0.0047	4.77	265.11	131.29	1.28	1.21
UT1-R3	1782	Design Q	52	585.67	587.77		587.84	0.0037	2.15	28.67	36.21	0.33	0.35
UT1-R3	1782	2-Yr Q	113	585.67	588.46		588.57	0.0039	2.83	63.52	65.18	0.42	0.53
UT1-R3	1782	10-Yr Q	290	585.67	589.48		589.64	0.0045	3.88	149.16	100.92	0.79	0.88
UT1-R3	1782	50-Yr Q	487	585.67	590.17		590.37	0.0049	4.64	226.18	121.96	1.22	1.17
UT1-R3	1782	100-Yr Q	573	585.67	590.42		590.63	0.0050	4.89	257.56	129.54	1.38	1.28
UT1-R3	1621	Design Q	52	584.93	586.32		586.58	0.0264	4.08	12.73	13.79	6.04	1.48
UT1-R3	1621	2-Yr Q	113	584.93	586.98	586.71	587.34	0.0199	4.89	26.73	33.88	4.09	1.81
UT1-R3	1621	10-Yr Q	290	584.93	588.09		588.48	0.0130	5.71	89.99	79.78	2.93	2.05
UT1-R3	1621	50-Yr Q	487	584.93	588.88		589.25	0.01022	6.05	163.74	105.23	2.94	2.1
UT1-R3	1621	100-Yr Q	573	584.93	589.17		589.54	0.009431	6.14	196.05	114.19	2.94	2.11
UT1-R4	1360	Design Q	70	582.15	584.35		584.46	0.004426	2.64	26.66	22.18	0.85	0.36
UT1-R4	1360	2-Yr Q	172	582.15	585.28		585.48	0.004311	3.67	60.46	55.59	0.82	0.59
UT1-R4	1360	10-Yr Q	431	582.15	586.51		586.8	0.004351	4.92	167.17	109.92	1.06	0.92
UT1-R4	1360	50-Yr Q	714	582.15	587.33		587.68	0.004442	5.72	263.39	123.85	1.59	1.16
UT1-R4	1360	100-Yr Q	838	582.15	587.63		588.01	0.004478	6	301.43	128.95	1.8	1.25
UT1-R4	1149	Design Q	70	581.04	583.31		583.45	0.005236	2.91	24.19	19.79	1.09	0.44
UT1-R4	1149	2-Yr Q	172	581.04	584.27		584.5	0.004987	3.99	60.82	57.18	0.92	0.7
UT1-R4	1149	10-Yr Q	431	581.04	585.67		585.93	0.003873	4.78	199.74	131.45	0.78	0.86
UT1-R4	1149	50-Yr Q	714	581.04	586.53		586.8	0.003766	5.39	322.13	155.74	1.07	1.02
UT1-R4	1149	100-Yr Q	838	581.04	586.83		587.11	0.003765	5.62	371.06	165.39	1.18	1.09
UT1-R4	913	Design Q	70	579.69	581.88		582.05	0.006659	3.31	21.5	18.25	1.51	0.57
UT1-R4	913	2-Yr Q	172	579.69	582.93		583.22	0.005804	4.43	50.79	37.78	1.6	0.85
UT1-R4	913	10-Yr Q	431	579.69	584.41		584.83	0.005447	5.86	152.45	112.54	1.29	1.27
UT1-R4	913	50-Yr Q	714	579.69	585.39		585.79	0.004705	6.31	280.38	148.24	1.4	1.36
UT1-R4	913	100-Yr Q	838	579.69	585.68		586.1	0.004779	6.6	325.2	159.09	1.56	1.47
UT1-R4	779	Design Q	70	578.6	581.15		581.3	0.004751	3.17	25.63	20.51	0.96	0.49
UT1-R4	779	2-Yr Q	172	578.6	582.22		582.49	0.005018	4.46	57.09	38.51	1.36	0.83
UT1-R4	779	10-Yr Q	431	578.6	583.43		583.98	0.007254	6.79	125.09	76.51	2.51	1.7
UT1-R4	779	50-Yr Q	714	578.6	584.29	583.52	584.97	0.007904	8.06	222.5	140.6	2.48	2.24
UT1-R4	779	100-Yr Q	838	578.6	584.62	584.23	585.28	0.00757	8.24	272.8	159.74	2.46	2.3
UT1-R4	554	Design Q	70	578.07	580.56		580.61	0.002019	1.73	40.37	31.21	0.28	0.16
UT1-R4	554	2-Yr Q	172	578.07	581.81		581.87	0.001465	1.93	89.46	48.09	0.32	0.17
UT1-R4	554	10-Yr Q	431	578.07	583.02		583.14	0.001752	2.91	169.5	97.4	0.48	0.33
UT1-R4	554	50-Yr Q	714	578.07	583.81		584	0.002068	3.68	265.33	146.14	0.63	0.49
UT1-R4	554	100-Yr Q	838	578.07	584.07		584.3	0.002254	4.01	307.24	199.34	0.59	0.58
UT1-R4	328	Design Q	70	577.04	579.83		579.95	0.004493	2.77	25.26	16.63	1.09	0.39
UT1-R4	328	2-Yr Q	172	577.04	581.39		581.49	0.001947	2.66	107.68	90.95	0.23	0.3
UT1-R4	328	10-Yr Q	431	577.04	582.52		582.68	0.002441	3.77	247.6	160.29	0.4	0.53
UT1-R4	328	50-Yr Q	714	577.04	583.24		583.45	0.002942	4.64	385	216.36	0.6	0.77
UT1-R4	328	100-Yr Q	838	577.04	583.5		583.72	0.002977	4.85	442.09	224.52	0.69	0.82
UT1-R4	188	Design Q	70	576.37	579.33		579.44	0.002987	2.55	27.41	14.81	0.8	0.31
UT1-R4	188	2-Yr Q	172	576.37	581.17		581.26	0.001322	2.63	119.84	111.67	0.13	0.27

Poplin Ridge Site UT1 (HEC-RAS Output)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Power Total (lb/ft s)	Shear Chan (lb/sq ft)
UT1-R4	188	10-Yr Q	431	576.37	582.17		582.35	0.002259	4.06	263.41	177.07	0.34	0.59
UT1-R4	188	50-Yr Q	714	576.37	582.81		583.04	0.002908	5.02	387.64	210.26	0.61	0.86
UT1-R4	188	100-Yr Q	838	576.37	583.04		583.29	0.003093	5.33	437.73	220.17	0.73	0.95
UT1-R4	112	Design Q	70	575.87	578.98	577.71	579.13	0.004924	3.17	22.08	11.38	1.56	0.49
UT1-R4	112	2-Yr Q	172	575.87	581.06	578.94	581.14	0.001854	2.44	110.03	94.01	0.21	0.26
UT1-R4	112	10-Yr Q	431	575.87	581.98	580.66	582.15	0.002993	3.81	212.1	134.4	0.63	0.57
UT1-R4	112	50-Yr Q	714	575.87	582.47	581.47	582.75	0.00444	5.08	287	156.58	1.24	0.97
UT1-R4	112	100-Yr Q	838	575.87	582.64	581.69	582.97	0.005078	5.58	313.03	163.83	1.59	1.16
UT1-R4	91		Culvert										
UT1-R4	69	Design Q	70	575.85	578.91	577.85	579.05	0.006004	3.05	22.98	15.84	1.48	0.49
UT1-R4	69	2-Yr Q	172	575.85	580.08	579.01	580.29	0.006007	3.64	47.19	25.54	2.32	0.64
UT1-R4	69	10-Yr Q	431	575.85	581.4	580.33	581.73	0.006005	4.75	122.57	91.88	1.71	0.95
UT1-R4	69	50-Yr Q	714	575.85	582.23	581.35	582.61	0.006002	5.36	218.96	138.8	1.89	1.13
UT1-R4	69	100-Yr Q	838	575.85	582.5	581.65	582.9	0.006003	5.62	257.61	154.09	2.01	1.22

Poplin Ridge Site UT2 (HEC-RAS Output)

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Power Total (lb/ft s)	Shear Chan (lb/sq ft)
UT2-R1	UT-2	2990.84	Design Q	60.00	581.38	583.38		583.4900	0.00	2.63	24.30	27.96	0.49	0.29
UT2-R1	UT-2	2990.84	2-Yr Q	171.00	581.38	584.39		584.5900	0.00	3.83	65.70	52.07	0.73	0.51
UT2-R1	UT-2	2990.84	10-Yr Q	430.00	581.38	587.21		587.3200	0.00	3.23	295.83	110.51	0.21	0.28
UT2-R1	UT-2	2990.84	50-Yr Q	713.00	581.38	588.07		588.2500	0.00	4.26	397.96	129.41	0.43	0.46
UT2-R1	UT-2	2990.84	100-Yr Q	836.00	581.38	588.31		588.5300	0.00	4.72	430.48	136.23	0.55	0.55
UT2-R1	UT-2	2886.41	Design Q	60.00	580.98	582.93		583.0700	0.00	3.03	22.69	29.58	0.54	0.37
UT2-R1	UT-2	2886.41	2-Yr Q	171.00	580.98	583.86		584.1400	0.01	4.60	62.31	54.17	0.99	0.73
UT2-R1	UT-2	2886.41	10-Yr Q	430.00	580.98	587.16		587.2300	0.00	2.91	410.42	149.92	0.11	0.22
UT2-R1	UT-2	2886.41	50-Yr Q	713.00	580.98	588.01		588.1200	0.00	3.74	543.42	160.97	0.24	0.34
UT2-R1	UT-2	2886.41	100-Yr Q	836.00	580.98	588.25		588.3800	0.00	4.10	582.56	162.88	0.32	0.41
UT2-R1	UT-2	2769.21	Design Q	60.00	580.49	582.59		582.6700	0.00	2.27	29.90	34.61	0.28	0.21
UT2-R1	UT-2	2769.21	2-Yr Q	171.00	580.49	583.46		583.6300	0.00	3.58	73.31	65.43	0.54	0.45
UT2-R1	UT-2	2769.21	10-Yr Q	430.00	580.49	587.12		587.1700	0.00	2.28	430.48	123.56	0.08	0.13
UT2-R1	UT-2	2769.21	50-Yr Q	713.00	580.49	587.94		588.0300	0.00	3.15	535.92	134.91	0.19	0.24
UT2-R1	UT-2	2769.21	100-Yr Q	836.00	580.49	588.16		588.2800	0.00	3.52	566.62	138.04	0.26	0.3
UT2-R1	UT-2	2632.17	Design Q	60.00	579.68	581.85	581.56	582.0800	0.01	4.02	24.66	48.96	0.60	0.66
UT2-R1	UT-2	2632.17	2-Yr Q	171.00	579.68	582.73	582.41	583.0000	0.01	5.10	82.86	82.84	0.86	0.91
UT2-R1	UT-2	2632.17	10-Yr Q	430.00	579.68	587.10		587.1200	0.00	1.99	650.09	164.80	0.04	0.1
UT2-R1	UT-2	2632.17	50-Yr Q	713.00	579.68	587.91		587.9500	0.00	2.76	787.85	176.46	0.10	0.18
UT2-R1	UT-2	2632.17	100-Yr Q	836.00	579.68	588.13		588.1800	0.00	3.09	827.07	179.64	0.14	0.22
UT2-R1	UT-2	2519.11	Design Q	60.00	579.55	580.99	580.71	581.1400	0.01	3.06	21.27	33.41	0.92	0.44
UT2-R1	UT-2	2519.11	2-Yr Q	171.00	579.55	581.39	581.39	581.8400	0.02	5.53	43.08	66.84	2.72	1.3
UT2-R1	UT-2	2519.11	10-Yr Q	430.00	579.55	587.09		587.1000	0.00	1.40	728.37	161.32	0.02	0.05
UT2-R1	UT-2	2519.11	50-Yr Q	713.00	579.55	587.88		587.9100	0.00	2.01	861.06	172.85	0.05	0.09
UT2-R1	UT-2	2519.11	100-Yr Q	836.00	579.55	588.09		588.1400	0.00	2.27	898.26	176.13	0.07	0.12
UT2-R2	UT-2	2417.44	Design Q	60.00	579.20	579.98		580.0800	0.01	2.50	23.97	52.21	0.92	0.37
UT2-R2	UT-2	2417.44	2-Yr Q	171.00	579.20	581.32		581.3500	0.00	1.41	121.28	80.69	0.11	0.08
UT2-R2	UT-2	2417.44	10-Yr Q	430.00	579.20	587.09		587.1000	0.00	0.70	725.80	137.32	0.00	0.01
UT2-R2	UT-2	2417.44	50-Yr Q	713.00	579.20	587.88		587.9000	0.00	1.04	841.27	153.13	0.01	0.02
UT2-R2	UT-2	2417.44	100-Yr Q	836.00	579.20	588.10		588.1200	0.00	1.19	874.56	157.83	0.02	0.03
UT2-R2	UT-2	2280.91	Design Q	60.00	578.03	579.38	578.86	579.4100	0.00	1.47	40.78	57.23	0.16	0.11
UT2-R2	UT-2	2280.91	2-Yr Q	171.00	578.03	581.29		581.3000	0.00	0.95	185.51	84.02	0.03	0.03
UT2-R2	UT-2	2280.91	10-Yr Q	430.00	578.03	587.09		587.0900	0.00	0.67	798.73	132.59	0.00	0.01
UT2-R2	UT-2	2280.91	50-Yr Q	713.00	578.03	587.88		587.8900	0.00	1.00	907.98	142.78	0.01	0.02
UT2-R2	UT-2	2280.91	100-Yr Q	836.00	578.03	588.09		588.1100	0.00	1.14	938.66	145.51	0.02	0.03
UT2-R2	UT-2	2168.87	Design Q	60.00	577.80	578.53	578.51	578.7300	0.03	3.61	16.61	37.98	2.81	0.78
UT2-R2	UT-2	2168.87	2-Yr Q	171.00	577.80	581.28		581.2800	0.00	0.63	274.27	120.51	0.01	0.01
UT2-R2	UT-2	2168.87	10-Yr Q	430.00	577.80	587.09		587.0900	0.00	0.44	1148.76	197.32	0.00	0
UT2-R2	UT-2	2168.87	50-Yr Q	713.00	577.80	587.88		587.8900	0.00	0.66	1312.62	214.51	0.00	0.01
UT2-R2	UT-2	2168.87	100-Yr Q	836.00	577.80	588.10		588.1000	0.00	0.75	1358.92	218.59	0.01	0.01
UT2-R2	UT-2	1992.96	Design Q	60.00	576.72	578.54		578.5400	0.00	0.58	103.81	90.81	0.01	0.01
UT2-R2	UT-2	1992.96	2-Yr Q	171.00	576.72	581.27		581.2700	0.00	0.38	451.82	143.97	0.00	0
UT2-R2	UT-2	1992.96	10-Yr Q	430.00	576.72	587.09		587.0900	0.00	0.32	1434.30	202.20	0.00	0
UT2-R2	UT-2	1992.96	50-Yr Q	713.00	576.72	587.88		587.8900	0.00	0.48	1599.68	214.09	0.00	0
UT2-R2	UT-2	1992.96	100-Yr Q	836.00	576.72	588.10		588.1000	0.00	0.55	1645.84	217.54	0.00	0.01
UT2-R2	UT-2	1940.74	Design Q	60.00	575.35	578.49	576.54	578.5200	0.00	1.41	42.65	26.80	0.09	0.07
UT2-R2	UT-2	1940.74	2-Yr Q	171	575.35	581.2	577.43	581.26	0.000314	1.88	101.29	93.77	0.13	0.09
UT2-R2	UT-2	1940.74	10-Yr Q	430	575.35	587.07	578.72	587.08	0.000042	1.13	991.39	174.42	0.01	0.03

Poplin Ridge Site UT2 (HEC-RAS Output)

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Power Total (lb/ft s)	Shear Chan (lb/sq ft)
UT2-R2	UT-2	1940.74	50-Yr Q	713	575.35	587.86	579.87	587.88	0.000083	1.68	1131.83	187.36	0.02	0.06
UT2-R2	UT-2	1940.74	100-Yr Q	836	575.35	588.06	580.29	588.09	0.000105	1.91	1171.04	191.78	0.03	0.07
UT2-R2	UT-2	1914		Culvert										
UT2-R3	UT-2	1887.97	Design Q	60	575.01	577.95	576.2	577.98	0.000634	1.54	39.76	20.11	0.11	0.08
UT2-R3	UT-2	1887.97	2-Yr Q	171	575.01	579.29	577.09	579.4	0.001062	2.71	69.24	23.88	0.43	0.22
UT2-R3	UT-2	1887.97	10-Yr Q	430	575.01	580.78	578.4	581.11	0.002017	4.71	109.02	57.55	1.75	0.6
UT2-R3	UT-2	1887.97	50-Yr Q	713	575.01	581.74	579.47	582.35	0.003017	6.46	135.82	69.9	4.33	1.06
UT2-R3	UT-2	1887.97	100-Yr Q	836	575.01	582.05	579.69	582.8	0.00347	7.17	144.62	72.99	5.84	1.28
UT2-R3	UT-2	1785.35	Design Q	65	575.46	577.76		577.85	0.004286	2.41	26.93	15.64	1.03	0.43
UT2-R3	UT-2	1785.35	2-Yr Q	181	575.46	579.06		579.22	0.004285	3.37	75.34	62.56	0.75	0.7
UT2-R3	UT-2	1785.35	10-Yr Q	454	575.46	580.62		580.81	0.003624	4.14	207.88	105.35	0.96	0.92
UT2-R3	UT-2	1785.35	50-Yr Q	751	575.46	581.65		581.87	0.003583	4.74	331.13	133.47	1.24	1.12
UT2-R3	UT-2	1785.35	100-Yr Q	881	575.46	582.01		582.23	0.003558	4.92	380.37	140.01	1.38	1.19
UT2-R3	UT-2	1661.22	Design Q	65	574.93	577.22		577.31	0.004324	2.42	26.85	15.63	1.04	0.43
UT2-R3	UT-2	1661.22	2-Yr Q	181	574.93	578.52		578.68	0.004319	3.38	75.01	62.39	0.76	0.71
UT2-R3	UT-2	1661.22	10-Yr Q	454	574.93	580.21		580.38	0.003174	3.95	221.11	108.59	0.81	0.83
UT2-R3	UT-2	1661.22	50-Yr Q	751	574.93	581.25		581.44	0.00319	4.54	348	135.75	1.09	1.02
UT2-R3	UT-2	1661.22	100-Yr Q	881	574.93	581.61		581.81	0.00319	4.73	398.2	142.31	1.22	1.09
UT2-R3	UT-2	1552.8	Design Q	65	574.46	576.76		576.85	0.004288	2.41	26.93	15.64	1.03	0.43
UT2-R3	UT-2	1552.8	2-Yr Q	181	574.46	578.06		578.22	0.004284	3.37	75.35	62.56	0.75	0.7
UT2-R3	UT-2	1552.8	10-Yr Q	454	574.46	579.92		580.06	0.002653	3.7	240.29	113.42	0.65	0.72
UT2-R3	UT-2	1552.8	50-Yr Q	751	574.46	580.94		581.11	0.002746	4.29	370.84	138.77	0.91	0.9
UT2-R3	UT-2	1552.8	100-Yr Q	881	574.46	581.3		581.48	0.00278	4.5	421.71	145.28	1.04	0.97
UT2-R3	UT-2	1408.17	Design Q	65	573.84	576.15		576.24	0.004227	2.4	27.06	15.67	1.01	0.42
UT2-R3	UT-2	1408.17	2-Yr Q	181	573.84	577.44		577.6	0.004251	3.36	75.68	62.73	0.74	0.7
UT2-R3	UT-2	1408.17	10-Yr Q	454	573.84	579.62		579.73	0.001935	3.3	277.81	122.32	0.44	0.56
UT2-R3	UT-2	1408.17	50-Yr Q	751	573.84	580.62		580.76	0.002128	3.91	412.66	144.14	0.68	0.74
UT2-R3	UT-2	1408.17	100-Yr Q	881	573.84	580.97		581.11	0.002212	4.13	463.91	150.96	0.79	0.81
UT2-R3	UT-2	1237.66	Design Q	65	573.11	575.44		575.53	0.004061	2.37	27.45	15.74	0.97	0.41
UT2-R3	UT-2	1237.66	2-Yr Q	181	573.11	576.73		576.89	0.004147	3.33	76.72	63.25	0.72	0.69
UT2-R3	UT-2	1237.66	10-Yr Q	454	573.11	579.38		579.46	0.001214	2.78	342.1	134.96	0.25	0.39
UT2-R3	UT-2	1237.66	50-Yr Q	751	573.11	580.35		580.44	0.001479	3.42	480.37	153.23	0.45	0.55
UT2-R3	UT-2	1237.66	100-Yr Q	881	573.11	580.68		580.79	0.001591	3.66	532	160.07	0.54	0.62
UT2-R3	UT-2	1073.14	Design Q	65	572.4	574.84		574.91	0.003438	2.23	29.11	16.06	0.8	0.36
UT2-R3	UT-2	1073.14	2-Yr Q	181	572.4	576.1		576.24	0.003687	3.2	81.84	65.76	0.62	0.63
UT2-R3	UT-2	1073.14	10-Yr Q	454	572.4	579.25		579.3	0.000734	2.31	422.78	145.41	0.14	0.26
UT2-R3	UT-2	1073.14	50-Yr Q	751	572.4	580.17		580.24	0.001	2.96	564.8	164.17	0.28	0.4
UT2-R3	UT-2	1073.14	100-Yr Q	881	572.4	580.48		580.56	0.001108	3.21	616.96	170.34	0.35	0.47
UT2-R4	UT-2	903.34	Design Q	74	571.67	574.21		574.3	0.003801	2.4	30.79	16.37	0.99	0.41
UT2-R4	UT-2	903.34	2-Yr Q	192	571.67	575.5		575.63	0.003451	3.18	90.5	70.21	0.57	0.61
UT2-R4	UT-2	903.34	10-Yr Q	478	571.67	579.16		579.19	0.000496	2.03	519.7	158.5	0.09	0.19
UT2-R4	UT-2	903.34	50-Yr Q	790	571.67	580.03		580.09	0.000736	2.68	666.25	175.6	0.2	0.32
UT2-R4	UT-2	903.34	100-Yr Q	926	571.67	580.33		580.39	0.000837	2.93	718.75	181.03	0.26	0.38
UT2-R4	UT-2	684.02	Design Q	74	570.73	573.57		573.64	0.002407	2.06	37.41	38.36	0.28	0.29
UT2-R4	UT-2	684.02	2-Yr Q	192	570.73	574.98		575.07	0.001927	2.59	122.63	81.6	0.28	0.39
UT2-R4	UT-2	684.02	10-Yr Q	478	570.73	579.09		579.11	0.00027	1.63	665.37	175.5	0.05	0.12
UT2-R4	UT-2	684.02	50-Yr Q	790	570.73	579.93		579.96	0.000439	2.22	818.56	190.93	0.11	0.21

Poplin Ridge Site UT2 (HEC-RAS Output)

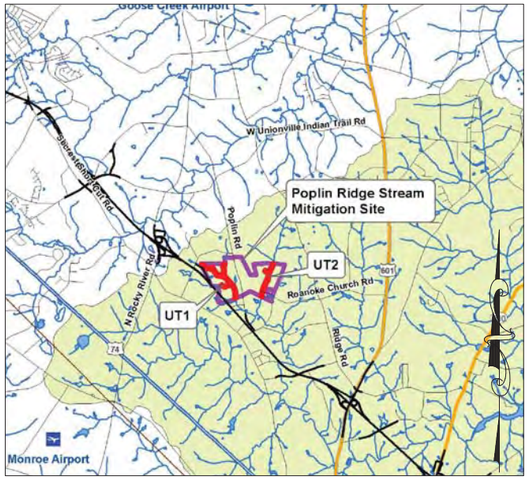
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Power Total (lb/ft s)	Shear Chan (lb/sq ft)
UT2-R4	UT-2	684.02	100-Yr Q	926	570.73	580.2		580.24	0.000515	2.46	872.13	196.04	0.15	0.26
UT2-R4	UT-2	525.85	Design Q	74	570.35	573.19		573.26	0.002406	2.06	37.42	38.37	0.28	0.29
UT2-R4	UT-2	525.85	2-Yr Q	192	570.35	574.7		574.78	0.00169	2.47	131.02	84.31	0.23	0.35
UT2-R4	UT-2	525.85	10-Yr Q	478	570.35	579.05		579.07	0.000217	1.5	726.9	181.86	0.04	0.1
UT2-R4	UT-2	525.85	50-Yr Q	790	570.35	579.87		579.9	0.000365	2.08	880.67	196.84	0.09	0.18
UT2-R4	UT-2	525.85	100-Yr Q	926	570.35	580.13		580.17	0.000433	2.31	933.68	201.75	0.12	0.22
UT2-R4	UT-2	295.58	Design Q	74	569.8	572.63		572.7	0.00244	2.07	37.1	37.9	0.29	0.29
UT2-R4	UT-2	295.58	2-Yr Q	192	569.8	574.38		574.44	0.001273	2.23	150.69	90.25	0.17	0.28
UT2-R4	UT-2	295.58	10-Yr Q	478	569.8	579.01		579.03	0.000159	1.34	822.09	191.27	0.02	0.08
UT2-R4	UT-2	295.58	50-Yr Q	790	569.8	579.8		579.82	0.000281	1.89	977.44	205.71	0.07	0.15
UT2-R4	UT-2	295.58	100-Yr Q	926	569.8	580.05		580.08	0.000338	2.11	1029.93	210.37	0.09	0.18
UT2-R4	UT-2	243.73	Design Q	74	569.68	572.5	570.99	572.57	0.00248	2.08	36.07	37.42	0.42	0.3
UT2-R4	UT-2	243.73	2-Yr Q	192	569.68	574.26	571.92	574.36	0.001747	2.62	91.19	90.34	0.62	0.39
UT2-R4	UT-2	243.73	10-Yr Q	478	569.68	579.01	573.43	579.02	0.000149	1.31	843.73	193.35	0.02	0.07
UT2-R4	UT-2	243.73	50-Yr Q	790	569.68	579.78	574.36	579.81	0.000265	1.85	999.49	207.68	0.06	0.14
UT2-R4	UT-2	243.73	100-Yr Q	926	569.68	580.03	574.72	580.06	0.00032	2.07	1051.89	212.29	0.09	0.18
UT2-R4	UT-2	215.8		Culvert										
UT2-R4	UT-2	187.8	Design Q	74	569.55	572.07	570.86	572.16	0.00391	2.43	30.49	16.31	1.02	0.42
UT2-R4	UT-2	187.8	2-Yr Q	192	569.55	573.3	571.79	573.48	0.004374	3.53	64.69	67.34	1.55	0.76
UT2-R4	UT-2	187.8	10-Yr Q	478	569.55	574.65	573.3	575.08	0.006726	5.59	107.79	103.72	5.95	1.68
UT2-R4	UT-2	187.8	50-Yr Q	790	569.55	575.51	574.21	576.25	0.009365	7.44	135.48	127.57	13.68	2.81
UT2-R4	UT-2	187.8	100-Yr Q	926	569.55	575.8	574.59	576.69	0.010603	8.2	144.47	134.43	18.16	3.35
UT2-R4	UT-2	88.95	Design Q	74	569.31	571.56	570.61	571.68	0.006008	2.82	26.2	15.5	1.66	0.59
UT2-R4	UT-2	88.95	2-Yr Q	192	569.31	572.76	571.54	572.98	0.006007	3.85	66.62	57.96	1.2	0.94
UT2-R4	UT-2	88.95	10-Yr Q	478	569.31	574.11	573.13	574.41	0.006001	5.04	171.96	96.07	1.83	1.4
UT2-R4	UT-2	88.95	50-Yr Q	790	569.31	575.06	573.92	575.4	0.006001	5.79	274.77	121.62	2.39	1.73
UT2-R4	UT-2	88.95	100-Yr Q	926	569.31	575.4	574.19	575.75	0.006005	6.05	317.19	130.93	2.61	1.84

14.6 Appendix D – Poplin Ridge Design Plan Sheets (11”x17”)

POPLIN RIDGE STREAM RESTORATION PROJECT

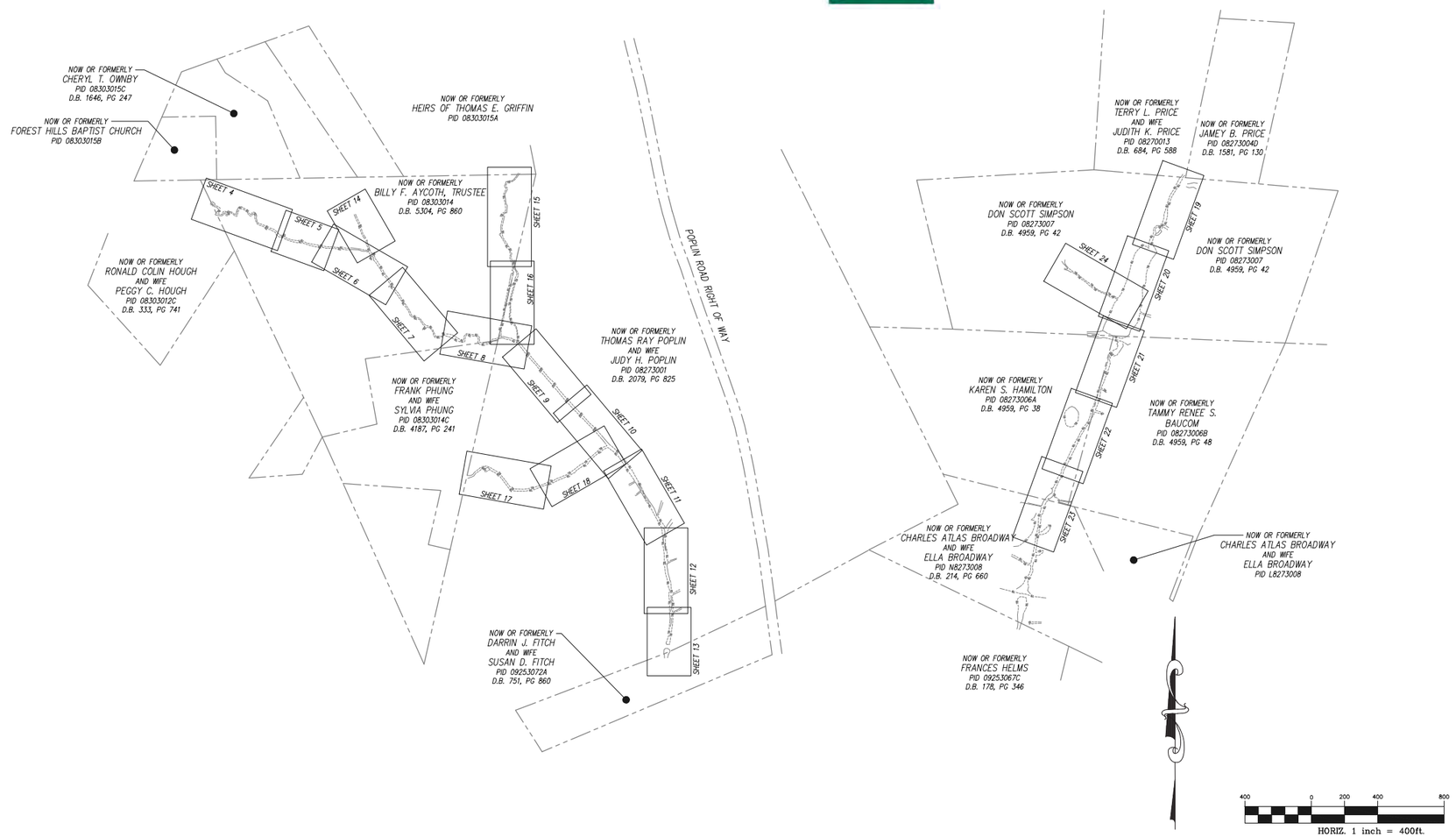
NCEEP PROJECT # 95359
FEBRUARY 2014
LOCATION: UNION COUNTY, NORTH CAROLINA

ENVIRONMENTAL BANC & EXCHANGE, LLC
909 CAPABILITY DRIVE, SUITE 3100
RALEIGH, NC 27606



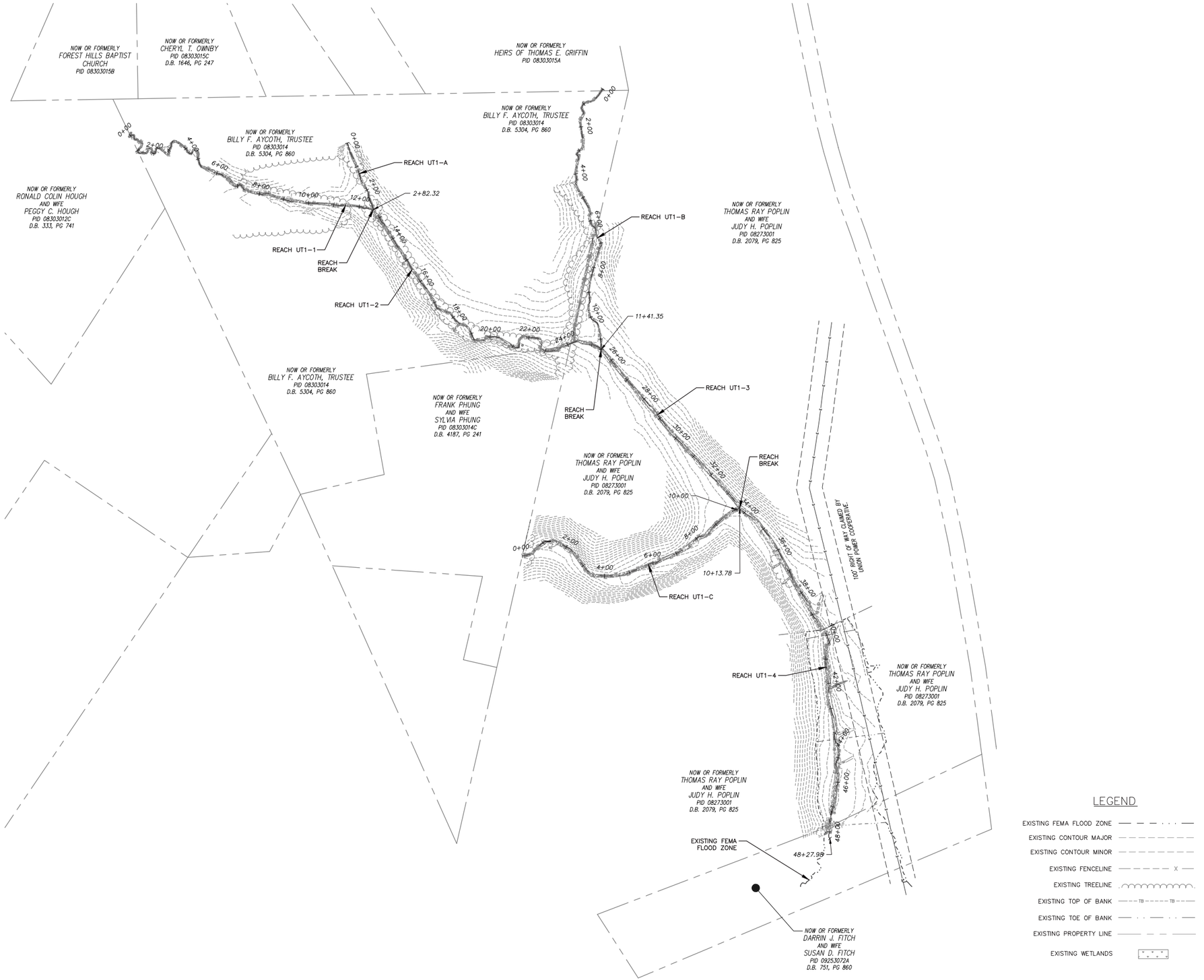
VICINITY MAP
NTS

SHEET LIST TABLE	
Sheet Number	Sheet Title
1	COVER
2	EXISTING CONDITIONS UT1
3	EXISTING CONDITIONS UT2
4	PLAN AND PROFILE UT1-1
5	PLAN AND PROFILE UT1-1
6	PLAN AND PROFILE UT1-2
7	PLAN AND PROFILE UT1-2
8	PLAN AND PROFILE UT1-2
9	PLAN AND PROFILE UT1-3
10	PLAN AND PROFILE UT1-3
11	PLAN AND PROFILE UT1-4
12	PLAN AND PROFILE UT1-4
13	PLAN AND PROFILE UT1-4
14	PLAN AND PROFILE UT1-A
15	PLAN AND PROFILE UT1-B
16	PLAN AND PROFILE UT1-B
17	PLAN AND PROFILE UT1-C
18	PLAN AND PROFILE UT1-C
19	PLAN AND PROFILE UT2-1
20	PLAN AND PROFILE UT2-2
21	PLAN AND PROFILE UT2-2
22	PLAN AND PROFILE UT2-3
23	PLAN AND PROFILE UT2-4
24	PLAN AND PROFILE UT2-A
25	PLANTING PLAN UT1
26	PLANTING PLAN UT2
27	MONITORING LOCATIONS
28	EROSION & SEDIMENT CONTROL PLAN - UT1
29	EROSION & SEDIMENT CONTROL PLAN - UT2
30	EROSION & SEDIMENT CONTROL NOTES
31	DETAIL 1
32	DETAIL 2
33	DETAIL 3
34	DETAIL 4
35	DETAIL 5



PRELIMINARY
NOT FOR CONSTRUCTION

DESIGN CONSULTANT
WK DICKSON
community infrastructure consultants
720 CORPORATE CENTER DR
RALEIGH, NC 27607
(919) 782-0495
NC LICENSE NO. F-0374



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720 Corporate Drive
Raleigh, NC 27607
(v) 919.782.0495
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www.wkdickson.com
NC. LICENSE NO. F-0374

EBX

FULL SCALE: 1"=200
0 200
2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR:
PRELIMINARY- NOT FOR CONSTRUCTION

PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

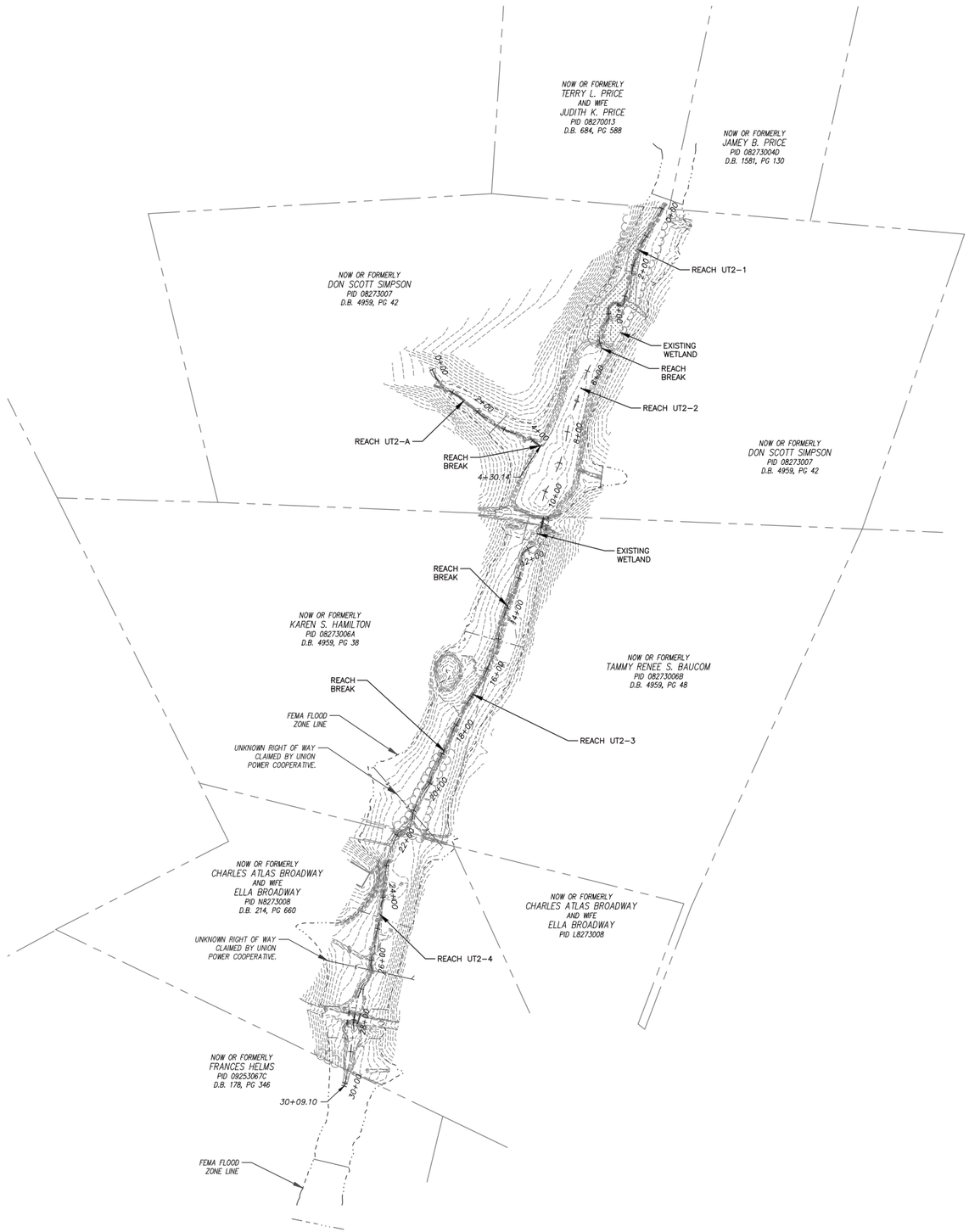
DRAWING TITLE:
EXISTING CONDITIONS UT1

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE:	JUNE 2013
Q.C.:	FM
Q.C. DATE:	05-30-13

DRAWING NUMBER:
2

PROJ. NO.:
20120118.00.RA



LEGEND

- EXISTING FEMA FLOOD ZONE
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING FENCELINE
- EXISTING TREELINE
- EXISTING TOP OF BANK
- EXISTING TOE OF BANK
- EXISTING PROPERTY LINE
- EXISTING WETLANDS

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0 200
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MARK	DATE	DESCRIPTION

REVISIONS:

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PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

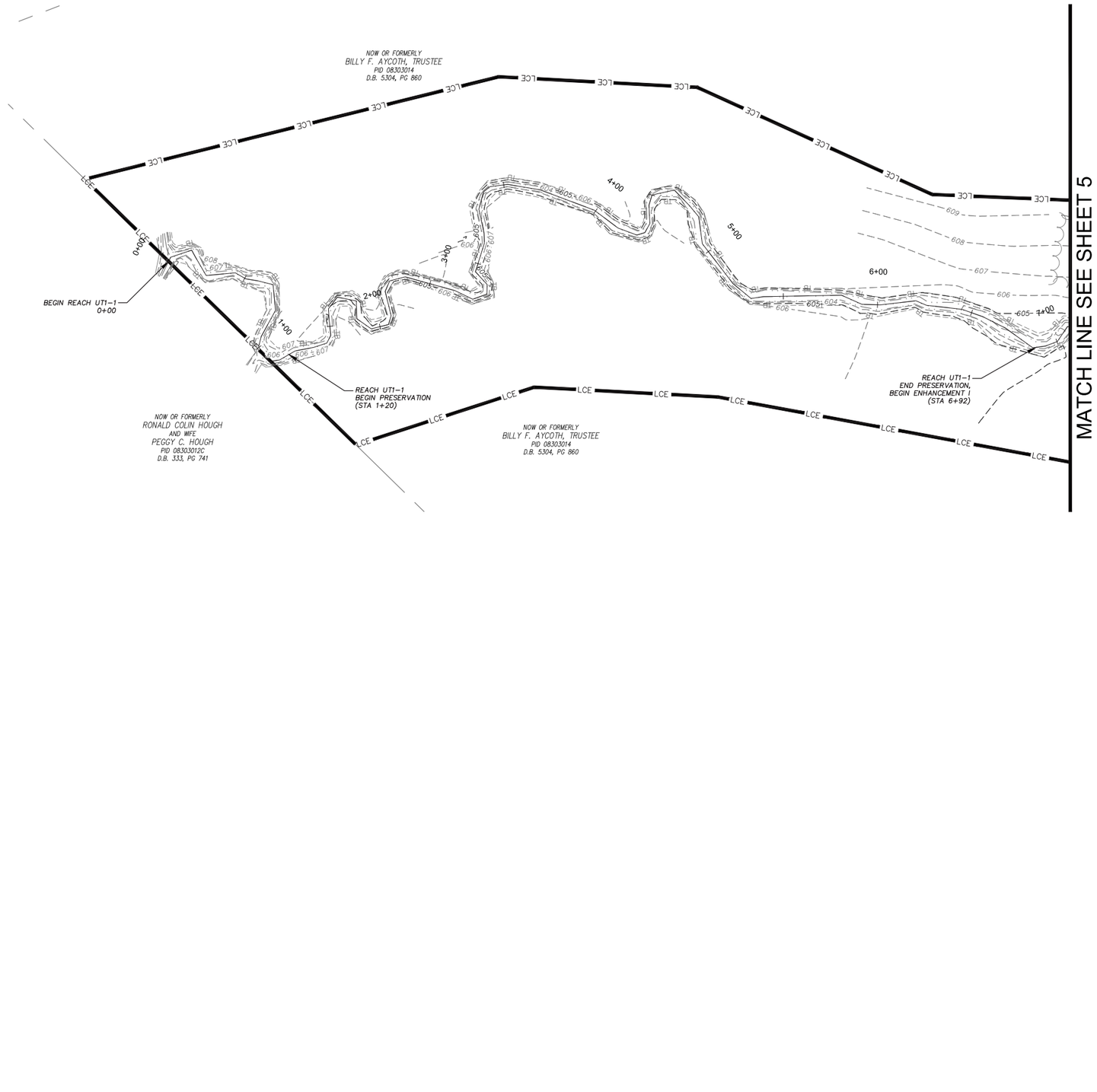
DRAWING TITLE:
EXISTING CONDITIONS UT2

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
3

PROJ. NO.:
20120118.00.RA



NOTES:

1. IN GENERAL, STREAM CONSTRUCTION SHALL PROCEED FROM AN UPSTREAM TO DOWNSTREAM DIRECTION.
2. ALL EXCAVATED MATERIAL MUST BE PLACED WITHIN DESIGNATED STOCKPILE AREAS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
3. ALL IMPERVIOUS DIKES AND BYPASS PUMPING EQUIPMENT SHALL BE MODIFIED AT THE END OF EACH DAY TO RESTORE NORMAL FLOW BACK TO THE CHANNEL.
4. NO MORE CHANNEL SHALL BE DISTURBED THAN CAN BE STABILIZED BY THE END OF THE WORK DAY OR PRIOR TO RESTORING FLOW TO NEWLY CONSTRUCTED CHANNEL SEGMENTS.
5. CONTRACTOR SHALL NOT COMPACT SOIL AROUND ROOTS OR TREES TO REMAIN, AND SHALL NOT DAMAGE SUCH TREES IN ANY WAY. EXCAVATED OR OTHER MATERIAL SHALL NOT BE PLACED, PILED OR STORED WITHIN THE CRITICAL ROOT ZONE AREA OF THE TREES TO BE SAVED.
6. THE PROPOSED CROSS-SECTIONS SHALL TIE INTO EXISTING GRADE AT A MAXIMUM SLOPE OF 5H:1V. FOR ALL AREAS WHERE THE PROPOSED TOP OF BANK ELEVATION IS GREATER THAN 0.75' BELOW EXISTING GRADE, A BANKFULL BENCH MUST BE CONSTRUCTED. SEE TYPICAL CROSS SECTION GRADING DETAIL ON SHEET 35 FOR DIMENSIONS.
7. UNLESS NOTED OTHERWISE, FILL MATERIAL GENERATED FROM CHANNEL EXCAVATION AND STABILIZATION SHALL BE PLACED INSIDE THE EXISTING CHANNEL TO BE ABANDONED AT AN ELEVATION THAT PROVIDES POSITIVE DRAINAGE TOWARDS THE PROPOSED CHANNEL.
8. FILL ALL ABANDONED DITCHES WITHIN THE PROPOSED EASEMENT PER CHANNEL BACKFILL DETAIL SHOWN ON SHEET 32 UNLESS DIRECTED OTHERWISE BY THE ENGINEER.
9. IF BEDROCK IS ENCOUNTERED DURING CHANNEL CONSTRUCTION, STRUCTURES MAY BE RELOCATED OR ELIMINATED PER DIRECTION OF THE ENGINEER

LEGEND

- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
- PROPOSED SPOT SHOT (×1.64 BERM, 2980)
- EXISTING TOP OF BANK (TB)
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT (LCE)
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
- LOG STRUCTURE (SEE DETAIL SHEET 34)
- LOG GRADE CONTROL STRUCTURE (SEE DETAIL SHEET 32)
- EXISTING CHANNEL BENCH
- PROPOSED FILL AREA
- PROPOSED CHANNEL PLUG (SEE DETAIL SHEET 32)
- LEAF PACK (SEE DETAIL SHEET 33)
- SMALL WOODY DEBRIS (SEE DETAIL SHEET 33)
- LIVE CUTTINGS BUNDLE (SEE DETAIL SHEET 33)
- EXISTING TREE
- FLOODPLAIN SILL (SEE DETAIL SHEET 34)
- DIFFUSE FLOW STRUCTURE (SEE DETAIL SHEET 34)
- ROCK STEP POOL (SEE DETAIL SHEET 33)
- ROCK CROSS VANE (SEE DETAIL SHEET 32)
- RIFFLE GRADE CONTROL (SEE DETAIL SHEET 35)
- ROCK GRADE CONTROL (SEE DETAIL SHEET 34)

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EBX

FULL SCALE: 1"=30 H, 1"=3 V
0 30
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 2/25/14

MARK	DATE	DESCRIPTION

REVISIONS:

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DRAWING TITLE:
PLAN AND PROFILE UT1-1

OWNER / 24 HR CONTACT:
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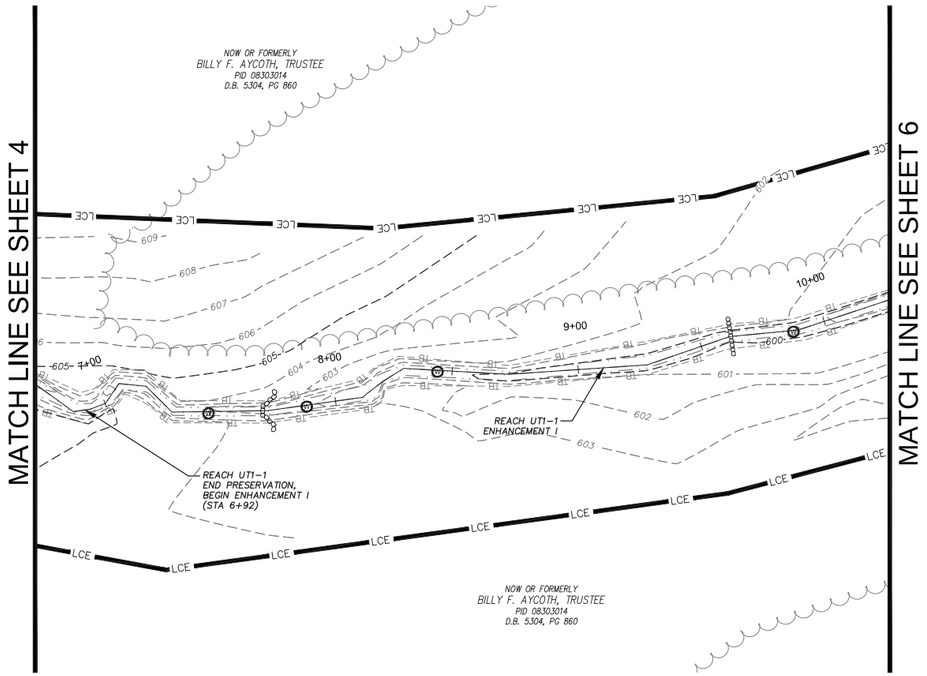
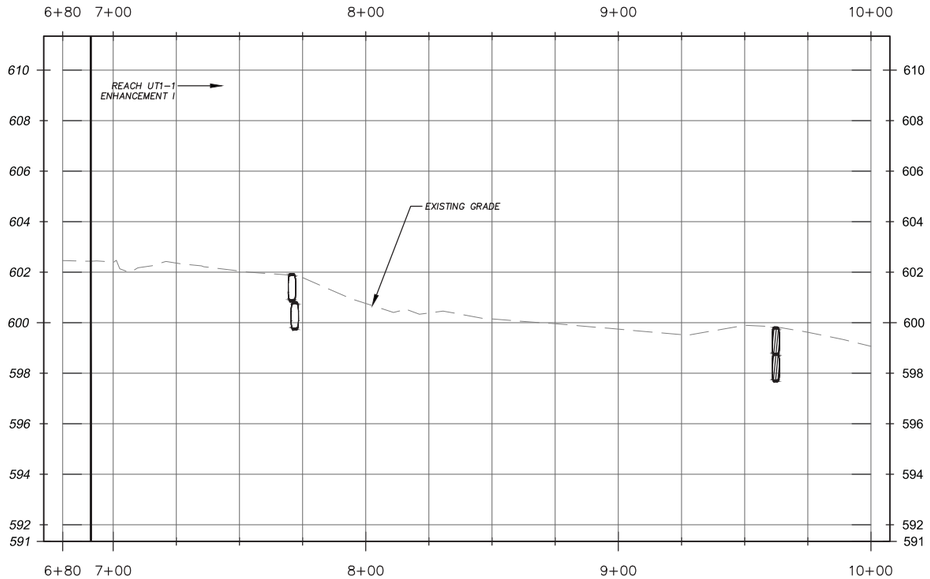
PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
4

PROJ. NO.:
20120118.00.RA





REACH UT1–1 NOTE:

PROPOSED ENHANCEMENT GRADING SHALL FOLLOW TYPICAL BANK GRADING OPTION 1 DETAIL ON SHEET 35. LAY BACK LEFT BANK FROM STATION 6+90 TO APPROXIMATELY 8+75.

NOTES:

1. IN GENERAL, STREAM CONSTRUCTION SHALL PROCEED FROM AN UPSTREAM TO DOWNSTREAM DIRECTION.
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7. UNLESS NOTED OTHERWISE, FILL MATERIAL GENERATED FROM CHANNEL EXCAVATION AND STABILIZATION SHALL BE PLACED INSIDE THE EXISTING CHANNEL TO BE ABANDONED AT AN ELEVATION THAT PROVIDES POSITIVE DRAINAGE TOWARDS THE PROPOSED CHANNEL.
8. FILL ALL ABANDONED DITCHES WITHIN THE PROPOSED EASEMENT PER CHANNEL BACKFILL DETAIL SHOWN ON SHEET 32 UNLESS DIRECTED OTHERWISE BY THE ENGINEER.
9. IF BEDROCK IS ENCOUNTERED DURING CHANNEL CONSTRUCTION, STRUCTURES MAY BE RELOCATED OR ELIMINATED PER DIRECTION OF THE ENGINEER

LEGEND

- EXISTING CONTOUR MAJOR — 50
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- PROPOSED CONTOUR MINOR — 42
- PROPOSED SPOT SHOT — 2980 ×1.64 BERM
- EXISTING TOP OF BANK — TB
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT — LCE
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
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MARK	DATE	DESCRIPTION

REVISIONS:
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PRELMINARY - NOT FOR CONSTRUCTION
PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

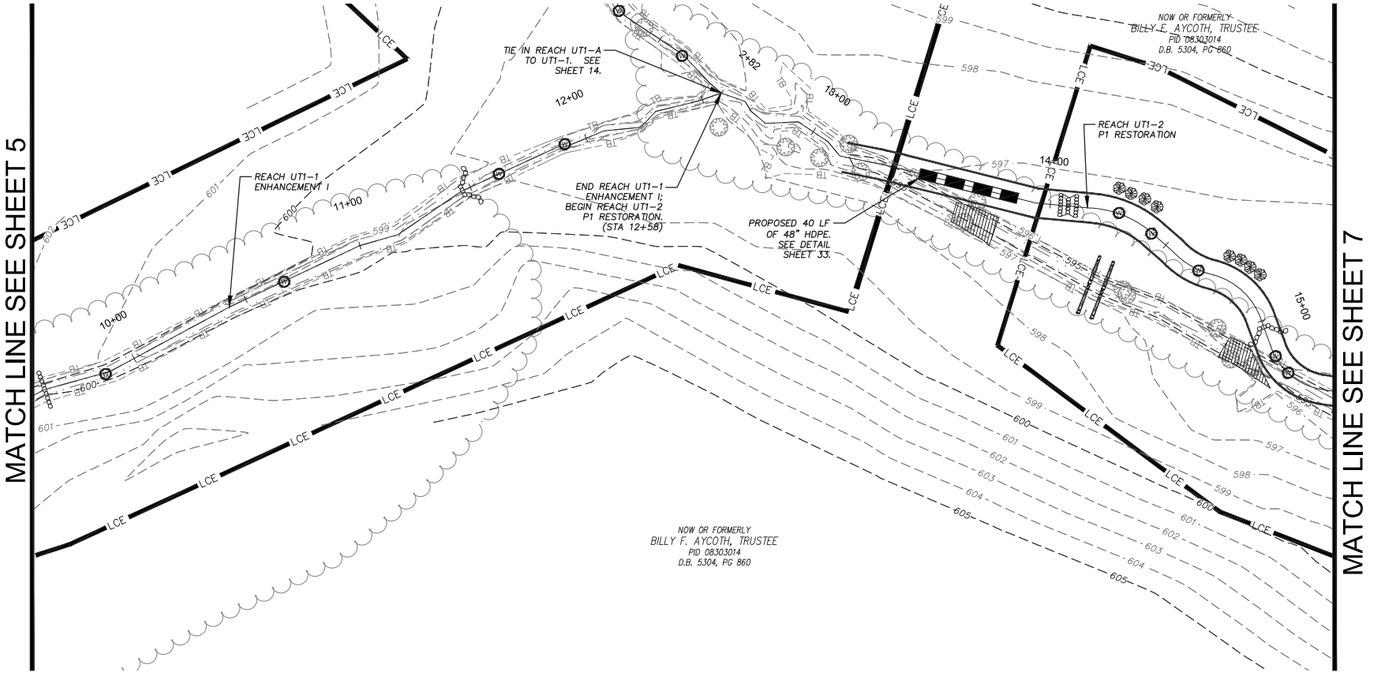
DRAWING TITLE:
PLAN AND PROFILE UT1-1

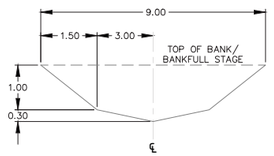
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

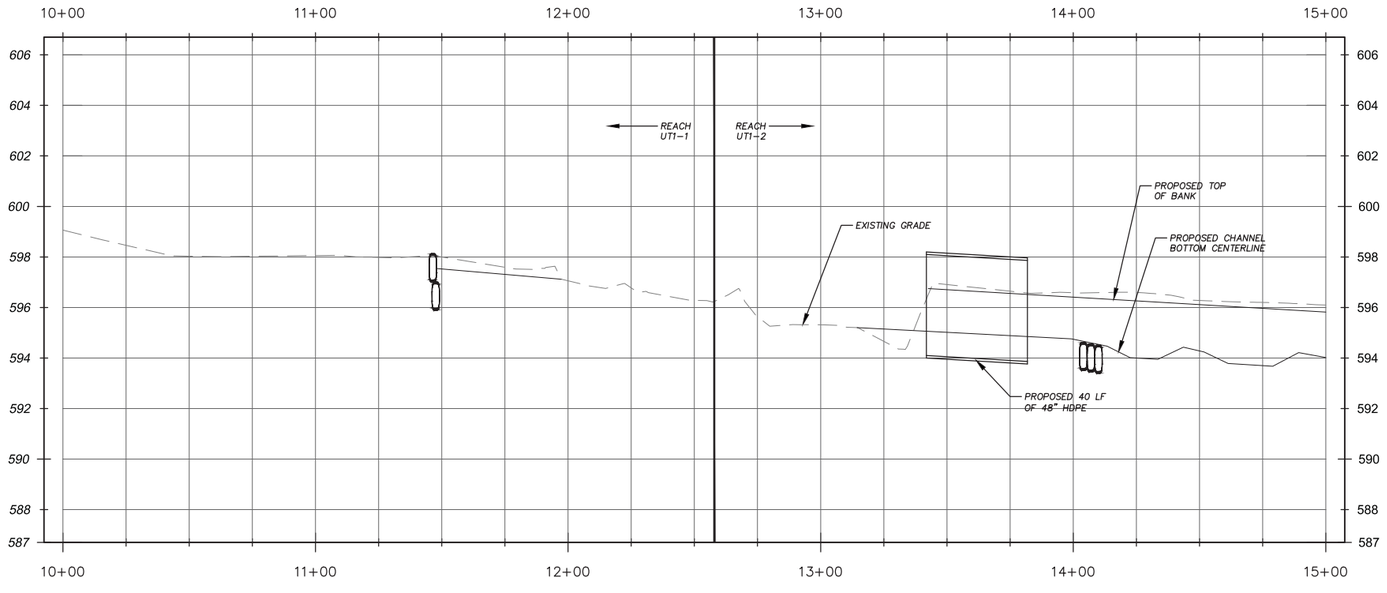
DRAWING NUMBER:
5

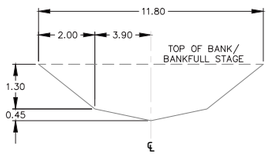
PROJ. NO.:
20120118.00.RA



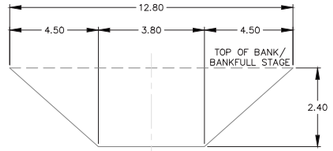


TYPICAL CROSS SECTION
FROM STA 11+40 TO STA 11+95

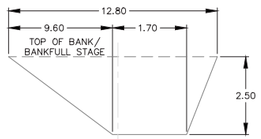




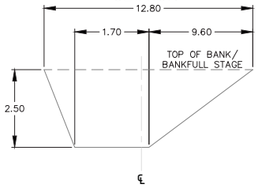
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION
TYP. SECTIONS STA 13+15 TO 24+89
REACH UT1-2

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- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
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- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
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PROJECT NAME: POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

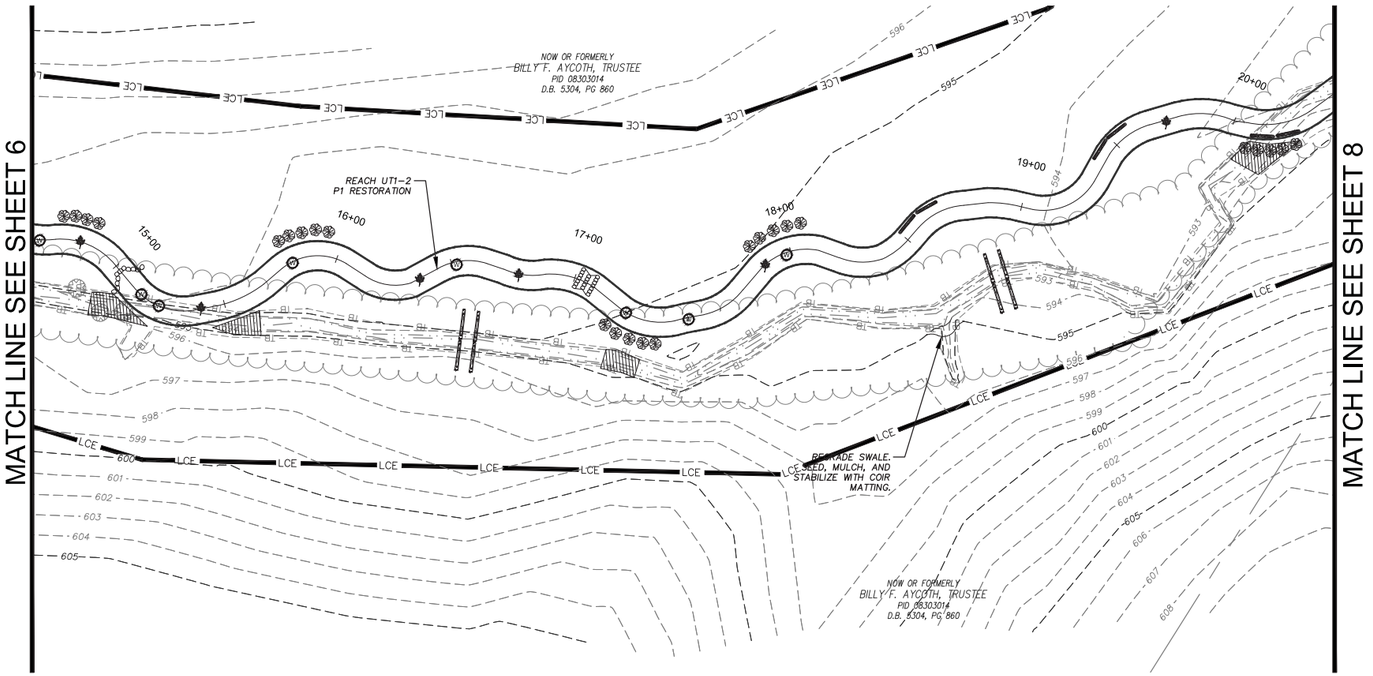
DRAWING TITLE: PLAN AND PROFILE UT1-2

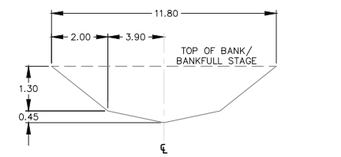
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

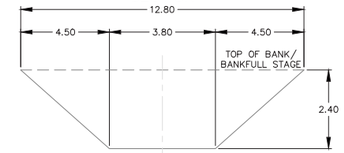
DRAWING NUMBER: 6

PROJ. NO.: 20120118.00.RA

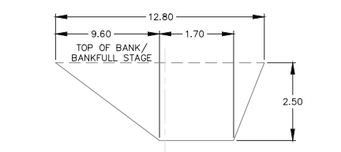




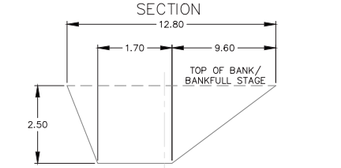
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

TYP. SECTIONS STA 13+15 TO 24+89

REACH UT1-2

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LEGEND

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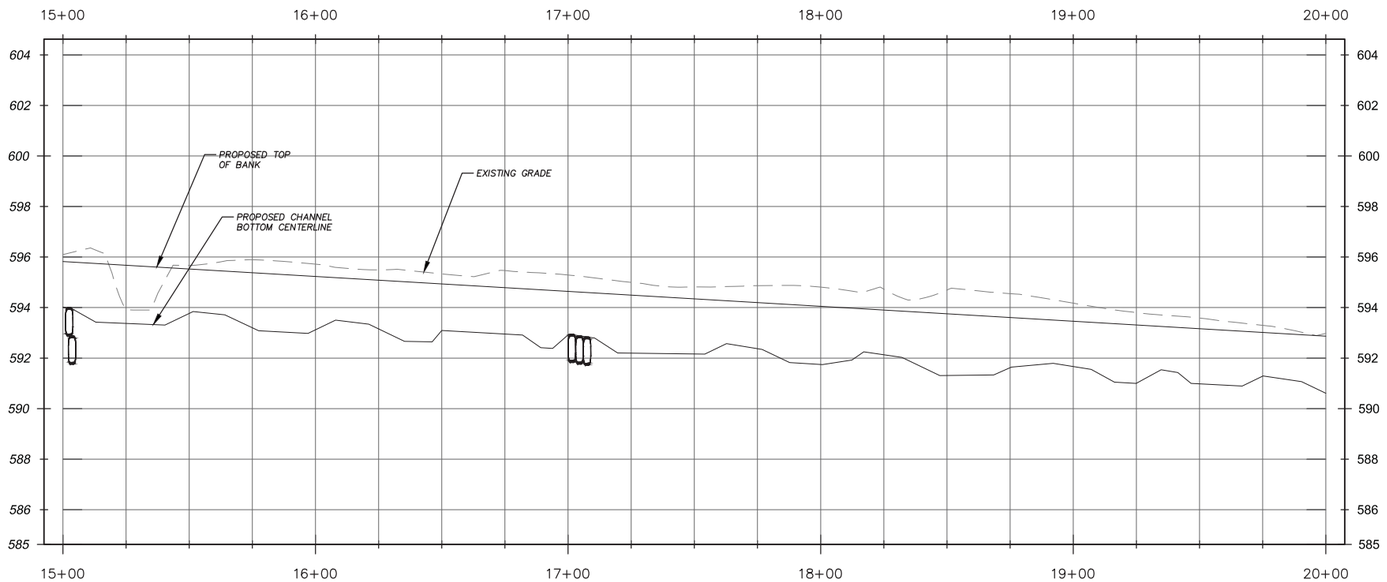

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PLOT DATE:
2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
PLAN AND PROFILE UT1-2

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

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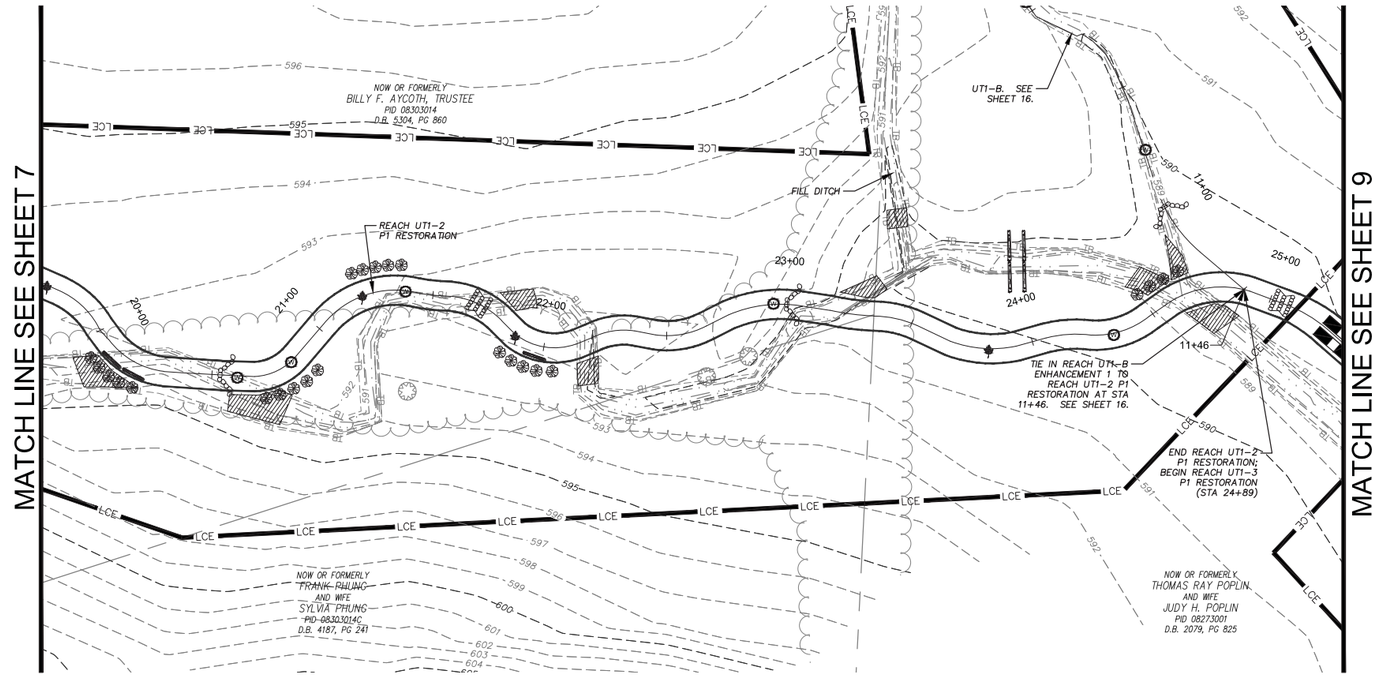
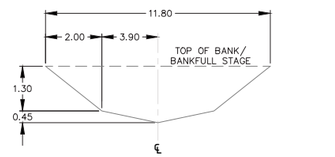
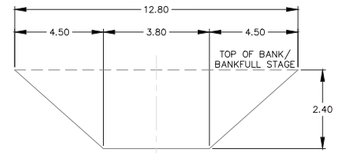
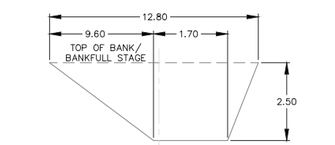




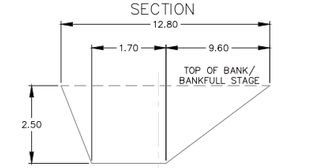
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

TYP. SECTIONS STA 13+15 TO 24+89

REACH UT1-2

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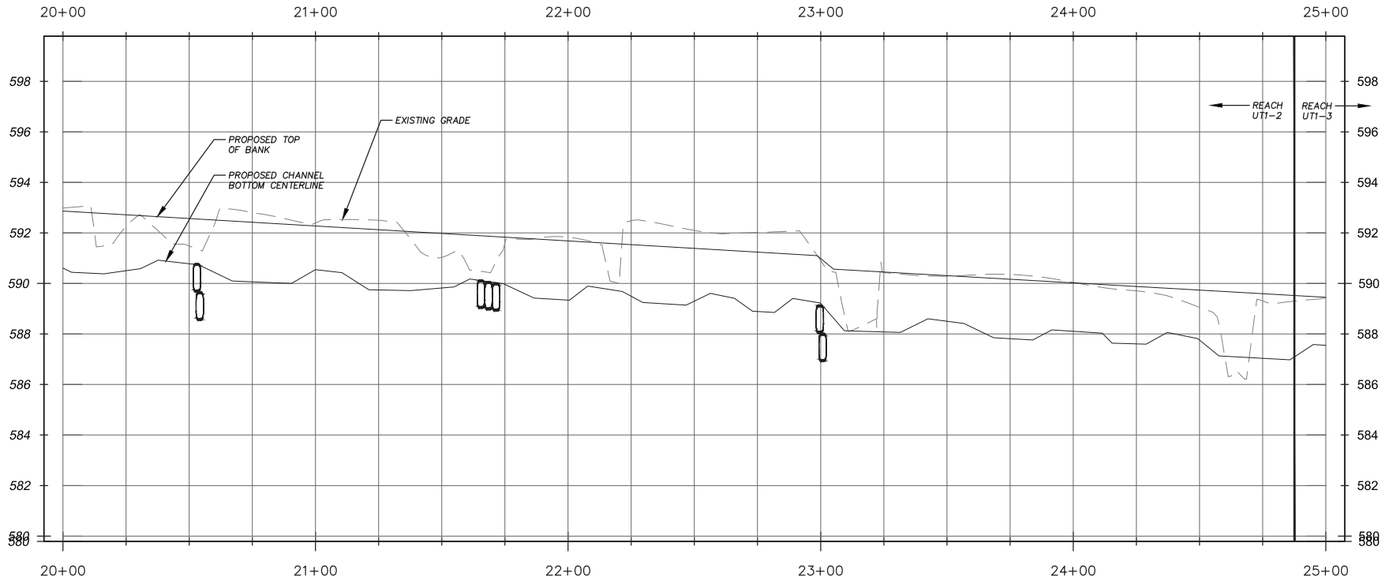

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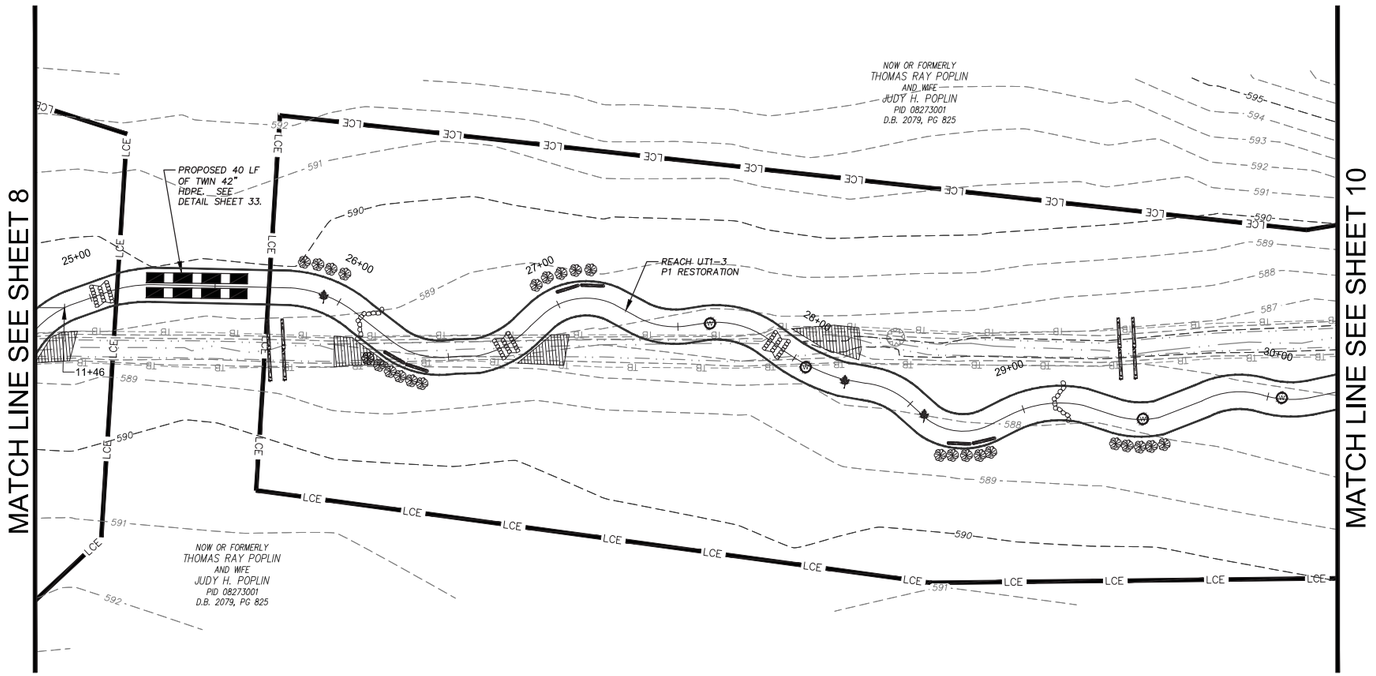
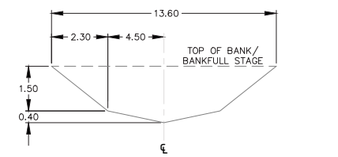
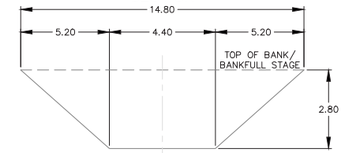
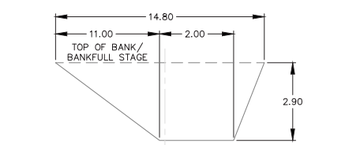




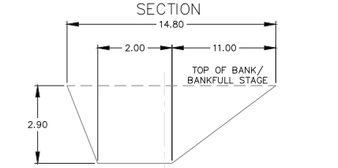
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

TYP. SECTIONS STA 24+89 TO 34+50

REACH UT1-3

NOTES:

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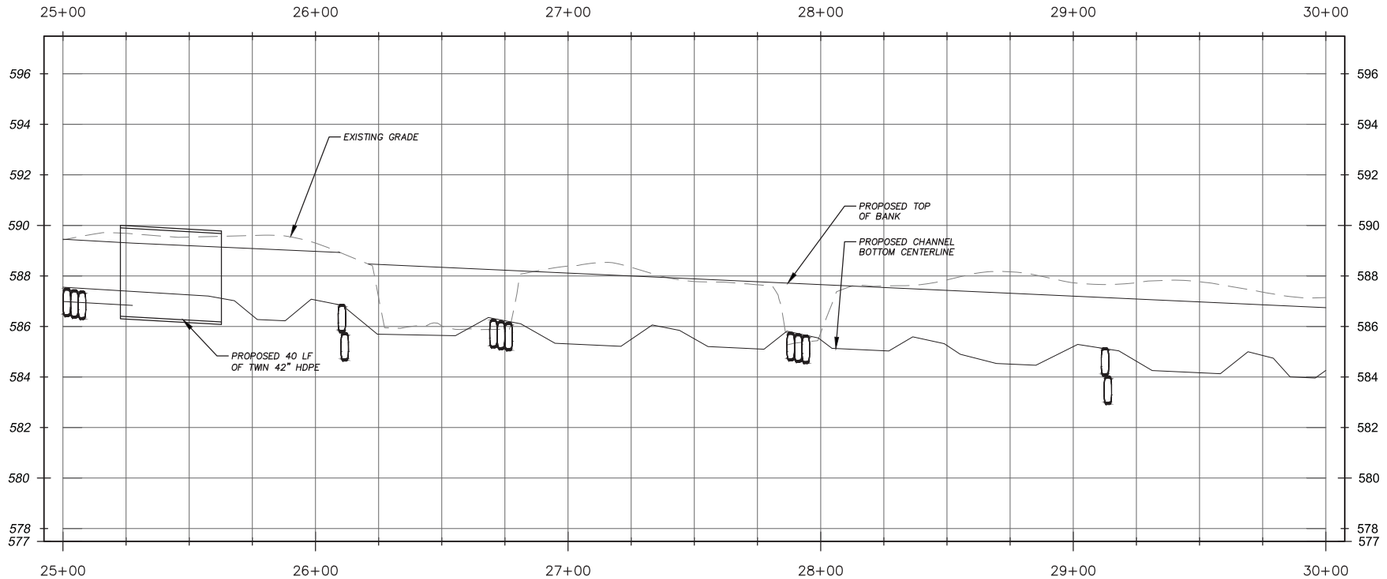
8. FILL ALL ABANDONED DITCHES WITHIN THE PROPOSED EASEMENT PER CHANNEL BACKFILL DETAIL SHOWN ON SHEET 32 UNLESS DIRECTED OTHERWISE BY THE ENGINEER.
9. IF BEDROCK IS ENCOUNTERED DURING CHANNEL CONSTRUCTION, STRUCTURES MAY BE RELOCATED OR ELIMINATED PER DIRECTION OF THE ENGINEER

LEGEND

EXISTING CONTOUR MAJOR
EXISTING CONTOUR MINOR
PROPOSED CONTOUR MAJOR
PROPOSED CONTOUR MINOR
PROPOSED SPOT SHOT
EXISTING TOP OF BANK
EXISTING BOTTOM OF BANK
PROPOSED CENTERLINE OF CHANNEL
EXISTING FENCELINE
EXISTING TREELINE
PROPOSED CHANNEL BOTTOM
PROPOSED TOP OF BANK
LIMITS OF PROPOSED CONSERVATION EASEMENT
LOG TOE PROTECTION (SEE DETAIL SHEET 32)
LOG STRUCTURE (SEE DETAIL SHEET 34)
LOG GRADE CONTROL STRUCTURE (SEE DETAIL SHEET 32)
EXISTING CHANNEL BENCH
PROPOSED FILL AREA
PROPOSED CHANNEL PLUG (SEE DETAIL SHEET 32)
LEAF PACK (SEE DETAIL SHEET 33)
SMALL WOODY DEBRIS (SEE DETAIL SHEET 33)
LIVE CUTTINGS BUNDLE (SEE DETAIL SHEET 33)
EXISTING TREE
FLOODPLAIN SILL (SEE DETAIL SHEET 34)
DIFFUSE FLOW STRUCTURE (SEE DETAIL SHEET 34)
ROCK STEP POOL (SEE DETAIL SHEET 33)
ROCK CROSS VANE (SEE DETAIL SHEET 32)
RIFFLE GRADE CONTROL (SEE DETAIL SHEET 35)
ROCK GRADE CONTROL (SEE DETAIL SHEET 34)



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DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

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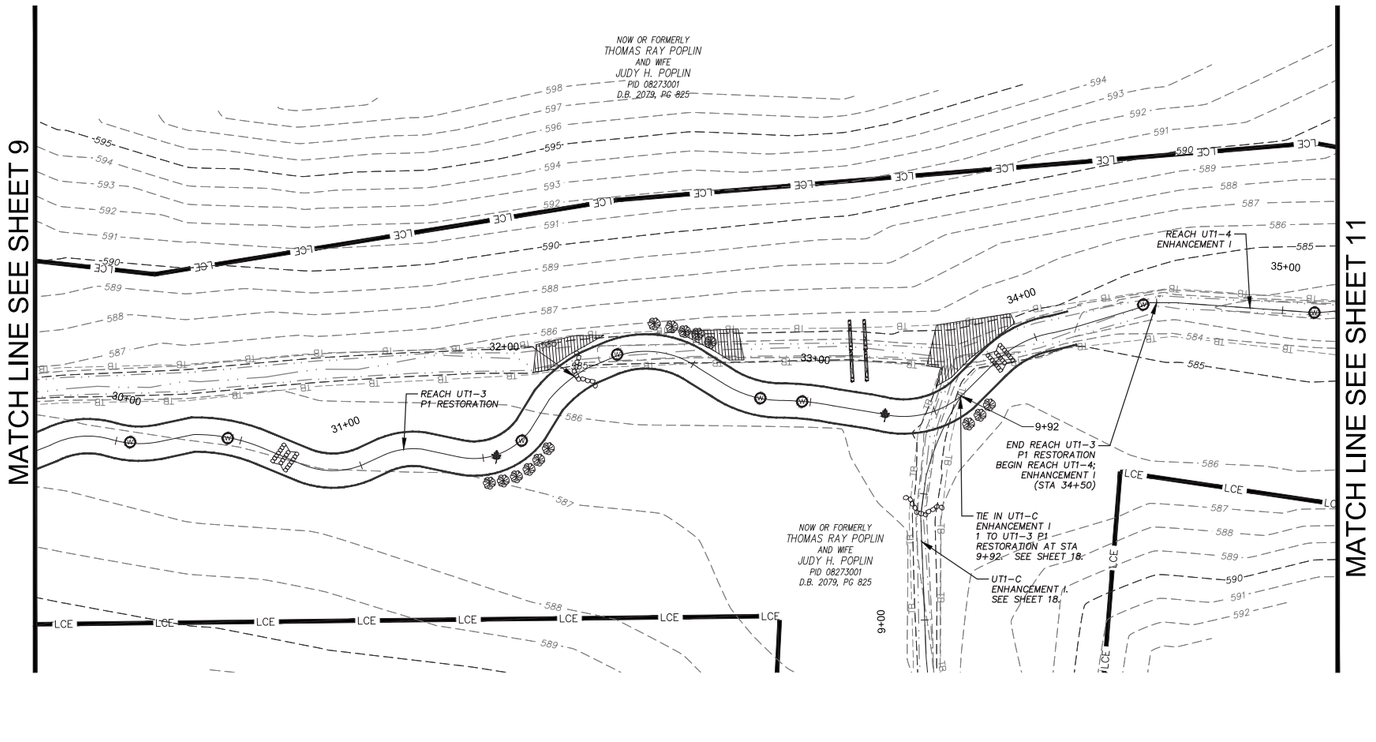
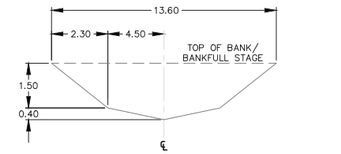
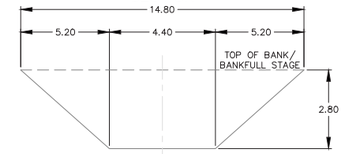
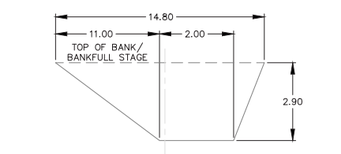




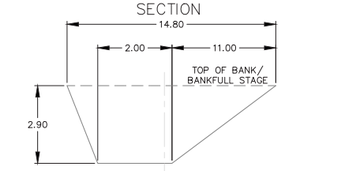
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



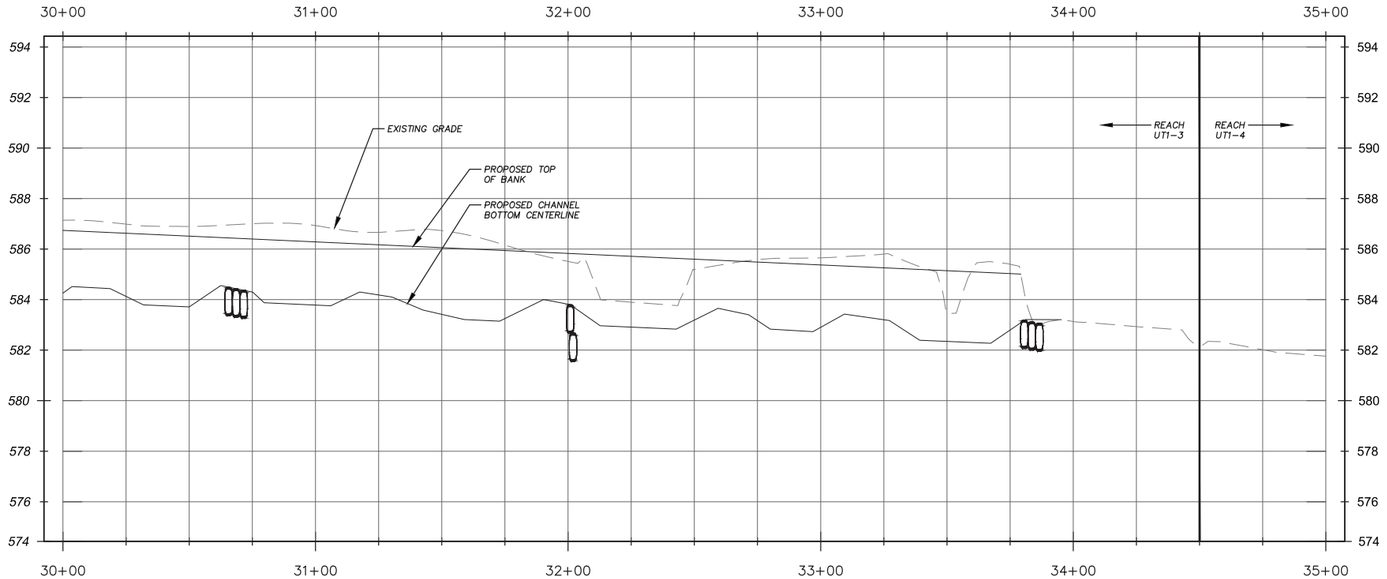
TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

TYP. SECTIONS STA 24+89 TO 34+50

REACH UT1-3



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LEGEND

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- PROPOSED CONTOUR MINOR — 42
- PROPOSED SPOT SHOT — 2980 × 1.64 BERM
- EXISTING TOP OF BANK — TB
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT — LCE
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
- LOG STRUCTURE (SEE DETAIL SHEET 34)
- LOG GRADE CONTROL STRUCTURE (SEE DETAIL SHEET 32)
- EXISTING CHANNEL BENCH
- PROPOSED FILL AREA
- PROPOSED CHANNEL PLUG (SEE DETAIL SHEET 32)
- LEAF PACK (SEE DETAIL SHEET 33)
- SMALL WOODY DEBRIS (SEE DETAIL SHEET 33)
- LIVE CUTTINGS BUNDLE (SEE DETAIL SHEET 33)
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- FLOODPLAIN SILL (SEE DETAIL SHEET 34)
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- ROCK CROSS VANE (SEE DETAIL SHEET 32)
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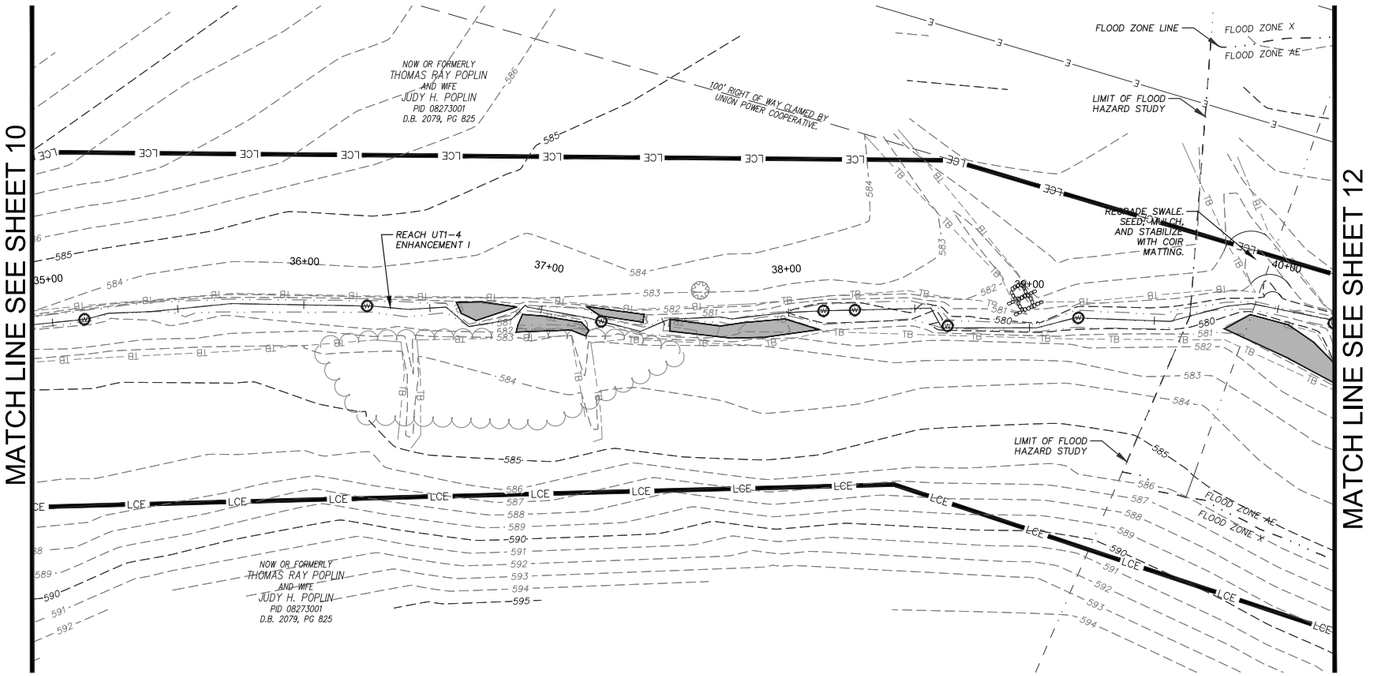

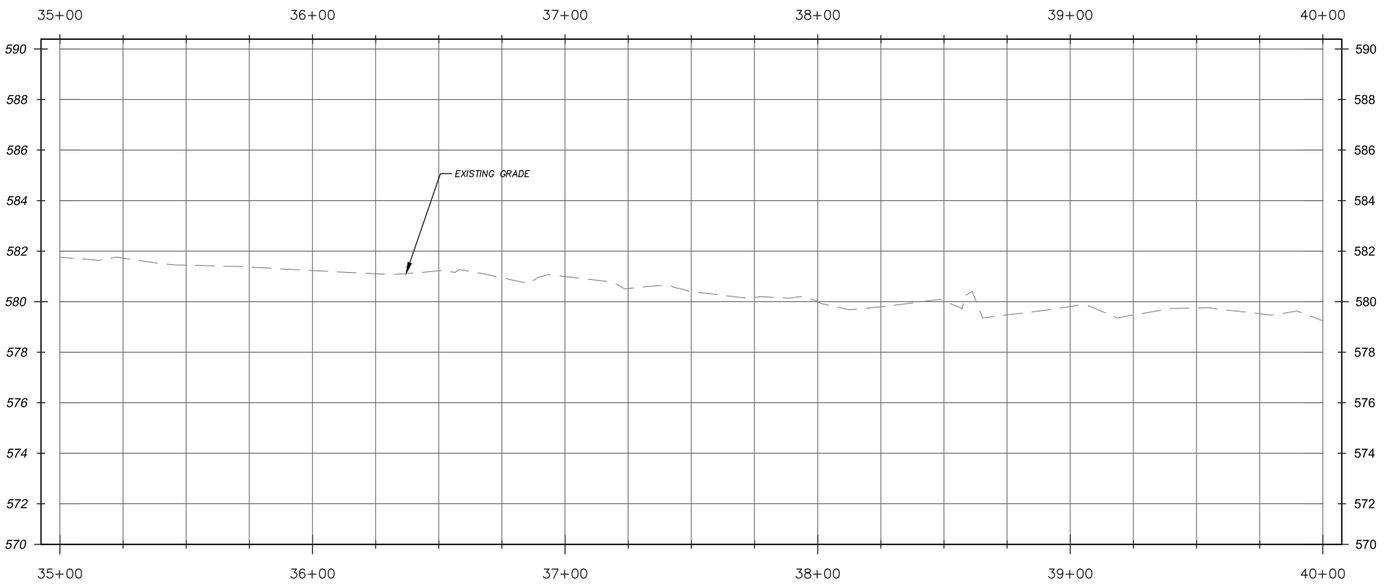

REACH UT1-4 NOTE:

PROPOSED ENHANCEMENT GRADING SHALL FOLLOW TYPICAL BANK GRADING OPTION 2 DETAIL ON SHEET 35. LAY BACK BANKS FROM STATION 34+50 TO APPROXIMATELY 47+09.

NOTES:

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DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

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PROJ. DATE: JUNE 2013
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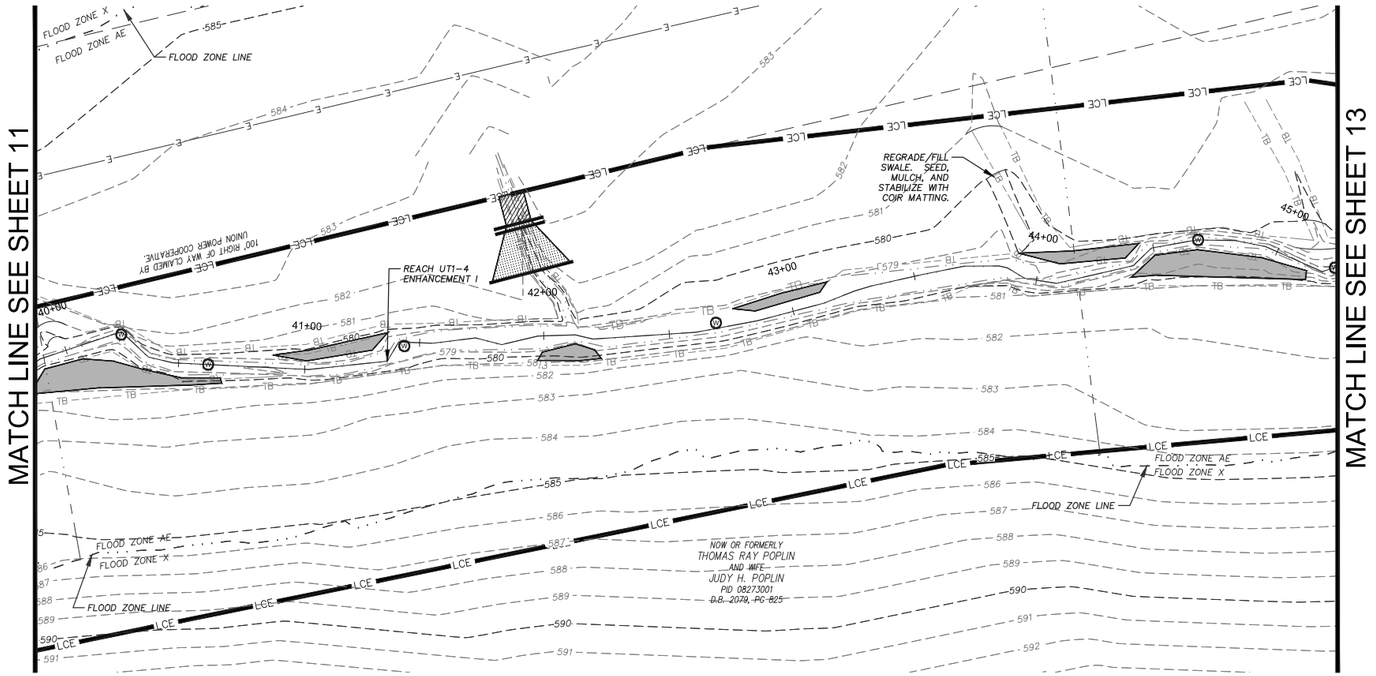

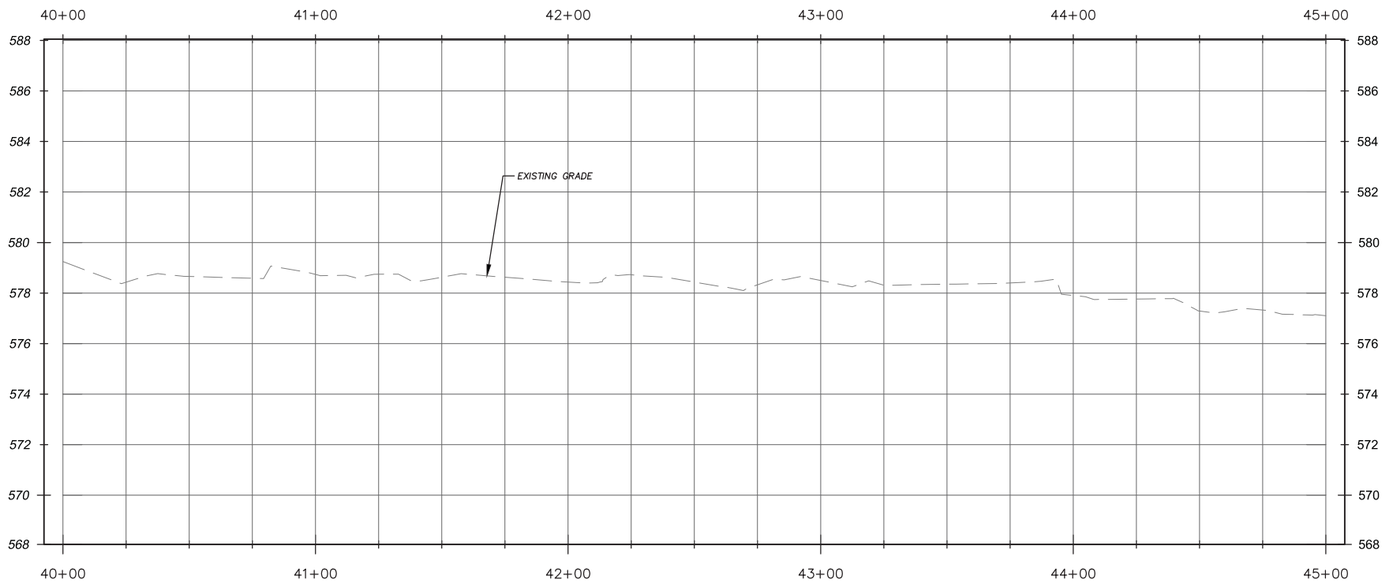

REACH UT1-4 NOTE:

PROPOSED ENHANCEMENT GRADING SHALL FOLLOW TYPICAL BANK GRADING OPTION 2 DETAIL ON SHEET 35. LAY BACK BANKS FROM STATION 34+50 TO APPROXIMATELY 47+09.

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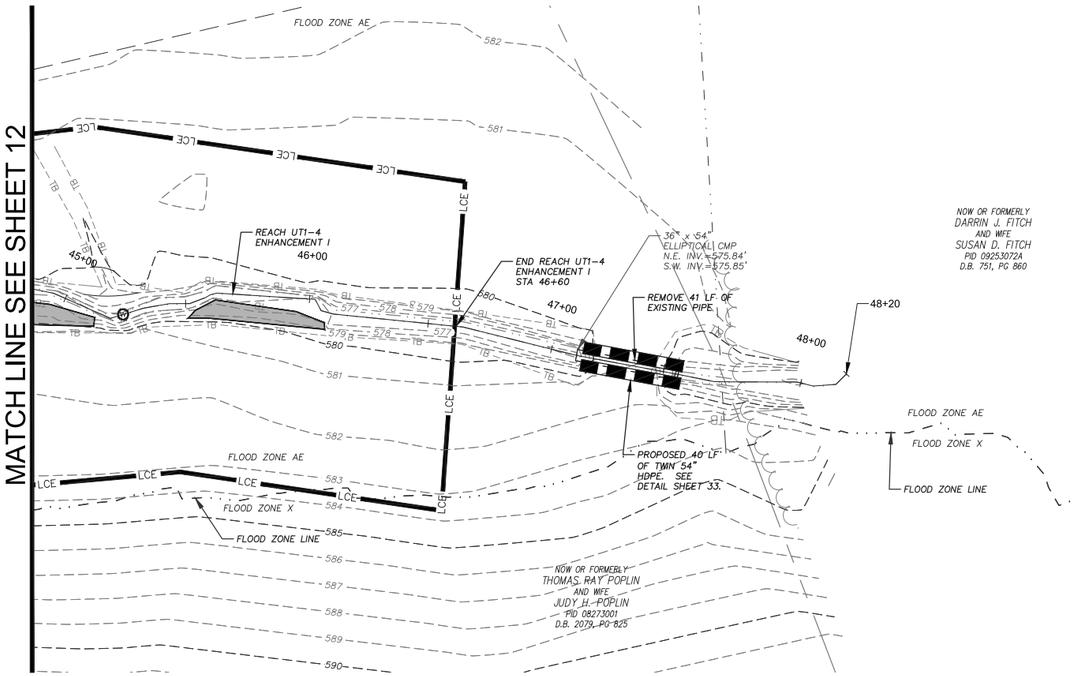

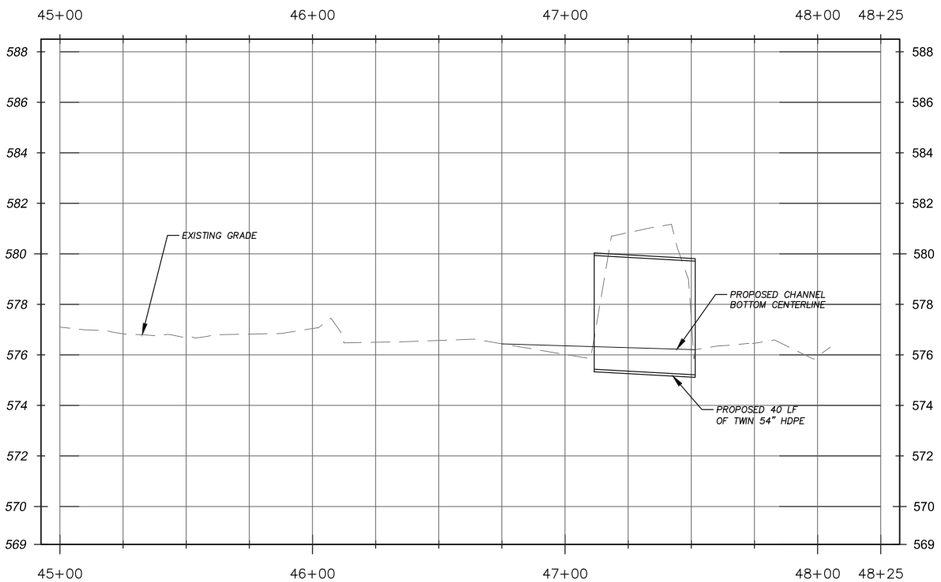

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- PROPOSED CHANNEL BOTTOM
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- LIMITS OF PROPOSED CONSERVATION EASEMENT — LCE
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
- LOG STRUCTURE (SEE DETAIL SHEET 34)
- LOG GRADE CONTROL STRUCTURE (SEE DETAIL SHEET 32)
- EXISTING CHANNEL BENCH
- PROPOSED FILL AREA
- PROPOSED CHANNEL PLUG (SEE DETAIL SHEET 32)
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PRELMINARY - NOT FOR CONSTRUCTION

PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
PLAN AND PROFILE UT1-4

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
13

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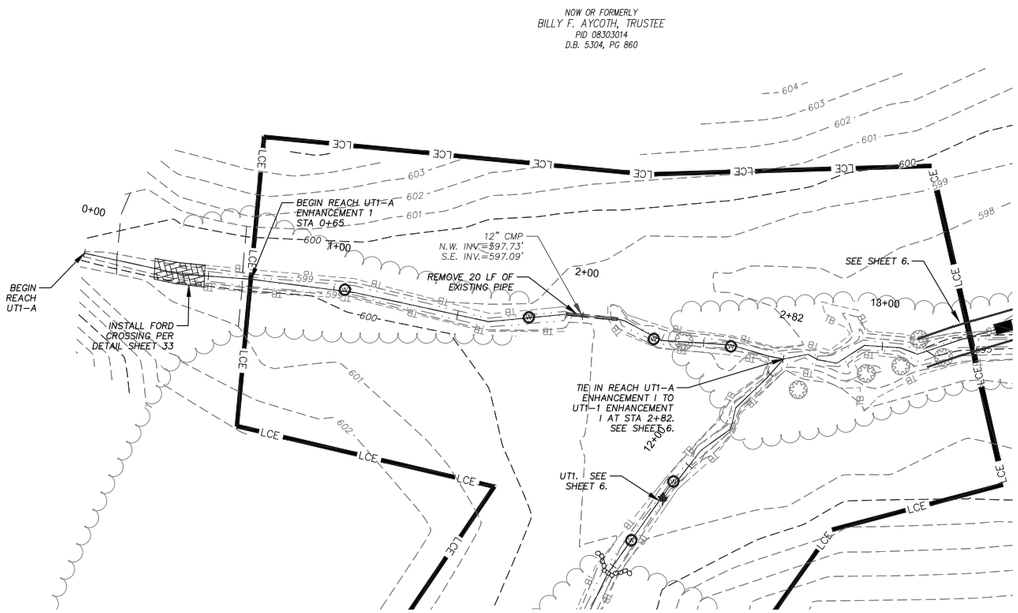
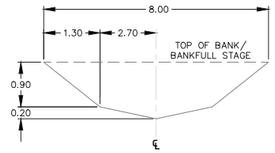
20120118.00.RA

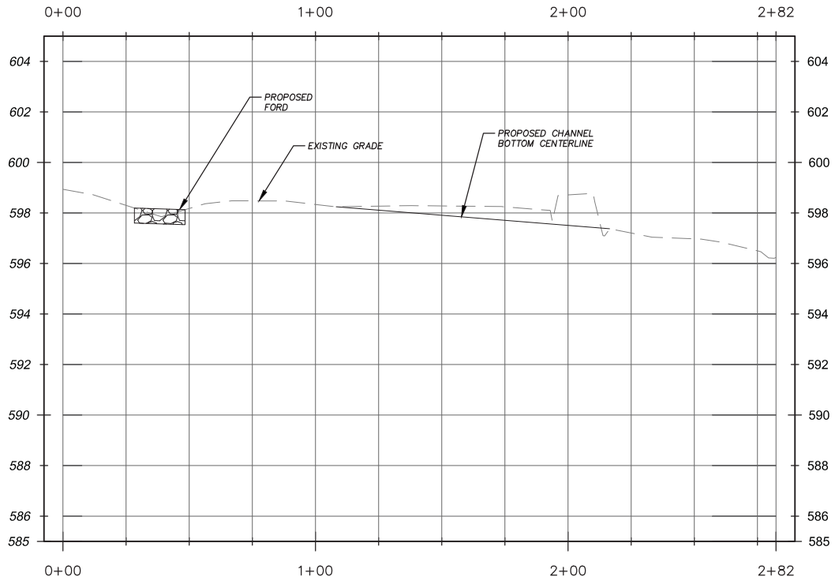


REACH UT1-A NOTE:

PROPOSED ENHANCEMENT GRADING SHALL FOLLOW TYPICAL BANK GRADING OPTION 1 DETAIL ON SHEET 35. LAY BACK BANKS FROM STATION 0+65 TO APPROXIMATELY 2+82.



TYPICAL SHALLOW CROSS SECTION
STA 1+06 TO 2+15
REACH UT1-A



NOTES:

1. IN GENERAL, STREAM CONSTRUCTION SHALL PROCEED FROM AN UPSTREAM TO DOWNSTREAM DIRECTION.
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4. NO MORE CHANNEL SHALL BE DISTURBED THAN CAN BE STABILIZED BY THE END OF THE WORK DAY OR PRIOR TO RESTORING FLOW TO NEWLY CONSTRUCTED CHANNEL SEGMENTS.
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6. THE PROPOSED CROSS-SECTIONS SHALL TIE INTO EXISTING GRADE AT A MAXIMUM SLOPE OF 5H:1V. FOR ALL AREAS WHERE THE PROPOSED TOP OF BANK ELEVATION IS GREATER THAN 0.75' BELOW EXISTING GRADE, A BANKFULL BENCH MUST BE CONSTRUCTED. SEE TYPICAL CROSS SECTION GRADING DETAIL ON SHEET 35 FOR DIMENSIONS.
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9. IF BEDROCK IS ENCOUNTERED DURING CHANNEL CONSTRUCTION, STRUCTURES MAY BE RELOCATED OR ELIMINATED PER DIRECTION OF THE ENGINEER

LEGEND

- EXISTING CONTOUR MAJOR — 50
- EXISTING CONTOUR MINOR — 46
- PROPOSED CONTOUR MAJOR — 50
- PROPOSED CONTOUR MINOR — 42
- PROPOSED SPOT SHOT — 2980 ×1.64 BERM
- EXISTING TOP OF BANK — TB
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE — X
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT — LCE
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
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DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
PLAN AND PROFILE UT1-A

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
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Q.C. DATE: 05-30-13

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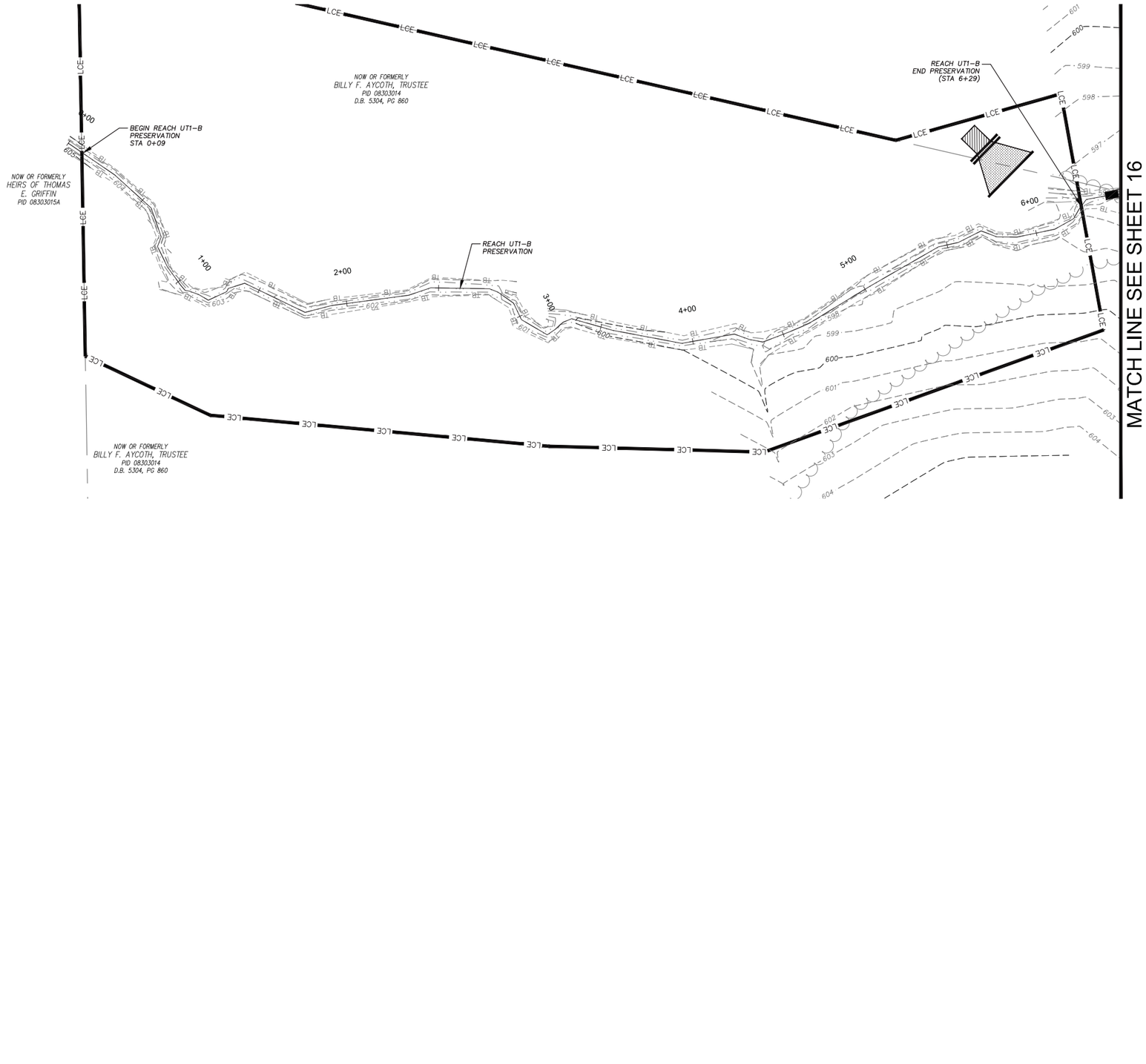

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- PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
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- EXISTING TOP OF BANK (TB)
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT (LCE)
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DRAWING TITLE:
PLAN AND PROFILE UT1-B

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

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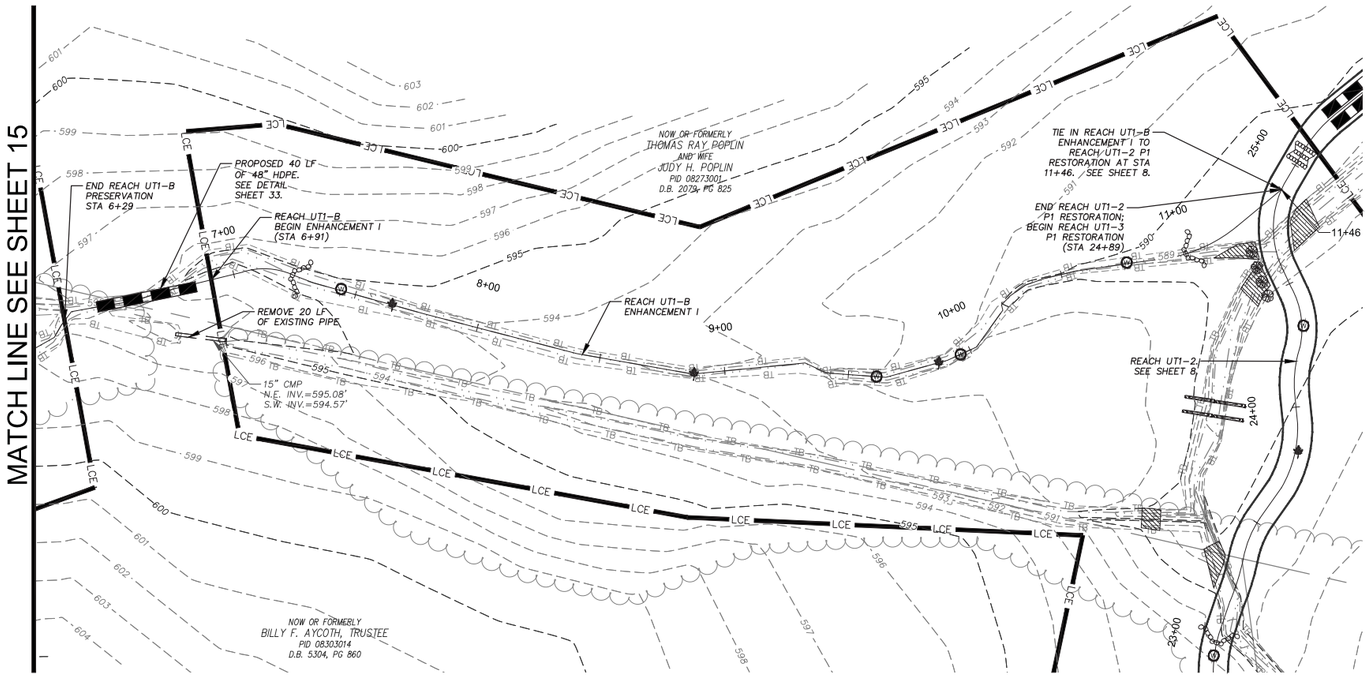
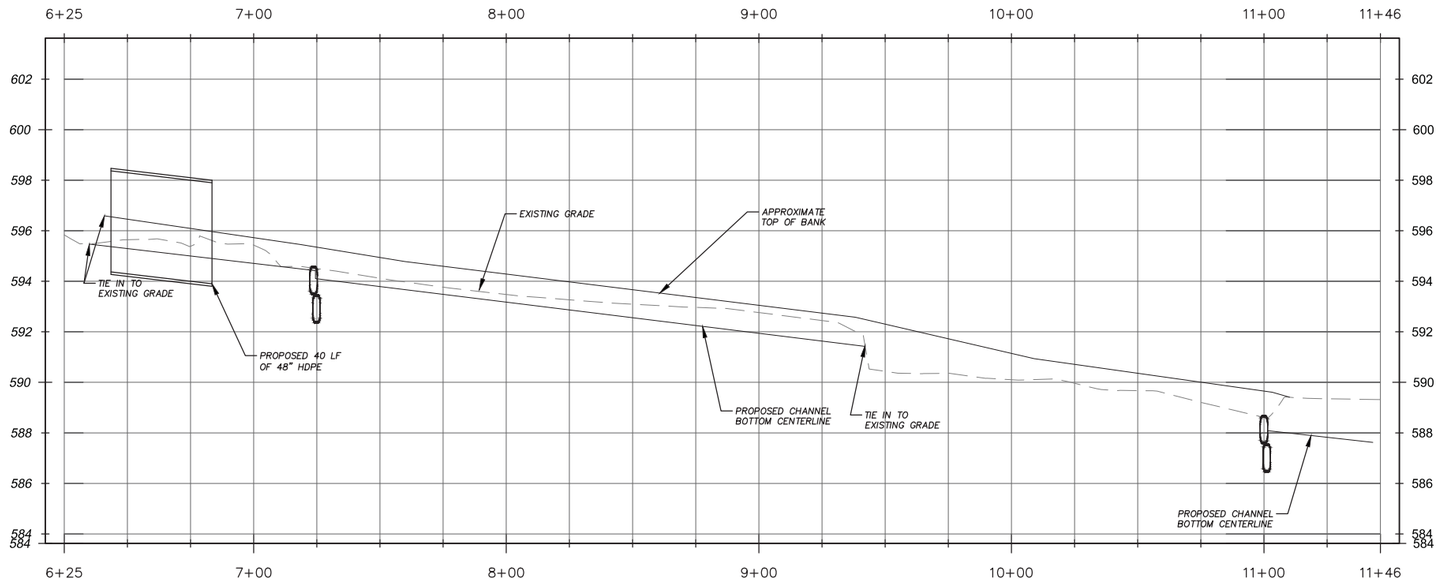
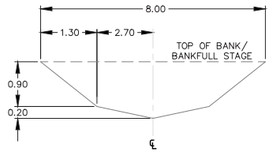




UT1-B NOTE:

REGRADE CHANNEL WITH DIMENSIONS PROVIDED IN TYPICAL CROSS SECTION BELOW, FROM STA 6+30 TO STA 9+42, AND STA 11+00 TO CONFLUENCE WITH REACH UT1-2.



TYPICAL CROSS SECTION

NOTES:

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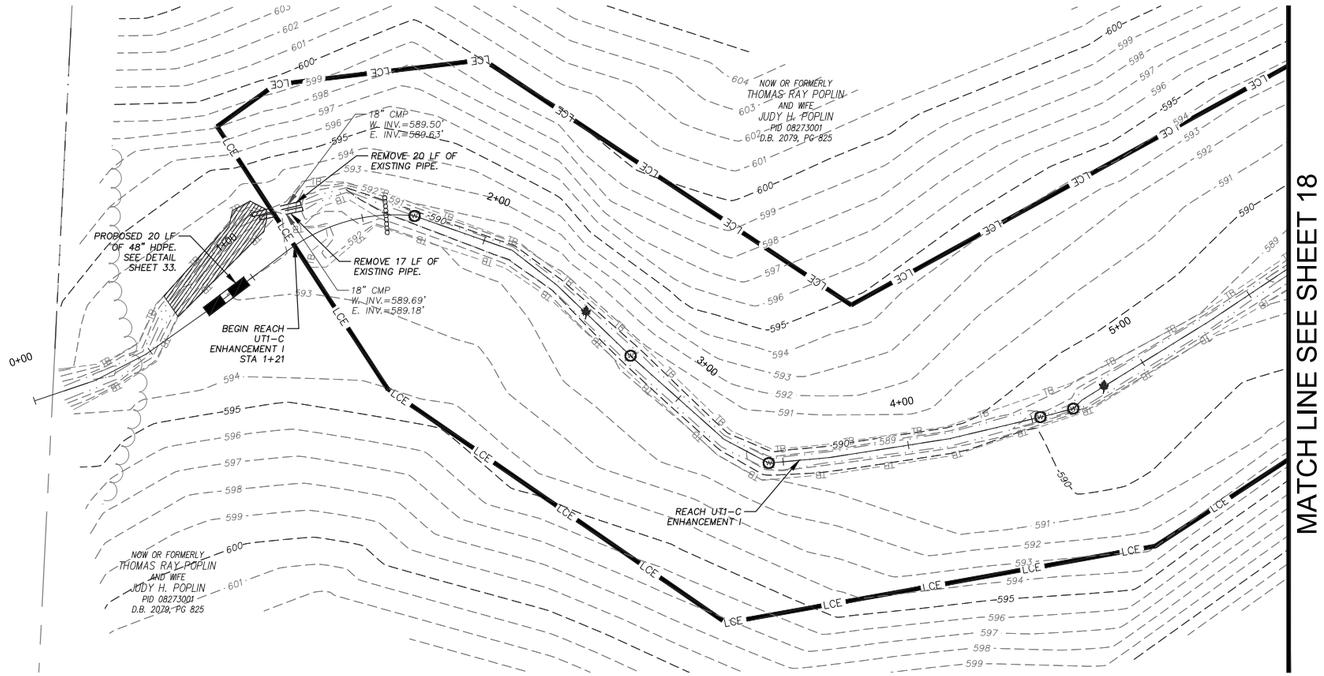
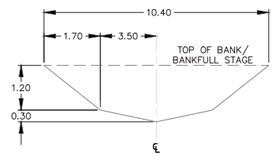


UT1-C NOTE:

PROPOSED ENHANCEMENT GRADING SHALL FOLLOW TYPICAL BANK GRADING OPTION 1 DETAIL ON SHEET 35. LAY BACK BANKS FROM STATION 0+36 TO APPROXIMATELY 9+42.



TYPICAL SHALLOW CROSS SECTION
STA 0+40 TO 1+65 AND STA 9+42 TO 9+71
REACH UT1-C

NOTES:

1. IN GENERAL, STREAM CONSTRUCTION SHALL PROCEED FROM AN UPSTREAM TO DOWNSTREAM DIRECTION.
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LEGEND

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- EXISTING CONTOUR MINOR — 46
- PROPOSED CONTOUR MAJOR — 50
- PROPOSED CONTOUR MINOR — 42
- PROPOSED SPOT SHOT — 2980 × 1.64 BERM
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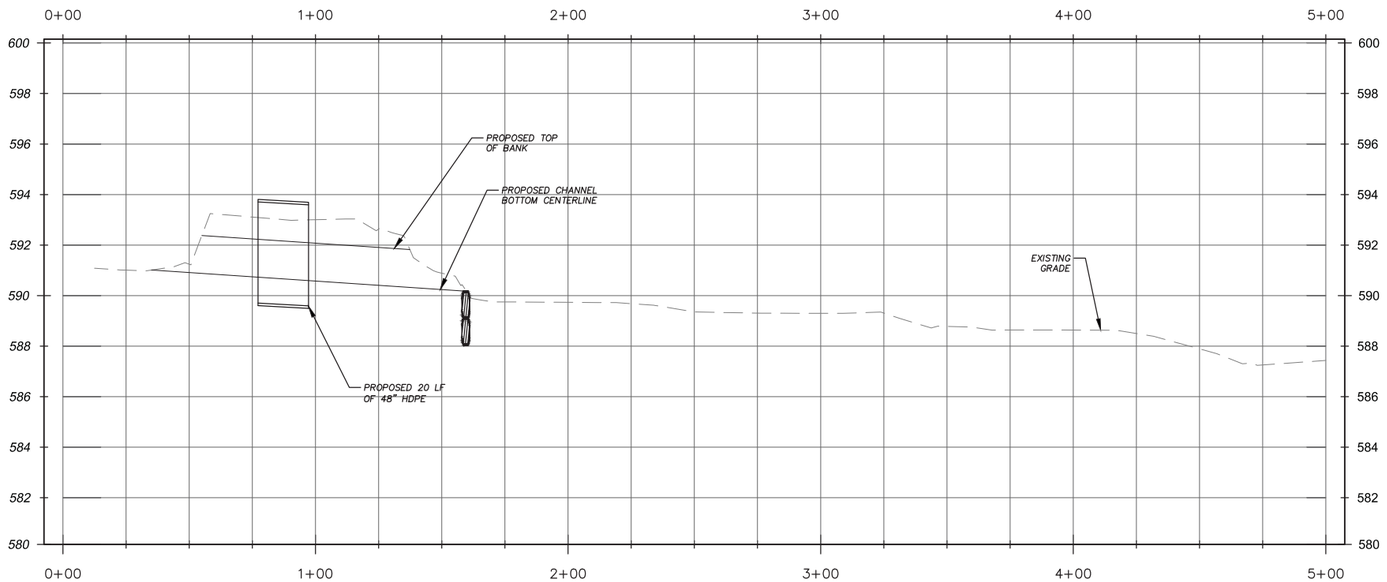

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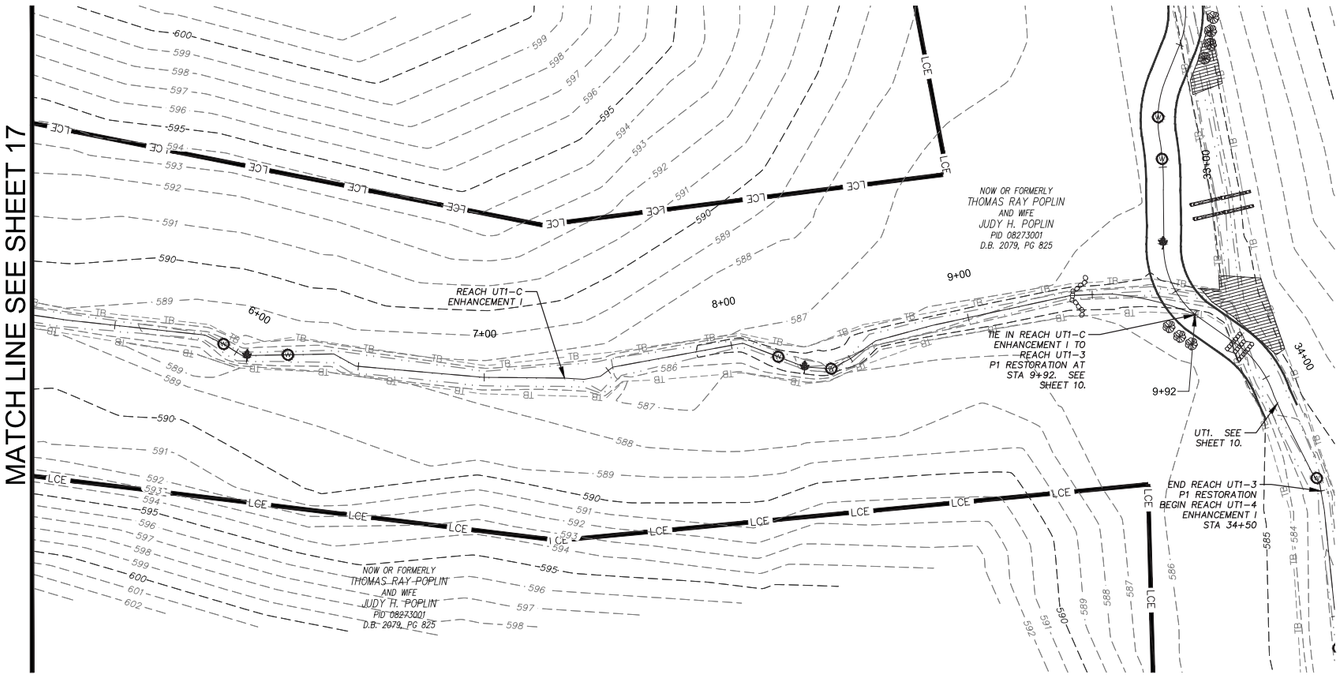

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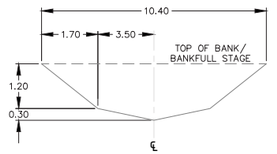

TYPICAL SHALLOW CROSS SECTION
STA 0+40 TO 1+65 AND STA
9+42 TO 9+71
REACH UT1-C

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- EXISTING TOP OF BANK — TB
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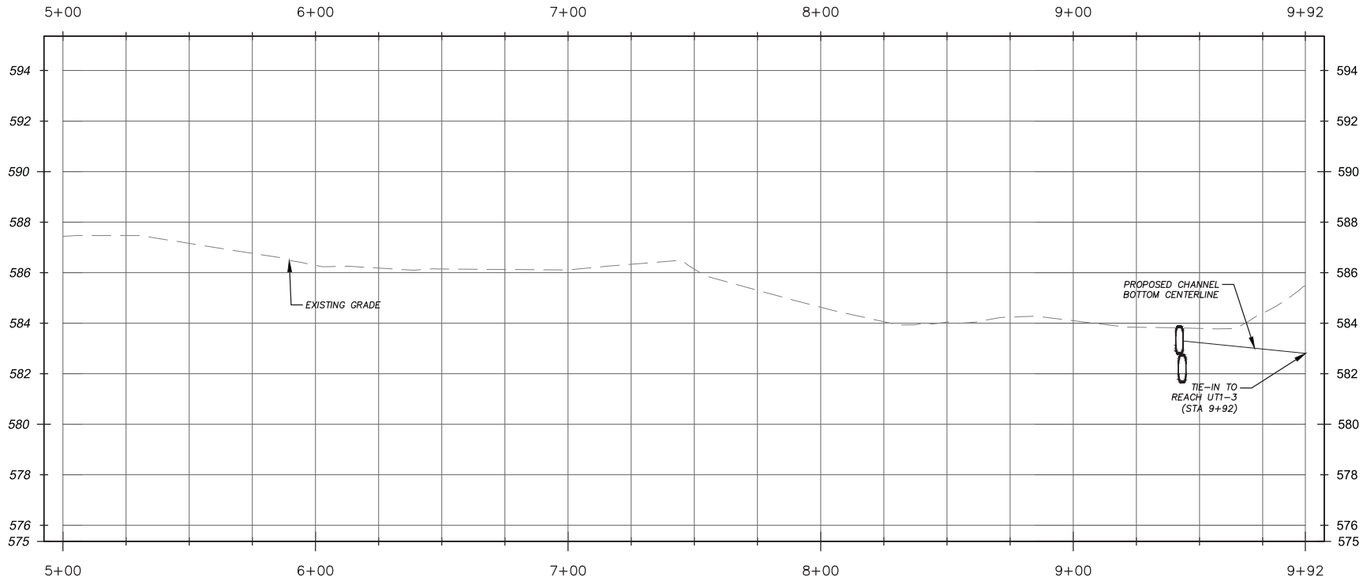

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MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR:
PRELMINARY - NOT FOR CONSTRUCTION
PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

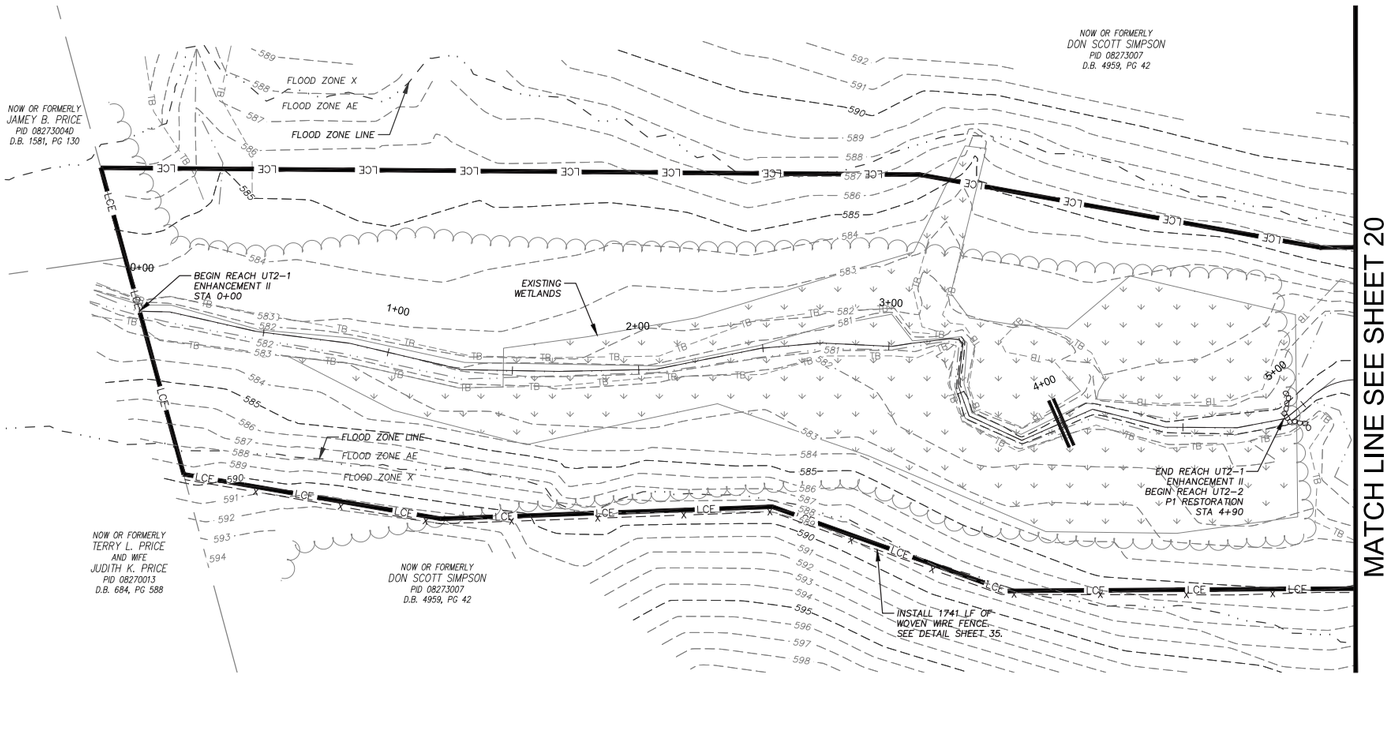
DRAWING TITLE:
PLAN AND PROFILE UT1-C

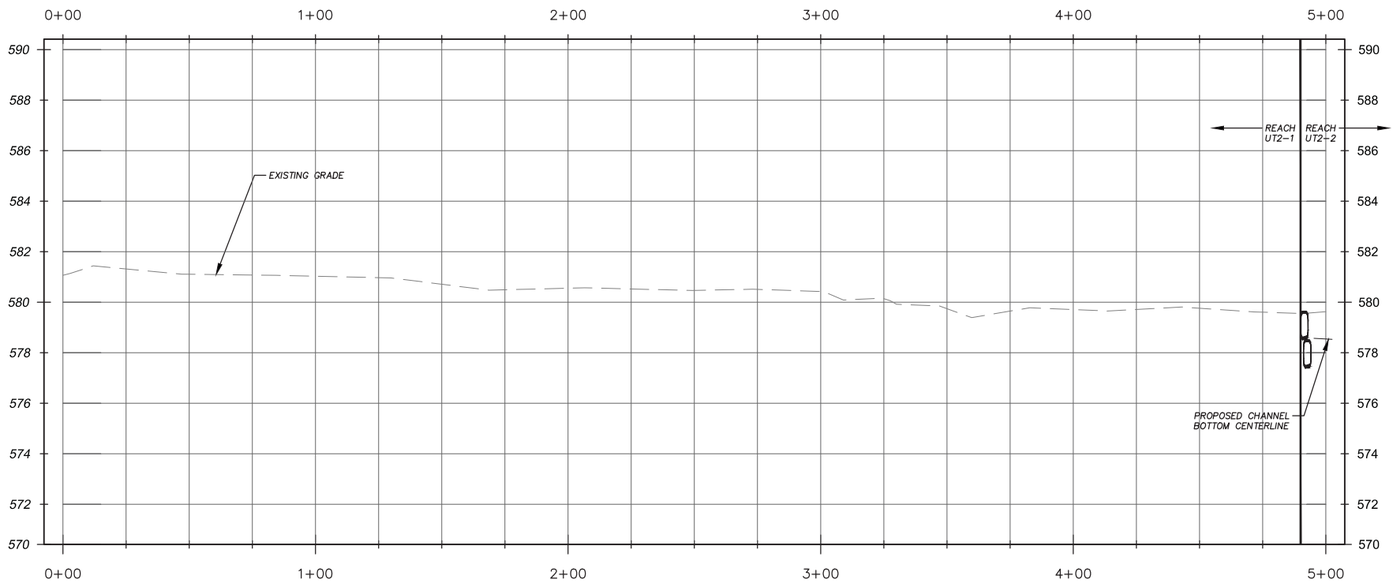
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
18

PROJ. NO.:
20120118.00.RA





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POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
PLAN AND PROFILE UT2-1

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
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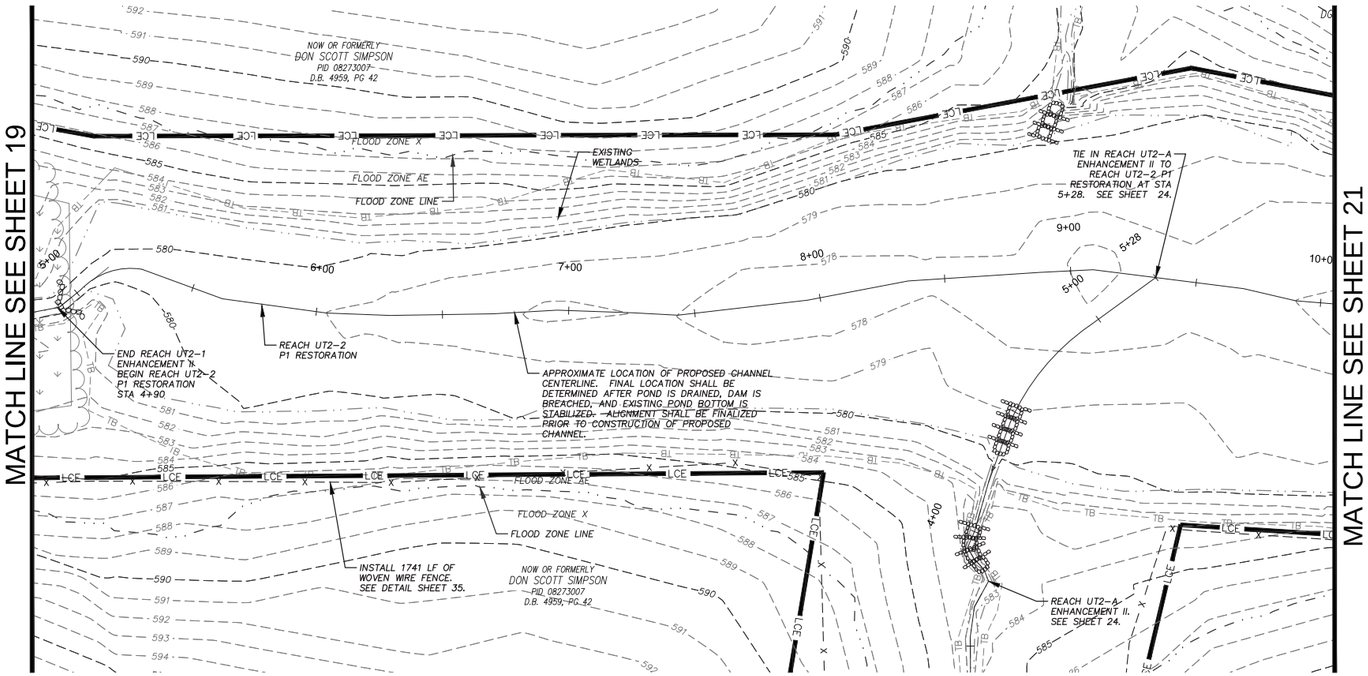

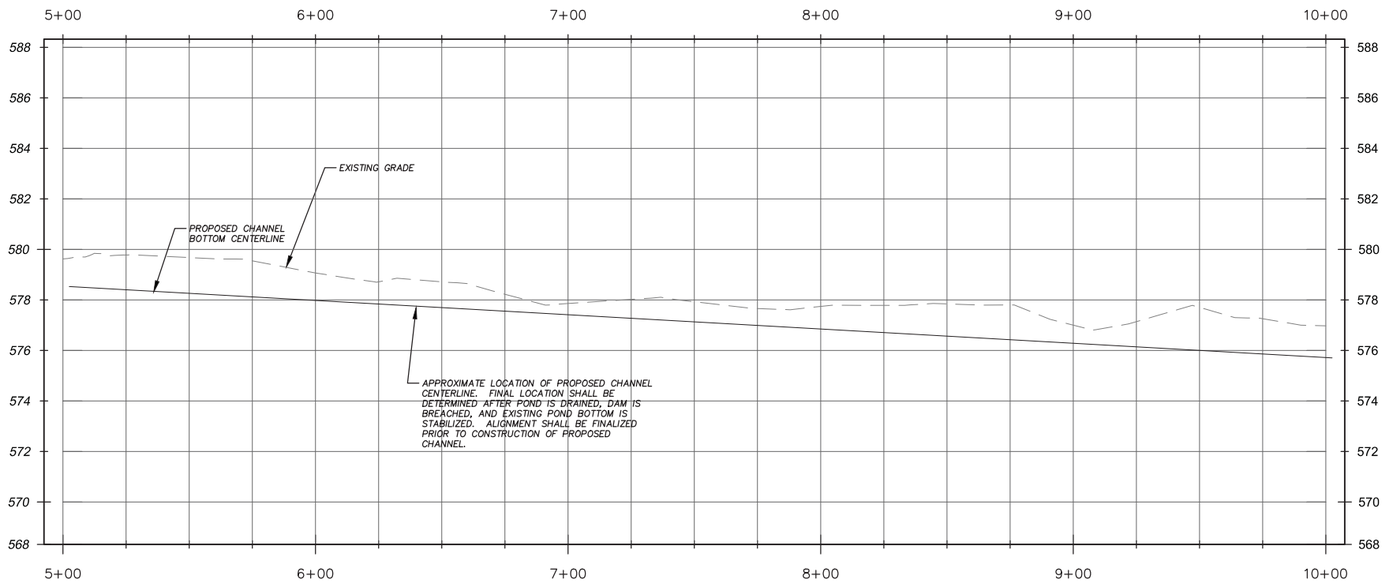

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DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
PLAN AND PROFILE UT2-2

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

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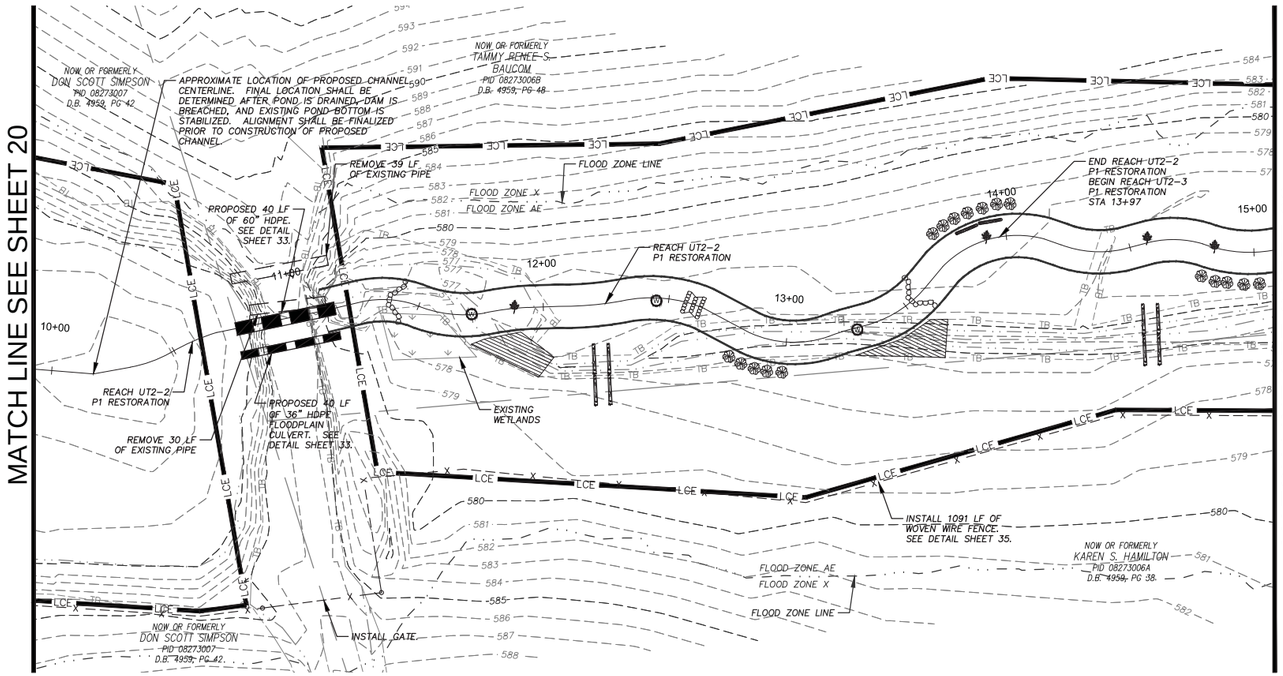
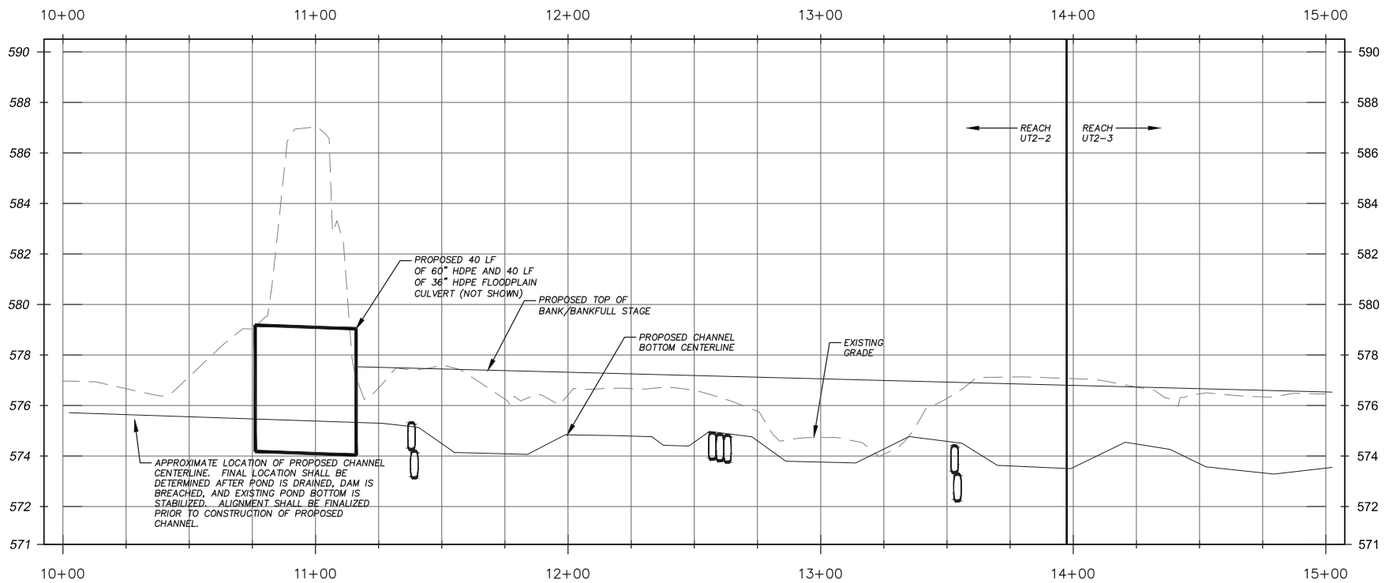
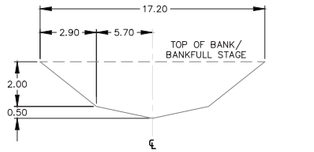
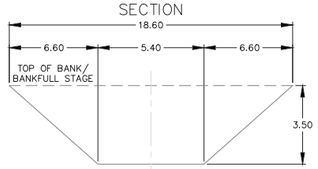


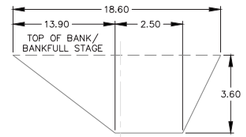




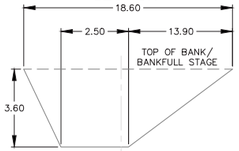
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

TYPICAL SECTIONS STA 11+17 TO 19+18

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DRAWING TITLE:
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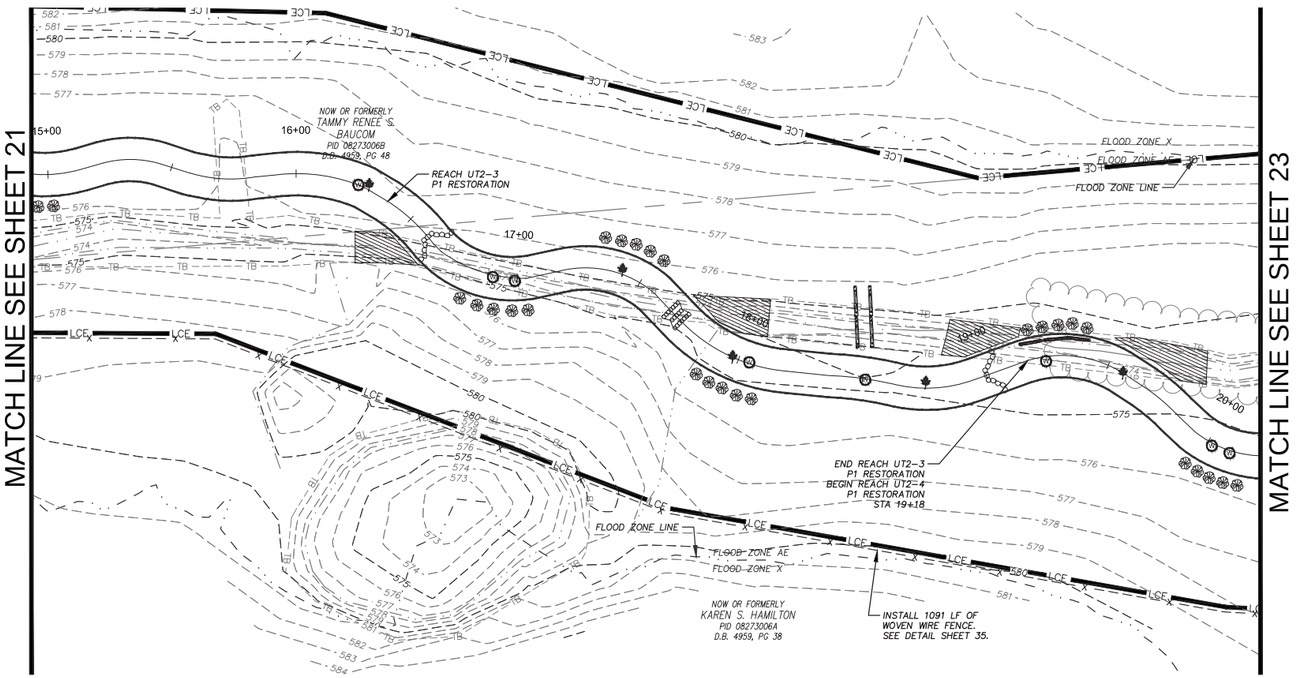
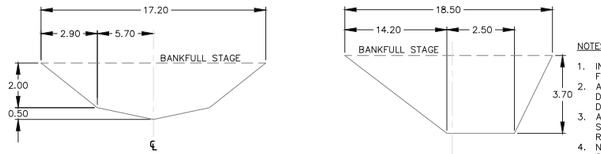
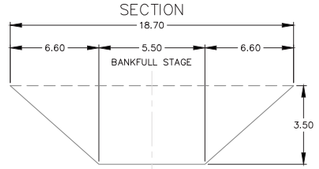




TYPICAL SHALLOW CROSS SECTION

TYPICAL RIGHT MEANDER CROSS SECTION



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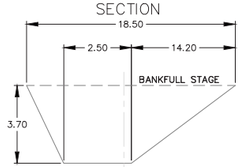

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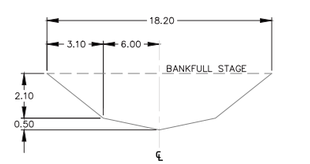

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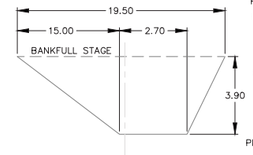

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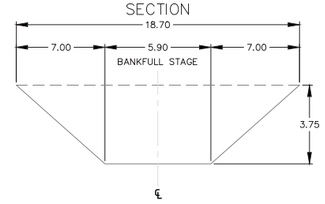

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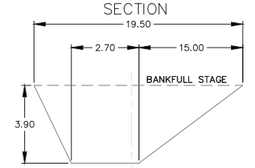

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STA 19+18 TO 30+20

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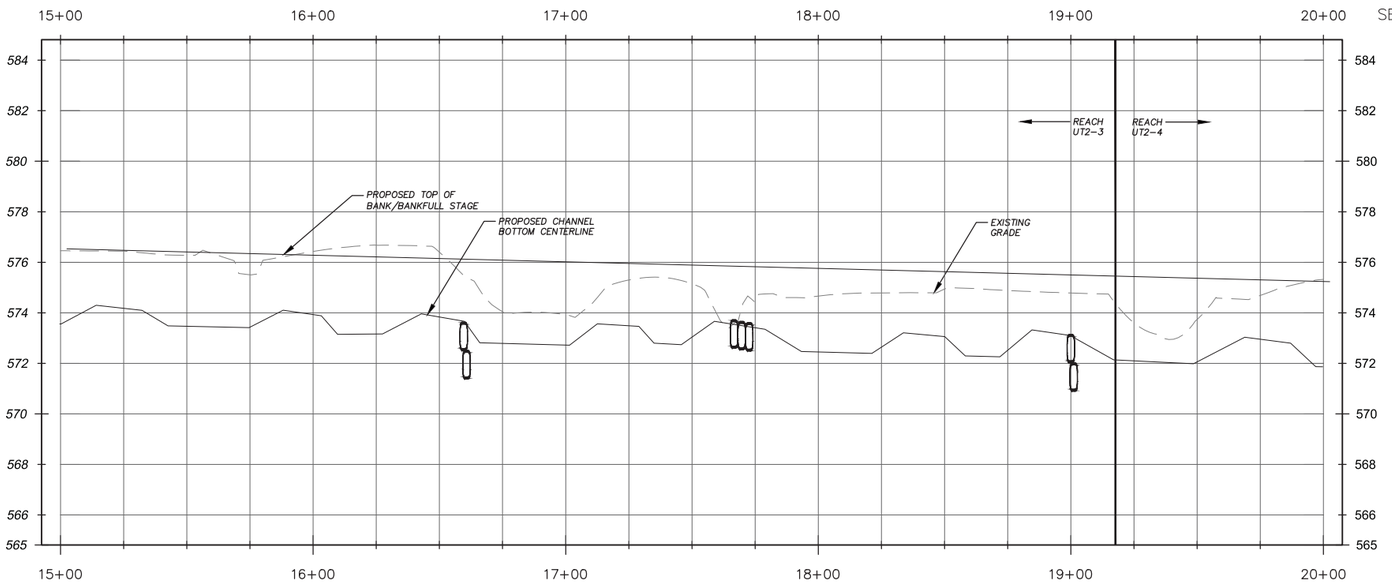
- EXISTING CHANNEL BENCH
- PROPOSED FILL AREA
- PROPOSED CHANNEL PLUG (SEE DETAIL SHEET 32)
- LEAF PACK (SEE DETAIL SHEET 33)
- SMALL WOODY DEBRIS (SEE DETAIL SHEET 33)
- LIVE CUTTINGS BUNDLE (SEE DETAIL SHEET 33)
- EXISTING TREE
- FLOODPLAIN SILL (SEE DETAIL SHEET 34)
- DIFFUSE FLOW STRUCTURE (SEE DETAIL SHEET 34)
- ROCK STEP POOL (SEE DETAIL SHEET 33)
- ROCK CROSS VANE (SEE DETAIL SHEET 32)
- RIFFLE GRADE CONTROL (SEE DETAIL SHEET 35)
- ROCK GRADE CONTROL (SEE DETAIL SHEET 34)



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NC. LICENSE NO. F-0374

EBX

FULL SCALE: 1"=30 H, 1"=3 V
0 30
2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: PRELIMINARY- NOT FOR CONSTRUCTION
PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

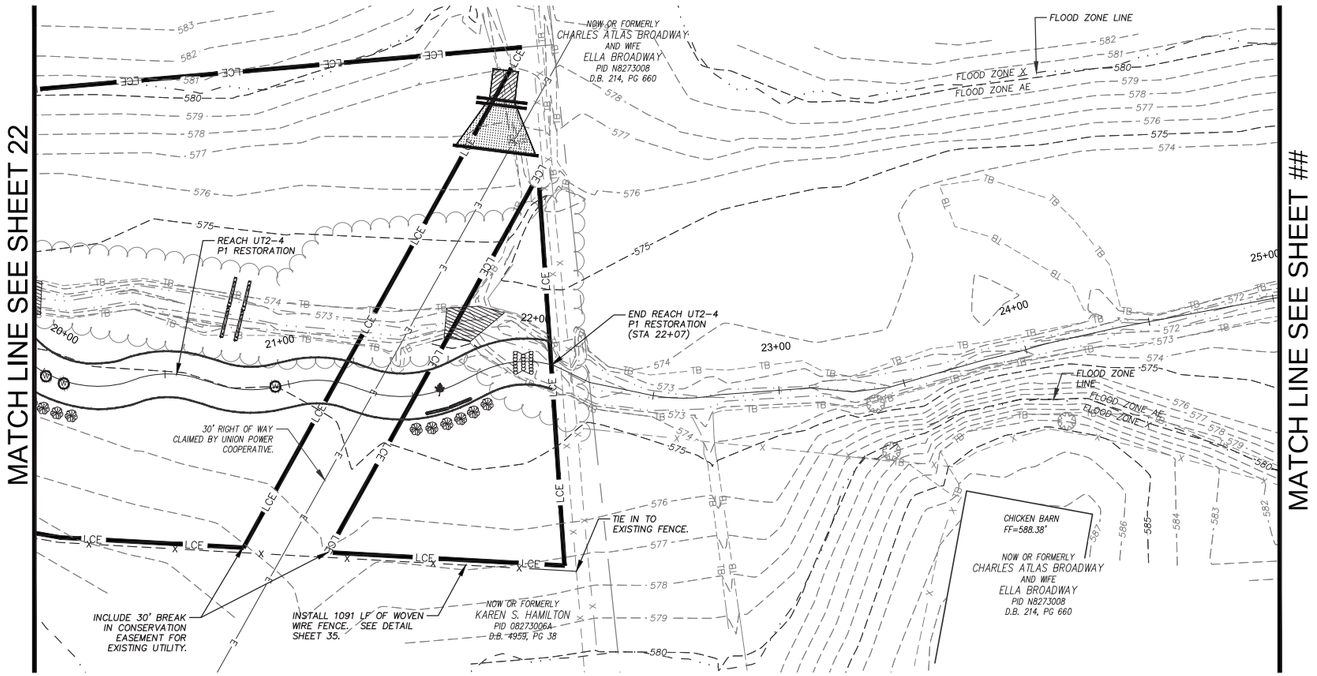
DRAWING TITLE:
PLAN AND PROFILE UT2-3

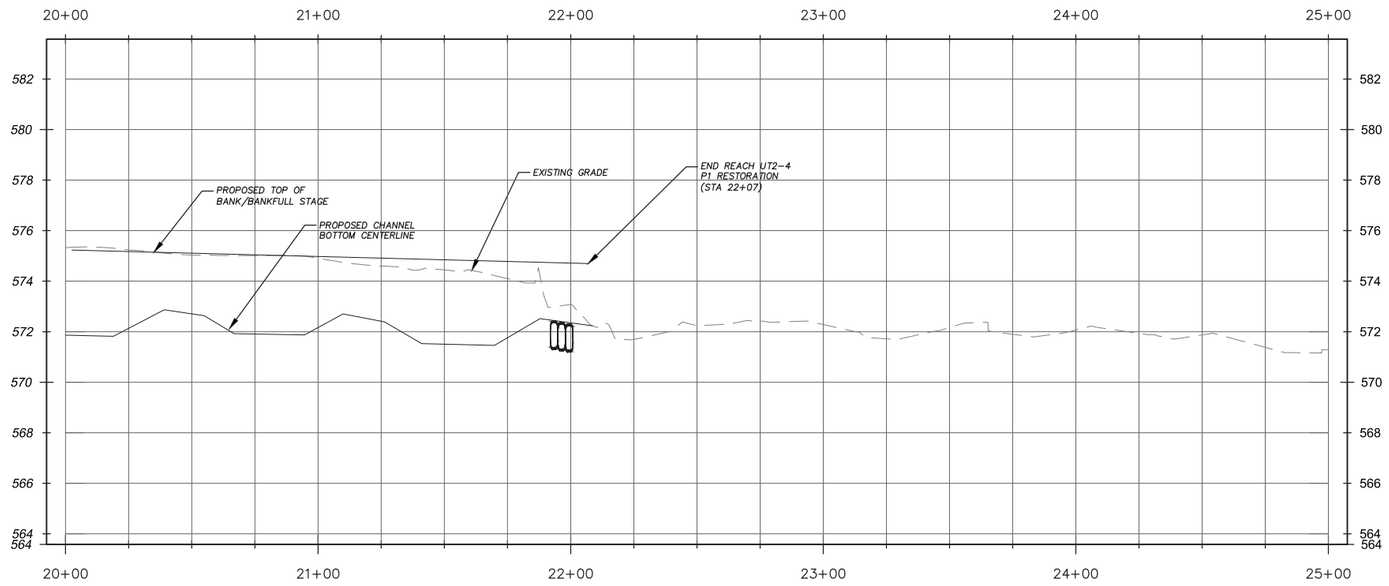
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

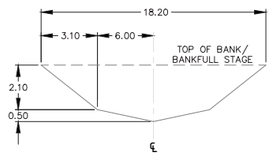
PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
22

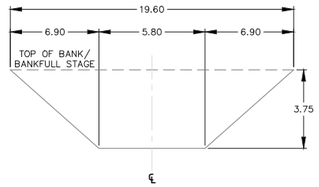
PROJ. NO.:
20120118.00.RA



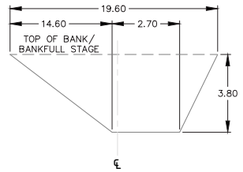




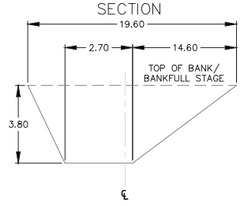
TYPICAL SHALLOW CROSS SECTION



TYPICAL POOL CROSS SECTION STRAIGHT REACH



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

TYPICAL SECTIONS STA 19+18 TO 30+20

NOTES:

1. IN GENERAL, STREAM CONSTRUCTION SHALL PROCEED FROM AN UPSTREAM TO DOWNSTREAM DIRECTION.
2. ALL EXCAVATED MATERIAL MUST BE PLACED WITHIN DESIGNATED STOCKPILE AREAS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
3. ALL IMPERVIOUS DIKES AND BYPASS PUMPING EQUIPMENT SHALL BE MODIFIED AT THE END OF EACH DAY TO RESTORE NORMAL FLOW BACK TO THE CHANNEL.
4. NO MORE CHANNEL SHALL BE DISTURBED THAN CAN BE STABILIZED BY THE END OF THE WORK DAY OR PRIOR TO RESTORING FLOW TO NEWLY CONSTRUCTED CHANNEL SEGMENTS.
5. CONTRACTOR SHALL NOT COMPACT SOIL AROUND ROOTS OR TREES TO REMAIN, AND SHALL NOT DAMAGE SUCH TREES IN ANY WAY. EXCAVATED OR OTHER MATERIAL SHALL NOT BE PLACED, PILED OR STORED WITHIN THE CRITICAL ROOT ZONE AREA OF THE TREES TO BE SAVED.
6. THE PROPOSED CROSS-SECTIONS SHALL TIE INTO EXISTING GRADE AT A MAXIMUM SLOPE OF 5H:1V. FOR ALL AREAS WHERE THE PROPOSED TOP OF BANK ELEVATION IS GREATER THAN 0.75' BELOW EXISTING GRADE, A BANKFULL BENCH MUST BE CONSTRUCTED. SEE TYPICAL CROSS SECTION GRADING DETAIL ON SHEET 35 FOR DIMENSIONS.
7. UNLESS NOTED OTHERWISE, FILL MATERIAL GENERATED FROM CHANNEL EXCAVATION AND STABILIZATION SHALL BE PLACED INSIDE THE EXISTING CHANNEL TO BE ABANDONED AT AN ELEVATION THAT PROVIDES POSITIVE DRAINAGE TOWARDS THE PROPOSED CHANNEL.
8. FILL ALL ABANDONED DITCHES WITHIN THE PROPOSED EASEMENT PER CHANNEL BACKFILL DETAIL SHOWN ON SHEET 32 UNLESS DIRECTED OTHERWISE BY THE ENGINEER.
9. IF BEDROCK IS ENCOUNTERED DURING CHANNEL CONSTRUCTION, STRUCTURES MAY BE RELOCATED OR ELIMINATED PER DIRECTION OF THE ENGINEER

LEGEND

- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
- PROPOSED SPOT SHOT
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
- LOG STRUCTURE (SEE DETAIL SHEET 34)
- LOG GRADE CONTROL STRUCTURE (SEE DETAIL SHEET 32)
- EXISTING CHANNEL BENCH
- PROPOSED FILL AREA
- PROPOSED CHANNEL PLUG (SEE DETAIL SHEET 32)
- LEAF PACK (SEE DETAIL SHEET 33)
- SMALL WOODY DEBRIS (SEE DETAIL SHEET 33)
- LIVE CUTTINGS BUNDLE (SEE DETAIL SHEET 33)
- EXISTING TREE
- FLOODPLAIN SILL (SEE DETAIL SHEET 34)
- DIFFUSE FLOW STRUCTURE (SEE DETAIL SHEET 34)
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- RIFFLE GRADE CONTROL (SEE DETAIL SHEET 35)
- ROCK GRADE CONTROL (SEE DETAIL SHEET 34)

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DUPLIN CO. NORTH CAROLINA
ENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
PLAN AND PROFILE UT2-4

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE:	JUNE 2013
Q.C.:	FM
Q.C. DATE:	05-30-13

DRAWING NUMBER:
23

PROJ. N0.:
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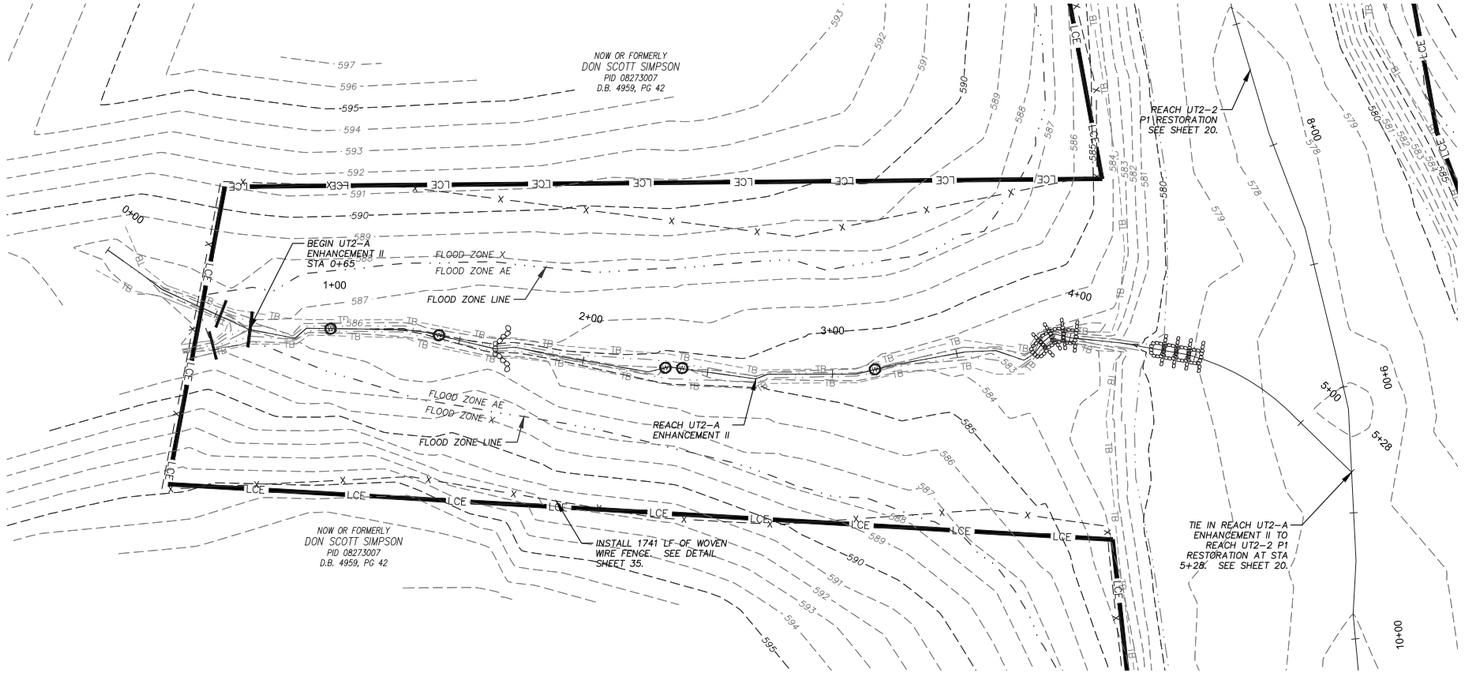
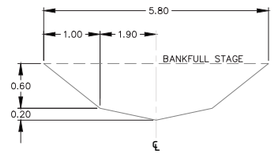


UT2-A NOTE:

PROPOSED ENHANCEMENT GRADING SHALL FOLLOW TYPICAL BANK GRADING OPTION 1 DETAIL ON SHEET 35. LAY BACK BANKS FROM STATION 0+00 TO APPROXIMATELY 3+90.



TYPICAL SHALLOW CROSS SECTION

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8. FILL ALL ABANDONED DITCHES WITHIN THE PROPOSED EASEMENT PER CHANNEL BACKFILL DETAIL SHOWN ON SHEET 32 UNLESS DIRECTED OTHERWISE BY THE ENGINEER.
9. IF BEDROCK IS ENCOUNTERED DURING CHANNEL CONSTRUCTION, STRUCTURES MAY BE RELOCATED OR ELIMINATED PER DIRECTION OF THE ENGINEER

LEGEND

- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
- PROPOSED SPOT SHOT (2980, ×1.64, BERM)
- EXISTING TOP OF BANK (TB)
- EXISTING BOTTOM OF BANK
- PROPOSED CENTERLINE OF CHANNEL
- EXISTING FENCELINE
- EXISTING TREELINE
- PROPOSED CHANNEL BOTTOM
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT (LCE)
- LOG TOE PROTECTION (SEE DETAIL SHEET 32)
- LOG STRUCTURE (SEE DETAIL SHEET 34)
- LOG GRADE CONTROL STRUCTURE (SEE DETAIL SHEET 32)
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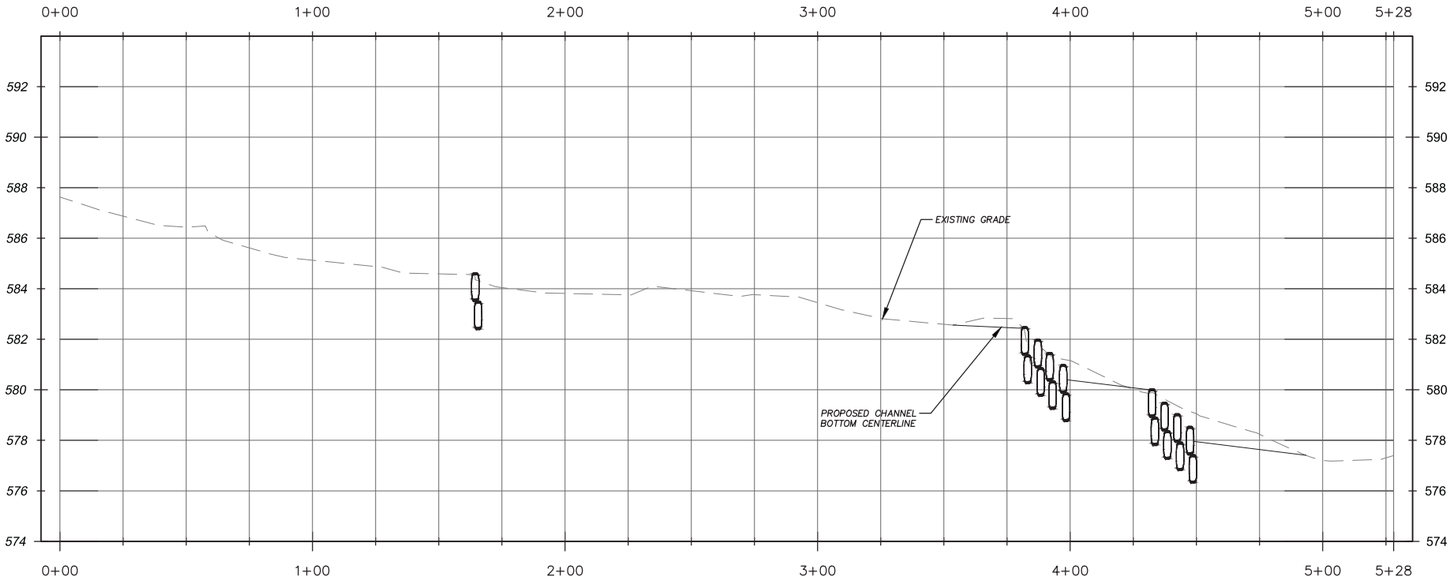
- RIFFLE GRADE CONTROL (SEE DETAIL SHEET 35)
- ROCK GRADE CONTROL (SEE DETAIL SHEET 34)



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PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

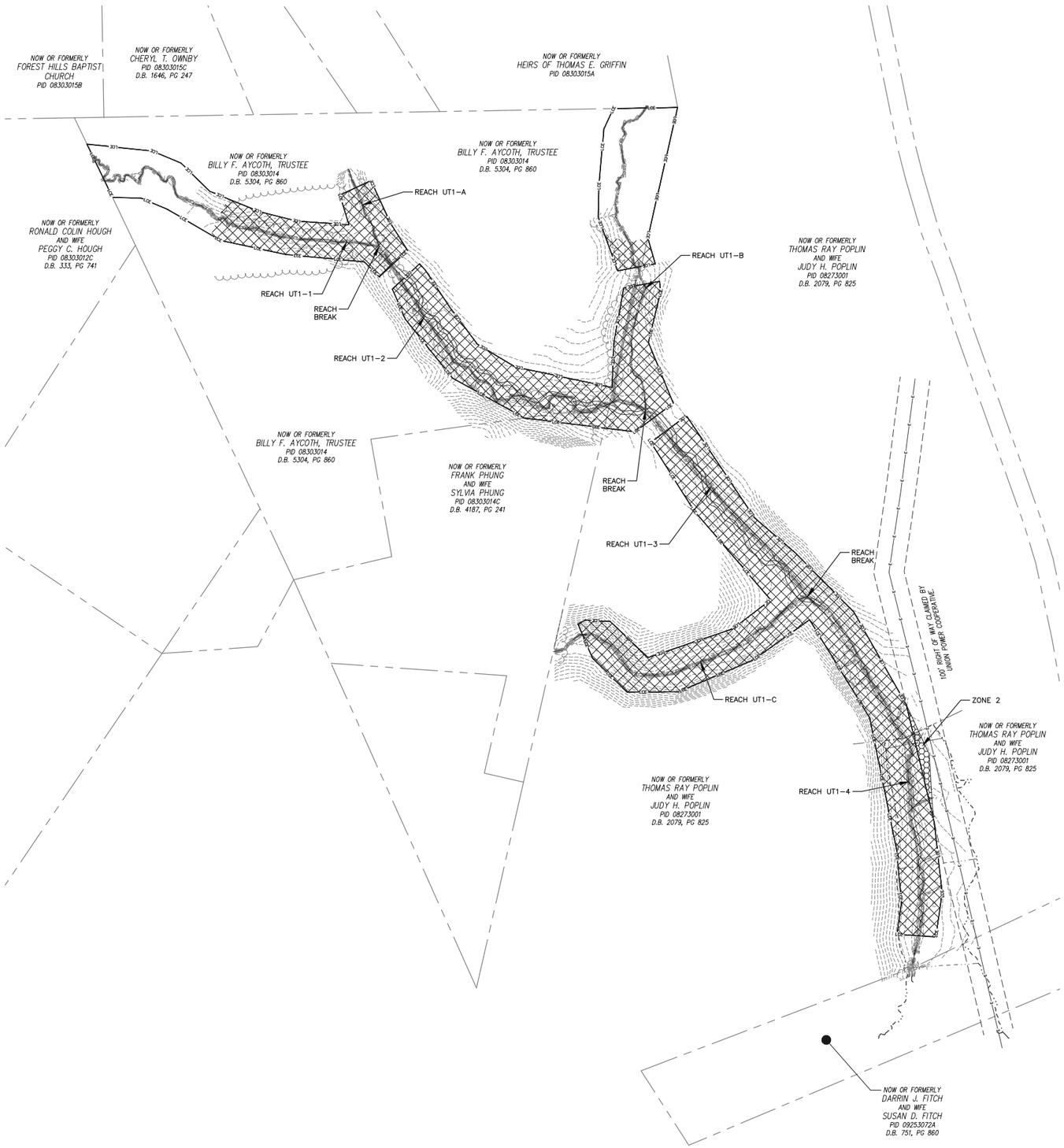
DRAWING TITLE:
PLAN AND PROFILE UT2-A

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
24

PROJ. NO.:
20120118.00.RA



Zone 1 Riparian Areas		
Common Name	**Scientific Name**	**Percent Composition**
Planting Plant Species		
River birch	*Betula nigra*	5%
Common hackberry	*Celtis occidentalis*	10%
Green ash	*Fraxinus pennsylvanica*	10%
American sycamore	*Platanus occidentalis*	10%
Southern red oak	*Quercus falcata*	20%
Water oak	*Quercus nigra*	15%
Northern red oak	*Quercus rubra*	15%
Slippery Elm	*Ulmus rubra*	15%
	Total Bareroot Stems	100%

Zone 2 Utility Easement Areas (bareroot or container)		
Common Name	**Scientific Name**	**Percent Composition**
Tag Alder	*Alnus serrulata*	20%
American hazelnut	*Corylus americana*	20%
Flowering crabapple	*Malus angustifolia*	20%
Wax myrtle	*Morella cerifera*	20%
Blackhaw viburnum	*Viburnum prunifolium*	20%
	Total Stems	100%

Live Staking and Live Cuttings Bundle Tree Species

Common Name	Scientific Name	Percent composition
Silky dogwood	*Cornus amomum*	45%
Silky willow	*Salix sericea*	45%
Black willow	*Salix nigra*	10%
		100%

PLANTING LEGEND

ZONE 1: RIPARIAN PLANTING

ZONE 2: UTILITY EASEMENT AREA

Permanent Riparian Seed Mix		
Common Name	**Scientific Name**	**Percent composition**
Bushy Bluestem	*Andropogon glomeratus*	15%
Sedge, Fringed	*Carex crinita*	10%
Sedge, Tussock	*Carex stricta*	5%
Virginia Wildrye	*Elymus virginicus*	15%
Purple Lovegrass	*Eragrostis spectabilis*	10%
Beaked panic grass	*Panicum anceps*	20%
Little Blue Stem	*Schizachyrium scoparium*	20%
Eastern Gamagrass	*Tripsacum dactyloides*	5%
	Total Pounds Seed Mix	100%

Temporary Riparian Seed Mix		
Common Name	**Scientific Name**	**Percent composition**
Seed Mix A - Winter		
Barley	*Hordeum sp.*	50%
Winter Rye	*Secale cereale*	50%
	Total Pounds Seed Mix	
Common Name	**Scientific Name**	**Percent composition**
Seed Mix B - Summer		
Sudangrass	*Sorghum bicolor*	40%
Foxtail Millet	*Setaria italica*	20%
Japanese Millet	*Echinochloa frumentacea*	40%
	Total Pounds Seed Mix	100%

NOTES:

1. Bare root planting is proposed for all areas within the easement not designated for live staking or live cutting bundles.
2. Bare root planting density is approximately 680 stems per acre.
3. Live cutting bundles are proposed along the outside of meander bends, adjacent to pools.
4. Live cutting bundles species shall include silky willows or black willows.
5. Live stakes are proposed along both banks of straight reaches adjacent to pools.

PLANTING NOTES

ALL PLANTING AREAS

1. EROSION CONTROL MEASURES SHALL BE PROPERLY MAINTAINED UNTIL PERMANENT VEGETATION IS ESTABLISHED. THE CONTRACTOR SHALL INSPECT EROSION CONTROL MEASURES AT THE END OF EACH WORKING DAY TO ENSURE MEASURES ARE FUNCTIONING PROPERLY.
2. DISTURBED AREAS NOT AT FINAL GRADE SHALL BE TEMPORARILY VEGETATED WITHIN 10 WORKING DAYS. UPON COMPLETION OF FINAL GRADING, PERMANENT VEGETATION SHALL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 10 WORKING DAYS. SEEDING SHALL BE IN ACCORDANCE WITH EROSION CONTROL PLAN.
3. ALL DISTURBED AREAS SHALL BE PREPARED PRIOR TO PLANTING BY DISC OR SPRING-TOOTH CHISEL PLOW TO MINIMUM DEPTH OF 12 INCHES. MULTIPLE PASSES SHALL BE MADE ACROSS PLANTING AREAS WITH THE IMPLEMENT AND THE FINAL PASS SHALL FOLLOW TOPOGRAPHIC CONTOURS.
4. COIR FABRIC MATERIALS SHALL NOT BE CUT WITH PLANTING IMPLEMENTS. THE SMALLEST OPENING NECESSARY TO ACCOMMODATE EACH PLANT SHALL BE CUT INTO COIR FABRIC USING A SHARP KNIFE OR SHEARS. NO HOLES LARGER THAN 12 INCHES SHALL BE MADE.
5. SPECIES SHALL BE DISTRIBUTED SUCH THAT 3 TO 6 PLANTS OF THE SAME SPECIES ARE GROUPED TOGETHER.
6. BARE ROOT PLANTINGS SHALL BE PLANTED ACCORDING TO DETAIL SHOWN ON SHEET 34. LIVE CUTTING BUNDLES SHALL BE PLANTED ACCORDING TO DETAIL SHOWN ON SHEET 33. LIVE STAKES SHALL BE PLANTED ACCORDING TO DETAIL SHOWN ON SHEET 32.

LEGEND

EXISTING FEMA FLOOD ZONE

EXISTING CONTOUR MAJOR

EXISTING CONTOUR MINOR

EXISTING FENCELINE

EXISTING TREELINE

EXISTING TOP OF BANK (TB)

EXISTING TOE OF BANK

EXISTING PROPERTY LINE

EXISTING WETLANDS

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0 200

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MARK	DATE	DESCRIPTION
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PRELIMINARY - NOT FOR CONSTRUCTION

PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINA

ENVIRONMENTAL BANC & EXCHANGE, LLC

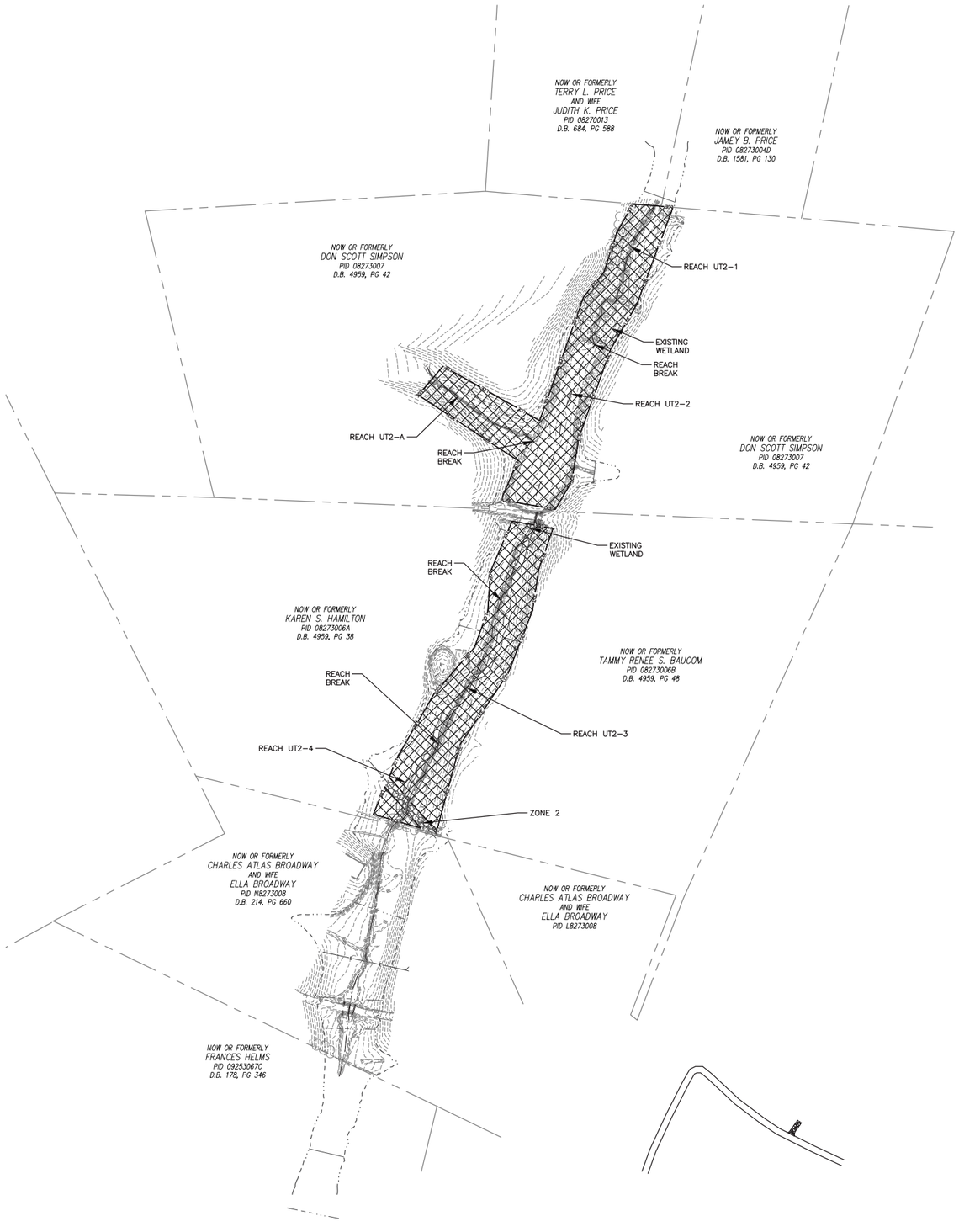
DRAWING TITLE:
PLANTING PLAN UT1

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE:	JUNE 2013
Q.C.:	FM
Q.C. DATE:	05-30-13

DRAWING NUMBER:
25

PROJ. NO.:
20120118.00.RA



Zone 1
Riparian Areas

Common Name	Scientific Name	Percent Composition
Planting Plant Species		
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Common hackberry	*Celtis occidentalis*	10%
Green ash	*Fraxinus pennsylvanica*	10%
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Water oak	*Quercus nigra*	15%
Northern red oak	*Quercus rubra*	15%
Slippery Elm	*Ulmus rubra*	15%
	Total Bareroot Stems	100%

Zone 2
Utility Easement Areas (bareroot or container)

Common Name	Scientific Name	Percent Composition
Tag Alder	*Alnus serrulata*	20%
American hazelnut	*Corylus americana*	20%
Flowering crabapple	*Malus angustifolia*	20%
Wax myrtle	*Morella cerifera*	20%
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PLANTING LEGEND

ZONE 1: RIPARIAN PLANTING

ZONE 2: UTILITY EASEMENT AREA

Permanent Riparian Seed Mix

Common Name	Scientific Name	Percent composition
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Beaked panic grass	*Panicum anceps*	20%
Little Blue Stem	*Schizachyrium scoparium*	20%
Eastern Gamagrass	*Tripsacum dactyloides*	5%
	Total Pounds Seed Mix	100%

Temporary Riparian Seed Mix

Common Name	Scientific Name	Percent composition
Seed Mix A - Winter		
Barley	*Hordeum sp.*	50%
Winter Rye	*Secale cereale*	50%
	Total Pounds Seed Mix	
Common Name	**Scientific Name**	**Percent composition**
Seed Mix B - Summer		
Sudangrass	*Sorghum bicolor*	40%
Foxtail Millet	*Setaria italica*	20%
Japanese Millet	*Echinochloa frumentacea*	40%
	Total Pounds Seed Mix	100%

NOTES:
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LEGEND

EXISTING FEMA FLOOD ZONE
EXISTING CONTOUR MAJOR
EXISTING CONTOUR MINOR
EXISTING FENCELINE
EXISTING TREELINE
EXISTING TOP OF BANK (TB)
EXISTING TOE OF BANK
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PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

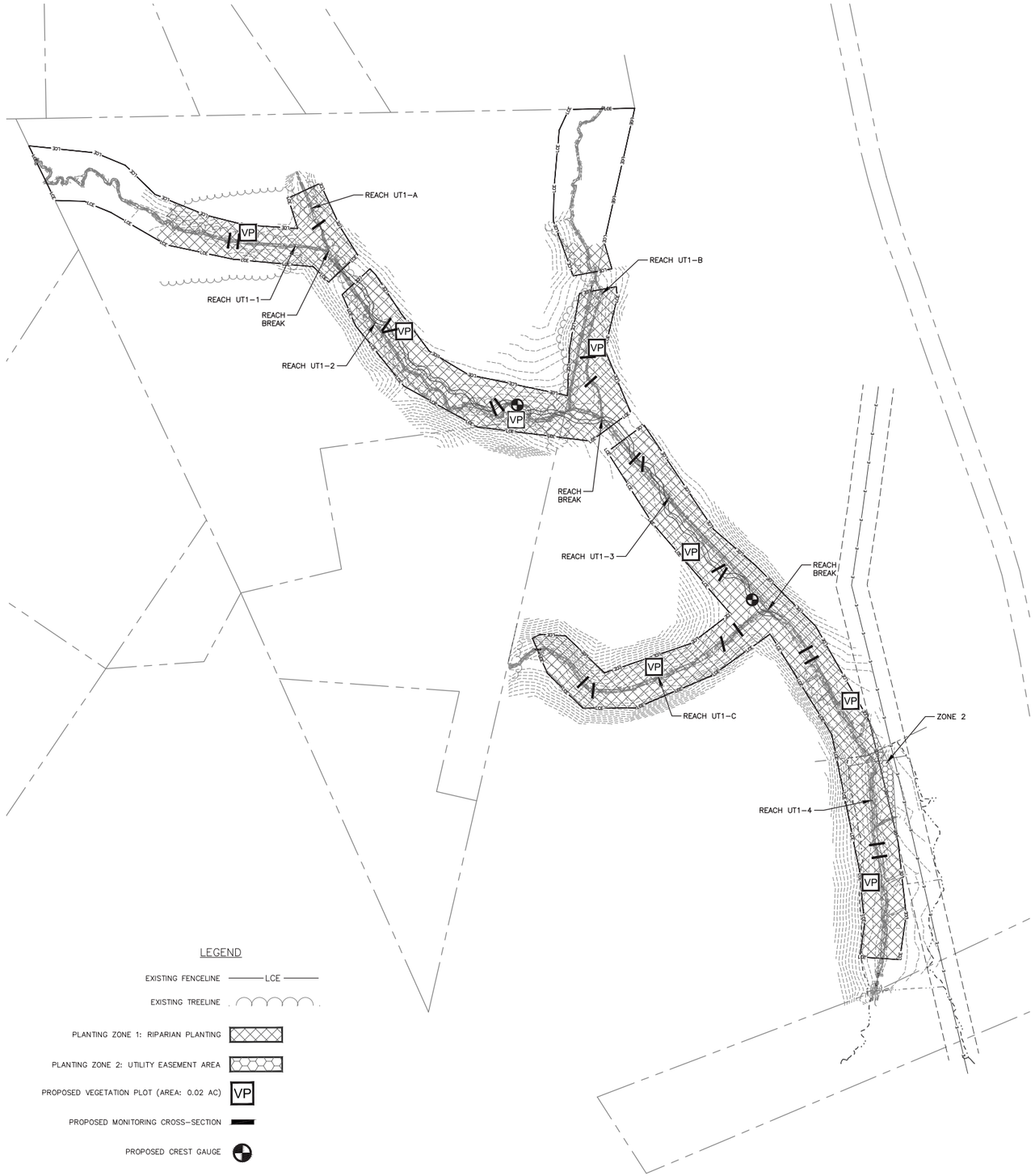
DRAWING TITLE:
PLANTING PLAN UT2

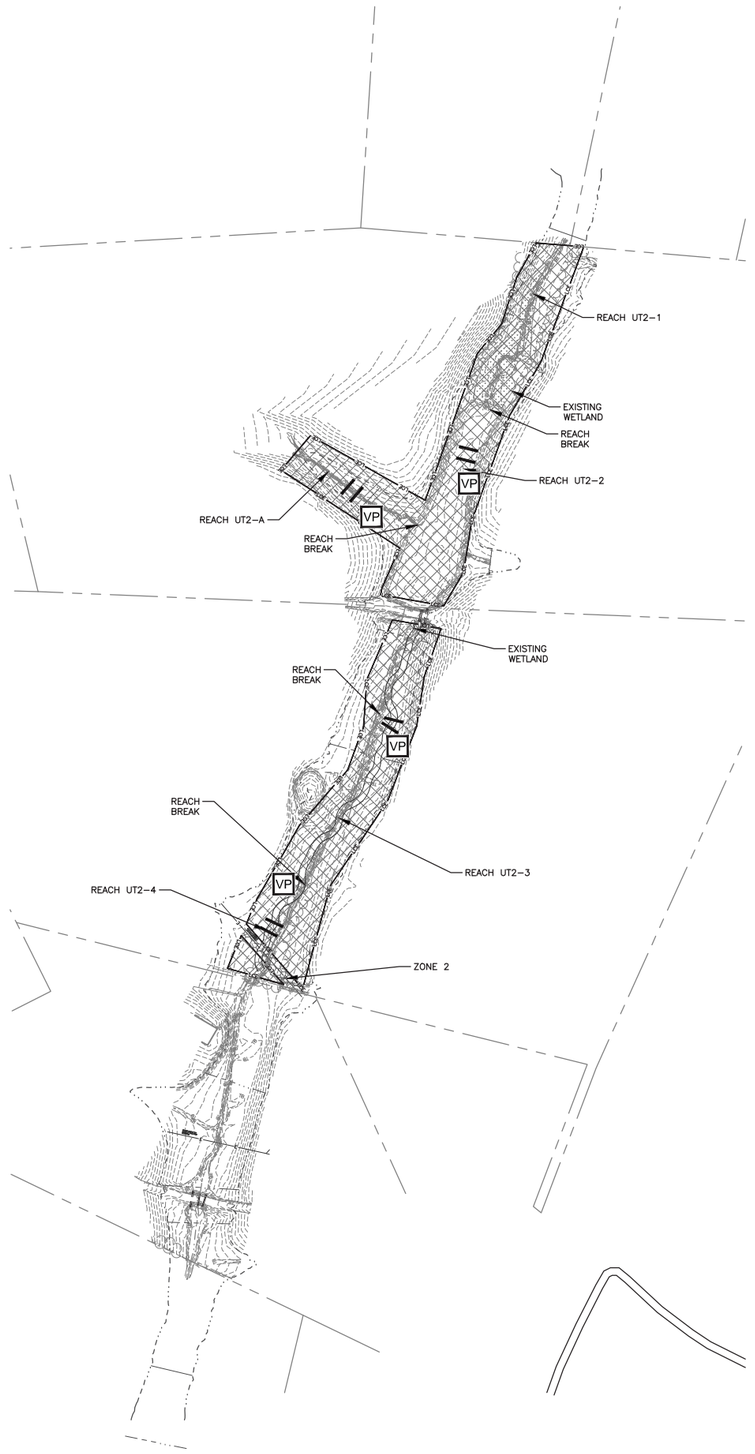
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE:	JUNE 2013
Q.C.:	FM
Q.C. DATE:	05-30-13

DRAWING NUMBER:
26

PROJ. NO.:
20120118.00.RA





LEGEND

- EXISTING FENCELINE — LCE —
- EXISTING TREELINE
- PLANTING ZONE 1: RIPARIAN PLANTING
- PLANTING ZONE 2: UTILITY EASEMENT AREA
- PROPOSED VEGETATION PLOT (AREA: 0.02 AC) VP
- PROPOSED MONITORING CROSS–SECTION
- PROPOSED CREST GAUGE

WK DICKSON
community infrastructure consultants
Transportation + Water Resources
Urban Development + Geomatics
720 Corporate Drive
Raleigh, NC 27607
(v) 919.782.0495
(f) 919.782.9672
www.wkdickson.com
NC. LICENSE NO. F-0374

EBX

FULL SCALE: 1"=200
0 200
2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR:
PRELIMINARY - NOT FOR CONSTRUCTION

PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
MONITORING LOCATIONS

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05–30–13

DRAWING NUMBER:
27

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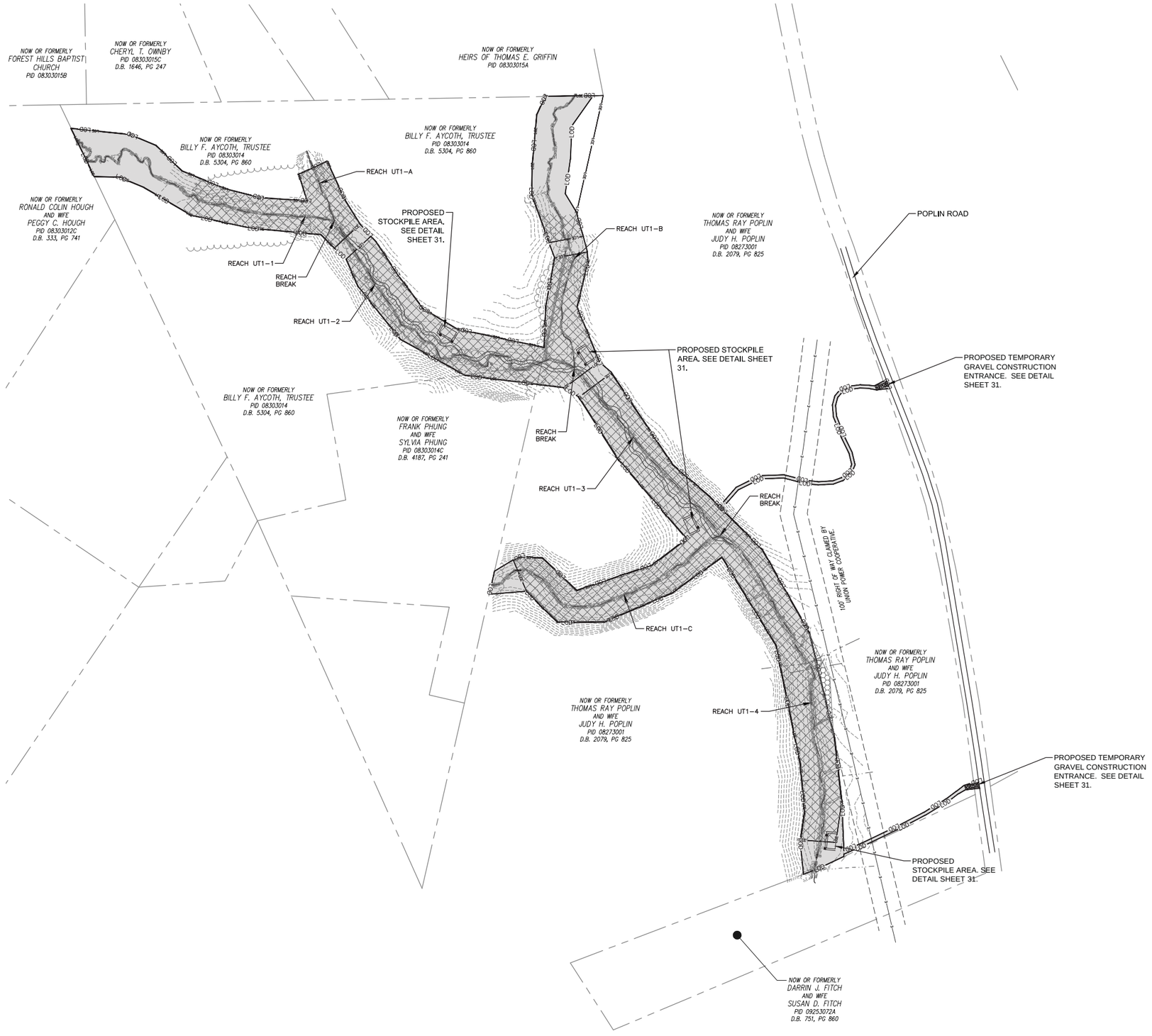

LEGEND

- LIMITS OF PROPOSED CONSERVATION EASEMENT
- TEMPORARY SILT FENCE
- EXISTING TREELINE
- EXISTING GRAVEL FARM PATH
- LIMITS OF DISTURBANCE (LOD)
- TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

TOTAL AREA OF DISTURBANCE – UT1: 20.7 ACRES
TOTAL AREA OF CONSERVATION EASEMENT – UT1: 19.2 ACRES

TOTAL AREA OF DISTURBANCE: 31.7 ACRES
TOTAL AREA OF CONSERVATION EASEMENT: 27.2 ACRES

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PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
EROSION & SEDIMENT CONTROL PLAN - UT1

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
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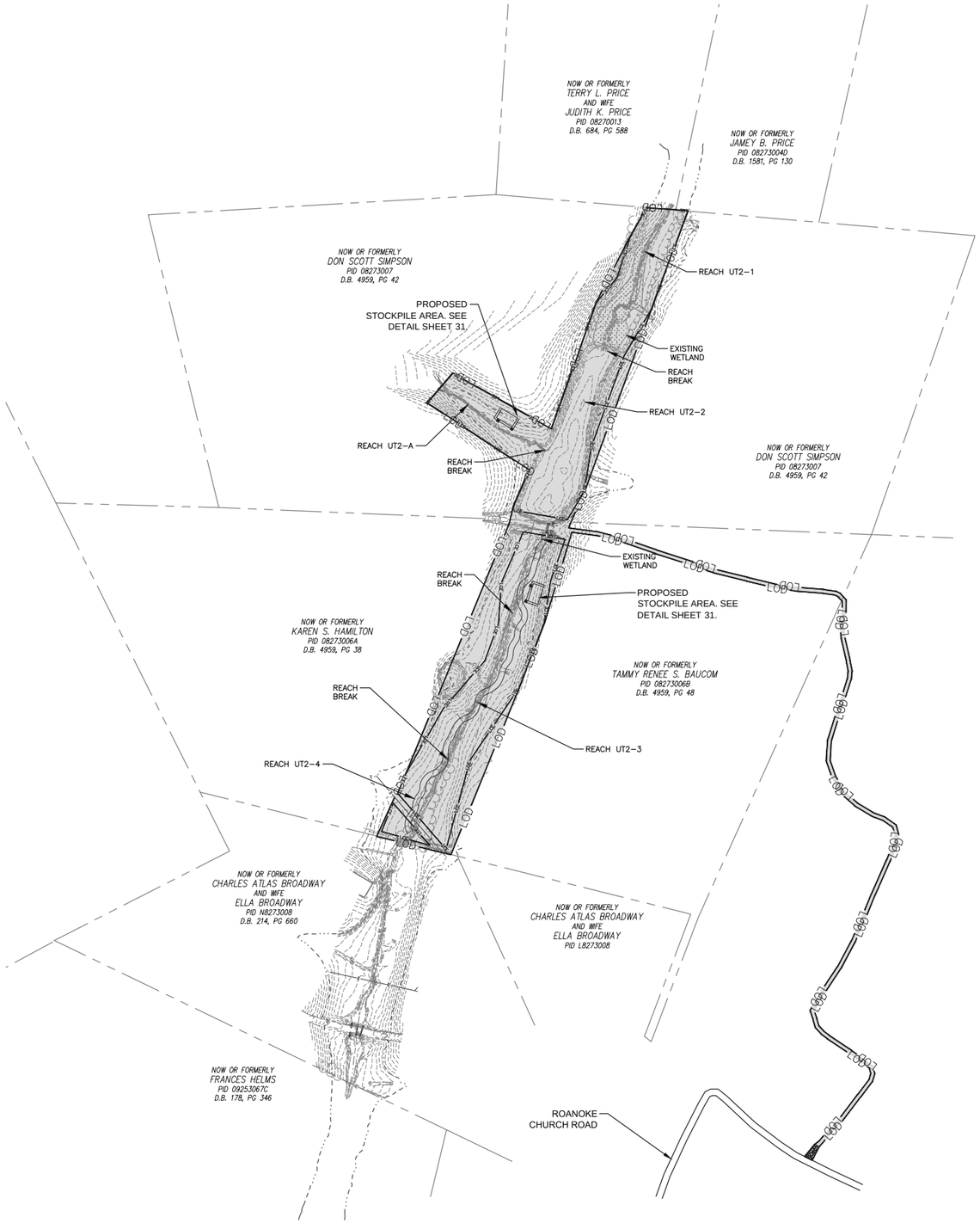

LEGEND

- LIMITS OF PROPOSED CONSERVATION EASEMENT
- TEMPORARY SILT FENCE
- EXISTING TREELINE
- EXISTING GRAVEL FARM PATH
- LIMITS OF DISTURBANCE (LOD)
- TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

TOTAL AREA OF DISTURBANCE – UT2: 11.1 ACRES
TOTAL AREA OF CONSERVATION EASEMENT – UT2: 8.0 ACRES

TOTAL AREA OF DISTURBANCE: 31.7 ACRES
TOTAL AREA OF CONSERVATION EASEMENT: 27.2 ACRES

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DRAWING TITLE:
EROSION & SEDIMENT CONTROL PLAN - UT2

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TEMPORARY SEEDING SCHEDULE – FALL

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120

SEEDING DATES
MOUNTAINS—AUG. 15 – DEC. 15

COASTAL PLAIN AND PIEDMONT—AUG. 15 – DEC. 30

SOIL AMENDMENTS
FOLLOW SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1,000 LB/ACRE 10–10–10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REPAIR AND REFERTILIZE DAMAGED AREAS IMMEDIATELY. TOPDRESS WITH 50 LB/ACRE OF NITROGEN IN MARCH. IF IT IS NECESSARY TO EXTEND TEMPORARY COVER BEYOND JUNE 15, OVERSEED WITH 50 LB/ACRE KOBE (PIEDMONT AND COASTAL PLAIN) OR KOREAN (MOUNTAINS) LESPEDEZA IN LATE FEBRUARY OR EARLY MARCH.

TEMPORARY SEEDING – LATE WINTER/EARLY SPRING

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
RYE (GRAIN)	120
ANNUAL LESPEDEZA (KOBE IN PIEDMONT AND COASTAL PLAIN, KOREAN IN MOUNTAINS)	50

OMIT ANNUAL LESPEDEZA WHEN DURATION OF TEMPORARY COVER IS NOT TO EXTEND BEYOND JUNE.

SEEDING DATES
MOUNTAINS – ABOVE 2500 FT: FEB. 15–MAY 15
BELOW 2500 FT: FEB. 1–MAY 1
PIEDMONT – JAN. 1–MAY 1
COASTAL PLAIN – DEC.1–APR. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10–10–10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IM– MEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING SCHEDULE – SUMMER

SEEDING MIXTURE

SPECIES	RATE (LB/ACRE)
GERMAN MILLET	40

IN THE PIEDMONT AND MOUNTAINS, A SMALL–STEMMED SUDANGRASS MAY BE SUBSTITUTED AT A RATE OF 50 LB/ACRE.

SEEDING DATES
MOUNTAINS – MAY 15–AUG. 15
PIEDMONT – MAY 1–AUG. 15
COASTAL PLAIN – APR. 15–AUG. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATIONS OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10–10–10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS AN ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, FERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

GROUND COVER SCHEDULE

SITE AREA DESCRIPTION	STABILIZATION TIME FRAME	STABILIZATION TIME FRAME EXCEPTIONS
PERIMETER DIKES, SWALES, DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	7 DAYS	IF SLOPES ARE 10' OR LESS IN LENGTH AND ARE NOT STEEPER THAN 2:1, 14 DAYS ARE ALLOWED
SLOPES 3:1 OR FLATTER	14 DAYS	7 DAYS FOR SLOPES GREATER THAN 50 FEET IN LENGTH
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	NONE (EXCEPT FOR PERIMETERS AND HWQ ZONES)

EROSION CONTROL:

GENERAL NOTES

1. REVIEW CONSTRUCTION SEQUENCE FOR ADDITIONAL EROSION CONTROL MEASURES. ALL PERMANENT AND TEMPORARY EROSION CONTROL STRUCTURES (I.E ROCK CHECK DAMS, SILT FENCE AND TEMPORARY CONSTRUCTION ENTRANCES) SHALL BE INSTALLED PRIOR TO THE START OF CONSTRUCTION OF THE LAND–DISTURBING ACTIVITY.
2. CONSTRUCTION ACCESS AREAS SHOWN ARE TO GUIDE CONTRACTOR DURING CONSTRUCTION. CONTRACTOR SHALL COORDINATE WITH ENGINEER IF ALTERNATIVE CONSTRUCTION ACCESS ROUTES WILL IMPROVE EFFICIENCY OF CONSTRUCTION.
3. ALL AREAS DISTURBED BY THE CONTRACTOR SHALL BE SEEDED PER THE SPECIFICATIONS IN THE SEEDING SCHEDULE SHOWN ON THIS SHEET.
4. MULCH: APPLY 2 TONS/ACRE GRAIN STRAW AND ANCHOR STRAW ON ALL OTHER DISTURBED AREAS.
5. EROSION CONTROL:
   A. INSTALL PERMANENT VEGETATIVE COVER AND THE LONG–TERM EROSION PROTECTION MEASURES OR STRUCTURES AS DIRECTED BY ENGINEER UPON CONSTRUCTION COMPLETION. APPROPRIATE EROSION CONTROL MEASURES MUST BE PLACED BETWEEN THE DISTURBED AREA AND AFFECTED WATERWAY AND MAINTAINED UNTIL PERMANENTLY VEGETATED.
   B. PROVIDE FOR HANDLING THE INCREASED RUNOFF CAUSED BY CHANGED SOIL AND SURFACE CONDITIONS. USE EFFECTIVE MEANS TO CONSERVE EXISTING ON–SITE SOIL CONDITIONS.
   C. DURING CONSTRUCTION ACTIVITIES, ALL DISTURBED AREAS SHALL BE STABILIZED AT THE END OF EACH WORKING DAY. USE TEMPORARY PLANT COVER, MULCHING, AND/OR STRUCTURES TO CONTROL RUNOFF AND PROTECT AREAS SUBJECT TO EROSION DURING CONSTRUCTION.
   D. ALL SEDIMENT AND EROSION CONTROLS ARE TO BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND AFTER ANY STORM EVENT OF GREATER THAN 0.5 INCHES OF PRECIPITATION DURING ANY 24–HOUR PERIOD. MAINTENANCE OF SEDIMENT TRAPPING STRUCTURES SHALL BE PERFORMED AS NECESSARY PER THESE INSPECTIONS. SILT FENCING SHALL BE INSTALLED AS SHOWN ON PLANS.
   E. STABILIZATION MEASURES SHALL BE INITIATED AT THE END OF EACH DAY IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED. GROUNDCOVER MUST BE ESTABLISHED PER THE "GROUND COVER SCHEDULE" SHOWN ON THIS SHEET IN AREAS WHERE CONSTRUCTION HAS TEMPORARILY CEASED. ALL AREAS WHERE FINAL GRADE HAS BEEN ESTABLISHED SHALL BE PERMANENTLY STABILIZED WITHIN 2 CALENDAR DAYS.
   F. CONTRACTOR MUST TAKE THE NECESSARY ACTION TO MINIMIZE THE TRACKING OF MUD ONTO THE PAVED ROADWAY FROM CONSTRUCTION AREAS. DAILY REMOVAL OF MUD/SOIL MAY BE REQUIRED.
   G. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING ALL PHASES OF CONSTRUCTION UNTIL THE COMPLETION OF ALL CONSTRUCTION ACTIVITIES AND ALL DISTURBED AREAS HAVE BEEN STABILIZED. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO CONTROL EROSION AND/OR OFF SITE SEDIMENTATION. CONTRACTOR SHALL REMOVE ALL TEMPORARY CONTROL DEVICES ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED. A MAXIMUM OF 500 LINEAR FEET OF STREAM MAY BE DISTURBED AT ANY ONE TIME.
   H. EROSION CONTROL MATTING (SEE DETAIL SHEET 41) SHALL BE INSTALLED ALONG CONSTRUCTED CHANNEL BANKS FROM APPROXIMATELY 2.0' TO 3.0' ABOVE TOP OF BANK DOWN TO CHANNEL TOE.
   I. SILT FENCING TO BE INSTALLED AROUND INDICATED STOCKPILE AREAS TO PREVENT LOSS OF SEDIMENT. STOCKPILE AREAS MAY BE RELOCATED UPON APPROVAL FROM ENGINEER.
   J. ASPHALT TACKIFIER SHALL NOT BE USED.
   K. ALL NECESSARY MEASURES MUST BE TAKEN TO PREVENT OIL, TAR, TRASH, AND OTHER POLLUTANTS FROM ENTERING THE ADJACENT OFF SITE AREAS.
   L. WETLANDS/STREAMS CANNOT BE ENCROACHED UNDER ANY CIRCUMSTANCES IF NOT APPROVED AS DESIGNATED IMPACT AREAS.
   M. ACTIVITIES MUST AVOID DISTURBANCE OF WOODY RIPARIAN VEGETATION WITHIN THE PROJECT AREA TO THE GREATEST EXTENT PRACTICABLE. REMOVAL OF VEGETATION MUST BE LIMITED TO ONLY THAT NECESSARY FOR CONSTRUCTION OF THE CHANNEL.
   N. NO ONSITE BURIAL OR BURNING OF VEGETATION OR CONSTRUCTION DEBRIS WILL BE PERMITTED. VEGETATIVE DEBRIS SHALL BE STOCKPILED AND DISPOSED OF ONSITE PER DIRECTION OF ENGINEER.
   O. ANY GRADING BEYOND THE CONSTRUCTION LIMITS SHOWN ON THE PLAN IS A VIOLATION OF THE NORTH CAROLINA EROSION CONTROL ORDINANCE, AND IS SUBJECT TO A FINE.
   P. PLEASE REFERENCE PLAN SHEET DETAILS AND NCDENR STANDARDS FOR CONSTRUCTION OF EROSION CONTROL MEASURES.
   Q. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL MEASURES RELATED TO THE CONSTRUCTION SITE.
   R. THE LOCATIONS OF SOME EROSION CONTROL MEASURES MAY HAVE TO BE ALTERED FROM THOSE SHOWN ON THE PLANS IF DRAINAGE PATTERNS CHANGE DURING CONSTRUCTION.
   S. IF IT IS DETERMINED DURING THE COURSE OF CONSTRUCTION THAT SIGNIFICANT SEDIMENT IS LEAVING THE SITE (DESPITE THE PROPER IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES), THE PERSON RESPONSIBLE FOR THE LAND DISTURBING ACTIVITY IS OBLIGATED TO TAKE ADDITIONAL PROTECTIVE ACTION.

CONSTRUCTION NOTES:

1. INSTALL EROSION CONTROL MEASURES AS DESCRIBED IN THE EROSION CONTROL PLAN AND NOTES. EROSION CONTROL MEASURES MAY BE PHASED–IN TO THOSE AREAS OF THE PROJECT CURRENTLY BEING WORKED ON. THE CONTRACTOR MAY MODIFY OR RELOCATE EROSION CONTROL MEASURES TO MAKE ADJUSTMENTS FOR UNFORESEEN FIELD CONDITIONS SO LONG AS PROPER CONSTRUCTION IS MAINTAINED TO ENSURE THE INTEGRITY AND USEFULNESS OF THE PROPOSED MEASURES. ALL DISTURBED AREAS ALONG CHANNEL BANKS SHALL BE STABILIZED WITH TEMPORARY SEED AND MULCH AT THE END OF EACH DAY.
2. IN GENERAL, STREAM CONSTRUCTION SHALL PROCEED FROM AN UPSTREAM TO DOWNSTREAM DIRECTION.
3. EXISTING WETLANDS CANNOT BE ENCROACHED UPON UNDER ANY CIRCUMSTANCES IF NOT APPROVED AS DESIGNATED IMPACT AREAS. HIGH VISIBILITY FENCING MUST BE PLACED AROUND ALL EXISTING WETLANDS THAT ARE LOCATED ADJACENT TO CONSTRUCTION ACTIVITIES AND/OR ARE LOCATED WITHIN THE PROPOSED CONSERVATION EASEMENT.
4. DURING STREAM CONSTRUCTION ACTIVITIES, THE WORK AREA SHALL BE STABILIZED AT THE END OF EACH WORKING DAY.
5. STOCKPILE AREAS MAY BE RELOCATED UPON THE APPROVAL OF THE ENGINEER. SILT FENCING MUST BE INSTALLED AROUND ALL STOCKPILE AREAS.
6. THE WORK TO RESHAPE THE CHANNEL BANKS WILL BE PERFORMED USING EQUIPMENT WORKING FROM THE TOP OF THE EXISTING STREAM BANK, WHERE POSSIBLE.
7. CONSTRUCTION EQUIPMENT WILL NOT BE PLACED WITHIN THE ACTIVE CHANNEL TO PERFORM WORK IF POSSIBLE. PLATFORMS SHOULD BE USED TO CROSS CHANNEL WHERE ACCESS IS NOT POSSIBLE.
8. NO MORE CHANNEL SHALL BE DISTURBED THAN CAN BE STABILIZED BY THE END OF THE WORK DAY OR PRIOR TO RESTORING FLOW TO NEWLY CONSTRUCTED CHANNEL SEGMENTS.
9. CONTRACTOR SHALL REMOVE ALL TEMPORARY CONTROL DEVICES ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED. A MAXIMUM OF 200 LINEAR FEET OF STREAM MAY BE DISTURBED AT ANY ONE TIME.
10. ALL EXCAVATED MATERIAL MUST BE PLACED WITHIN DESIGNATED STOCKPILE AREAS.
11. AT LOCATIONS IN WHICH THE EXISTING CHANNEL IS BEING MAINTAINED, TEMPORARY PUMP AROUND DAMS AND BYPASS PUMPING WILL BE USED TO DE–WATER THE WORK AREA AS DESCRIBED IN THE DETAILS.
12. WHEN THE PROPOSED CHANNEL HAS BEEN SUFFICIENTLY STABILIZED TO PREVENT EROSION, ALL TEMPORARY PUMP AROUND DAMS WILL BE REMOVED FROM THE ACTIVE STREAM CHANNEL AND NORMAL FLOW RESTORED. ACCUMULATED SEDIMENT SHALL BE DISPOSED OF IN DESIGNATED SPOILS AREAS PRIOR TO REMOVAL OF TEMPORARY PUMP AROUND DAM.
13. AT LOCATIONS IN WHICH ROCK STRUCTURES, BOULDER TOE STABILIZATION, AND LOG TOE STABILIZATION ARE CALLED FOR ON THE PLANS, TEMPORARY COFFER DAMS AND BYPASS PUMPING WILL BE USED TO DE–WATER THE WORK AREA, EXCEPT AT LOCATIONS IN WHICH THE NORMAL FLOW CAN BE DIVERTED AROUND THE WORK AREA WITH THE USE OF AN EXISTING CHANNEL. WHEN THE TOE HAS BEEN SUFFICIENTLY STABILIZED TO RESTRAIN EROSION ALL TEMPORARY COFFER DAMS WILL BE REMOVED FROM THE ACTIVE STREAM CHANNEL AND NORMAL FLOW RESTORED. ACCUMULATED SEDIMENT SHALL BE DISPOSED OF IN DESIGNATED SPOILS AREA PRIOR TO REMOVAL OF TEMPORARY COFFER DAM.
14. MATERIAL THAT IS REMOVED FROM THE STREAM WILL BE RE–DEPOSITED OUTSIDE OF THE ACTIVE CHANNEL AND ITS FLOODPLAIN.
15. TEMPORARY AND PERMANENT STABILIZATION OF ALL DISTURBED GRASSED AREAS AT THE TOP OF THE CHANNEL BANKS WILL BE IN ACCORDANCE WITH THE SEEDING AND MULCHING SPECIFICATION AS SHOWN ON PLANS.
16. RE–FERTILIZE AND RE–SEED DISTURBED AREAS IF NECESSARY.
17. TEMPORARY AND/OR PERMANENT IMPACTS TO EXISTING WETLANDS SHALL BE AVOIDED TO THE EXTENT POSSIBLE. HIGH VISIBILITY FENCING SHALL BE INSTALLED AROUND ALL EXISTING WETLANDS LOCATED WITHIN THE PROJECT AREA AND/OR ADJACENT TO ANY CONSTRUCTION ACTIVITIES.

STREAM CONSTRUCTION SEQUENCE:

1. CONDUCT PRE–CONSTRUCTION MEETING INCLUDING OWNER, ENGINEER, ASSOCIATED CONTRACTORS, AND OTHER AFFECTED PARTIES.
2. OBTAIN EROSION CONTROL PERMIT FROM NCDENR – LAND QUALITY SECTION AND ALL OTHER APPROVALS NECESSARY TO BEGIN AND COMPLETE THE PROJECT.
3. CONTRACTOR IS FULLY RESPONSIBLE FOR CONTACTING ALL APPROPRIATE PARTIES AND ASSURING THAT UTILITIES ARE LOCATED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. CALL NC ONE–CALL (PREVIOUSLY ULOCO) AT 1–800–632–4949 FOR UTILITY LOCATING SERVICES 48 HOURS PRIOR TO COMMENCEMENT OF ANY WORK. CONTRACTOR SHALL VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
4. PRIOR TO CONSTRUCTION, STABILIZED GRAVEL ENTRANCE/EXIT AND ROUTES OF INGRESS AND EGRESS SHALL BE ESTABLISHED AS SHOWN ON THE PLANS AND DETAILS.
5. PREPARE STAGING AND STOCKPILING AREAS IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS OR AS APPROVED BY THE ENGINEER. ANY EXCESS SPOIL FROM STREAM CONSTRUCTION SHALL BE USED TO CONSTRUCT CHANNEL PLUGS AS SHOWN ON PLANS.
6. INSTALL PUMP AROUND APPARATUS AND IMPERVIOUS DIKES AT UPSTREAM END OF PROJECT. AS CONSTRUCTION PROGRESSES, MOVE PUMP AROUND OPERATION DOWNSTREAM. (SEE DETAILS ON SHEET 41)
7. CONSTRUCT UPSTREAM PORTION OF THE CHANNEL FIRST, WORKING IN AN UPSTREAM TO DOWNSTREAM DIRECTION.
8. ROUGH GRADING OF CHANNEL SHALL BE PERFORMED PRIOR TO INSTALLATION OF STRUCTURES.
9. INSTALL STRUCTURES AS SHOWN ON PLANS AND DETAILS. PRIOR TO FINE GRADING, OBTAIN APPROVAL OF THE ENGINEER ON INSTALLATION OF STRUCTURES.
10. UPON COMPLETION OF FINE GRADING, INSTALL EROSION CONTROL MATTING OR SOD MATS ALONG CHANNEL BANKS.
11. FILL AND STABILIZE ABANDONED SEGMENTS OF THE EXISTING CHANNEL PER DIRECTION OF THE ENGINEER.
12. ALL IMPERVIOUS DIKES AND PUMPING APPARATUS SHALL BE REMOVED FROM THE STREAM AT THE END OF EACH DAY TO RESTORE NORMAL FLOW BACK TO THE CHANNEL.
13. DURING STREAM CONSTRUCTION ACTIVITIES, THE WORK AREA SHALL BE STABILIZED AT THE END OF EACH WORKING DAY.
14. INSTALL LIVE STAKE, BARE ROOT, AND CONTAINERIZED PLANTINGS AS SPECIFIED ON PLANTING PLANS.

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DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE:
EROSION & SEDIMENT CONTROL NOTES

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WHEN AND WHERE TO USE IT
SILT FENCE IS APPLICABLE IN AREAS:

WHERE THE MAXIMUM SHEET OR OVERLAND FLOW PATH LENGTH TO THE FENCE IS 100–FEET.
WHERE THE MAXIMUM SLOPE STEEPNESS (NORMAL [PERPENDICULAR] TO FENCE LINE) IS 2H:1V.
THAT DO NOT RECEIVE CONCENTRATED FLOWS GREATER THAN 0.5 CFS.

DO NOT PLACE SILT FENCE ACROSS CHANNELS OR USE IT AS A VELOCITY CONTROL BMP.

CONSTRUCTION SPECIFICATIONS:

1. USE A SYNTHETIC FILTER FABRIC OF AT LEAST 95% BY WEIGHT OF POLYOLEFINS OR POLYESTER, WHICH IS CERTIFIED BY THE MANUFACTURER OR SUPPLIER AS CONFORMING TO THE REQUIREMENTS IN ASTM D 6461. SYNTHETIC FILTER FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS TO PROVIDE A MINIMUM OF 6 MONTHS OF EXPECTED USABLE CONSTRUCTION LIFE AT A TEMPERATURE RANGE OF 0° TO 120° F.
2. ENSURE THAT POSTS FOR SEDIMENT FENCES ARE 1.33 LB/LINEAR FT STEEL WITH A MINIMUM LENGTH OF 5 FEET. MAKE SURE THAT STEEL POSTS HAVE PROJECTIONS TO FACILITATE FASTENING THE FABRIC.

CONSTRUCTION:

1. CONSTRUCT THE SEDIMENT BARRIER OF EXTRA STRENGTH SYNTHETIC FILTER FABRICS.
2. ENSURE THAT THE HEIGHT OF THE SEDIMENT FENCE DOES NOT EXCEED 24 INCHES ABOVE THE GROUND SURFACE. (HIGHER FENCES MAY IMPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.)
3. 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.
4. EXTRA STRENGTH FILTER FABRIC WITH 6 FEET POST SPACING DOES NOT REQUIRE WIRE MESH SUPPORT FENCE. SECURELY FASTEN THE FILTER FABRIC DIRECTLY TO POSTS. WIRE OR PLASTIC ZIP TIES SHOULD HAVE MINIMUM 50 POUND TENSILE STRENGTH.
5. EXCAVATE A TRENCH APPROXIMATELY 4 INCHES WIDE AND 8 INCHES DEEP ALONG THE PROPOSED LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
6. PLACE 12 INCHES OF THE FABRIC ALONG THE BOTTOM AND SIDE OF THE TRENCH.
7. BACKFILL THE TRENCH WITH SOIL PLACED OVER THE FILTER FABRIC AND COMPACT. THOROUGH COMPACTION OF THE BACKFILL IS CRITICAL TO SILT FENCE PERFORMANCE.
8. DO NOT ATTACH FILTER FABRIC TO EXISTING TREES.

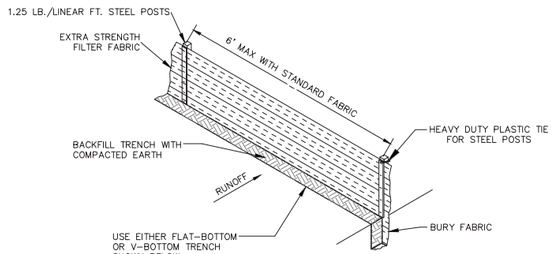
MAINTENANCE:

INSPECT SEDIMENT FENCES AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.

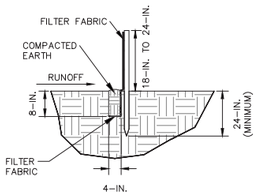
SHOULD THE FABRIC OF A SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.

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.

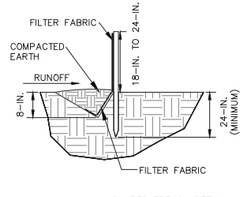
REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AND BRING THE AREA TO GRADE AND STABILIZE IT AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.



SILT FENCE INSTALLATION



FLAT–BOTTOM TRENCH DETAIL



V–SHAPED TRENCH DETAIL

TEMPORARY SILT FENCE

NTS

INSTALLATION NOTES:

SITE PREPARATION

GRADE AND COMPACT AREA.

REMOVE ALL ROCKS, CLODS, VEGETATION, AND OBSTRUCTIONS SO THAT MATTING WILL HAVE DIRECT CONTACT WITH THE SOIL.

PREPARE SEEDBED BY LOOSENING 3 TO 4 INCHES OF TOPSOIL ABOVE FINAL GRADE.

TEST SOILS FOR ANY NUTRIENT DEFICIENCIES AND SUBMIT SOIL TEST RESULTS TO THE ENGINEER. APPLY ANY TREATMENT SUCH AS LIME OR FERTILIZERS TO THE SOIL IF NEEDED.

SEEDING

SEE SHEETS 35, 36, 37 FOR SEEDING REQUIREMENTS.

APPLY SEED TO SOIL BEFORE PLACING MATTING.

INSTALLATION – STREAM BANK

SEE GRADING NOTES ON PLAN AND PROFILE SHEETS AND ON SHEET 40 FOR INFORMATION REGARDING WHAT AREAS ARE TO RECEIVE EROSION CONTROL MATTING.

OVERLAP ADJACENT MATS 4" (IN DIRECTION PARALLEL TO FLOW) AND ANCHOR EVERY 12" ACROSS THE OVERLAP. THE UPSTREAM MAT SHOULD BE PLACED OVER THE DOWNSTREAM MAT.

EDGES SHOULD BE SHINGLED AWAY FROM THE FLOW OF WATER.

LAY MAT LOOSE TO ALLOW CONTACT WITH SOIL. DO NOT STRETCH TIGHT.

ANCHOR MAT USING BIODEGRADABLE STAKES OR PINS.

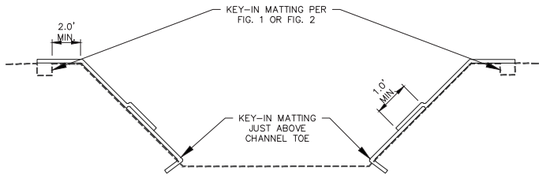
CUT 8" x 8" TRENCH ALONG TOP OF BANK FOR MAT TERMINATION AS SHOWN IN FIGURES 1 & 2. EXTEND MAT 2 TO 3 FEET PAST TOP OF BANK.

PLACE ADJACENT ROLLS IN THE ANCHOR TRENCH WITH A MINIMUM OF 4" OVERLAP. SECURE WITH BIODEGRADABLE STAKES OR PINES, BACKFILL ANCHOR TRENCH, AND COMPACT SOIL.

STAPLE AT 12" INTERVALS ALONG OVERLAP.

STREAM BANK MATTING TO BE INSTALLED FROM TOE OF BANK TO A MINIMUM OF 2.0' PAST TOP OF BANK. SEE FIGURE 3 FOR TERMINATION AT TOP OF BANK.

IF MORE THAN ROLL IS REQUIRED TO COVER THE CHANNEL FROM THE TOP OF BANK DOWN TO THE TOE, THEN OVERLAP MATTING BY A MINIMUM OF 1'.



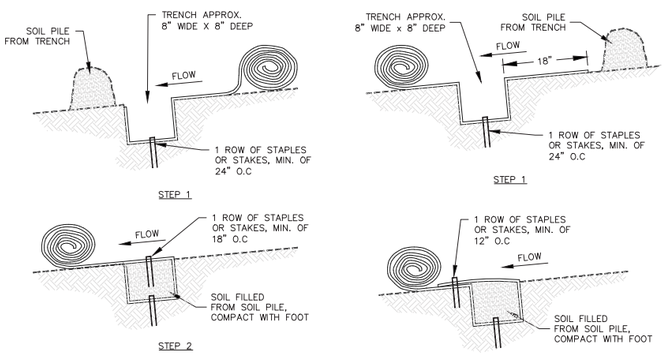


FIGURE 1

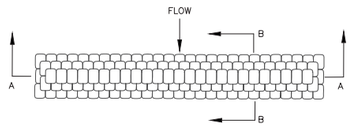
FIGURE 2

EROSION CONTROL MATTING MUST MEET OR EXCEED THE FOLLOWING REQUIREMENTS:

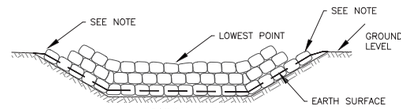
- 100 % COCONUT FIBER (COIR) TWINE WOVEN INTO A HIGH STRENGTH MATRIX.
- THICKNESS – 0.35 IN. MINIMUM.
- TENSILE STRENGTH – 1032 LB/FT MINIMUM
- SHEAR STRESS – 4.5 LBS/SQFT
- FLOW VELOCITY– OBSERVED 12 FT/SEC
- WEIGHT – 23 OZ/SY
- OPEN AREA (MEASURED) – 48%
- SLOPES – UP TO A MAXIMUM OF 1:1

EROSION CONTROL MATTING

NTS

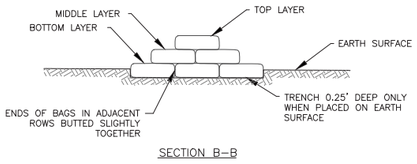


PLAN VIEW



SECTION A–A

NOTE: END OF DIKE AT GROUND LEVEL TO BE HIGHER THAN THE LOWEST POINT OF FLOW CHECK. SUFFICIENT SANDBAGS ARE TO BE PLACED TO PREVENT SCOURING.

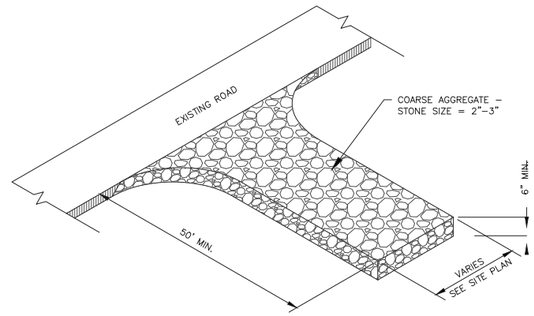


SECTION B–B

SANDBAG BARRIERS SHALL BE CONSTRUCTED OF THREE LAYERS OF SANDBAGS. THE BOTTOM LAYER SHALL CONSIST OF 3 ROWS OF BAGS, THE MIDDLE LAYER SHALL CONSIST OF 2 ROWS OF BAGS AND THE TOP LAYER SHALL CONSIST OF 1 ROW OF BAGS. THE RECOMMENDED DIMENSION OF A FILLED SANDBAG SHALL BE APPROXIMATELY 0.5 FT X 0.5 FT X 1.5 FT.

SANDBAG IMPERVIOUS DIKE

NTS



PURPOSE:

STABILIZED CONSTRUCTION ENTRANCES SHOULD BE USED AT ALL POINTS WHERE TRAFFIC WILL BE LEAVING A CONSTRUCTION SITE AND MOVING DIRECTLY ONTO A PUBLIC ROAD.

CONSTRUCTION SPECIFICATIONS:

1. CLEAR THE ENTRANCE AND EXIT AREA OF ALL VEGETATION, ROOTS, AND OTHER OBJECTIONABLE MATERIAL AND PROPERLY GRADE IT.
2. PLACE THE GRAVEL TO THE SPECIFIC GRADE AND DIMENSIONS SHOWN ON THE DETAIL, AND SMOOTH IT.
3. PROVIDE DRAINAGE TO CARRY WATER TO A SEDIMENT TRAP OR OTHER SUITABLE OUTLET.
4. USE GEOTEXTILE FABRICS BECAUSE THEY IMPROVE STABILITY OF THE FOUNDATION IN LOCATIONS SUBJECT TO SEEPAGE OR HIGH WATER TABLE.

MAINTENANCE:

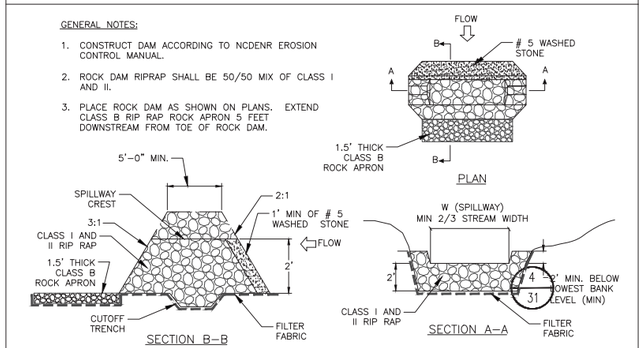
MAINTAIN THE GRAVEL PAD IN A CONDITION TO PREVENT MUD OR SEDIMENT FROM LEAVING THE CONSTRUCTION SITE. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH 2–INCH STONE. AFTER EACH RAINFALL, INSPECT ANY STRUCTURE USED TO TRAP SEDIMENT AND CLEAN IT OUT AS NECESSARY. IMMEDIATELY REMOVE ALL OBJECTIONABLE MATERIALS SPILLED, WASHED, OR TRACKED ONTO PUBLIC ROADWAYS, OR AIRFIELD PAVEMENTS.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

NTS

GENERAL NOTES:

1. CONSTRUCT DAM ACCORDING TO NCDENR EROSION CONTROL MANUAL.
2. ROCK DAM RIPRAP SHALL BE 50/50 MIX OF CLASS I AND II.
3. PLACE ROCK DAM AS SHOWN ON PLANS. EXTEND CLASS B RIP RAP ROCK APRON 5 FEET DOWNSTREAM FROM TOE OF ROCK DAM.



TEMPORARY ROCK CHECK DAM

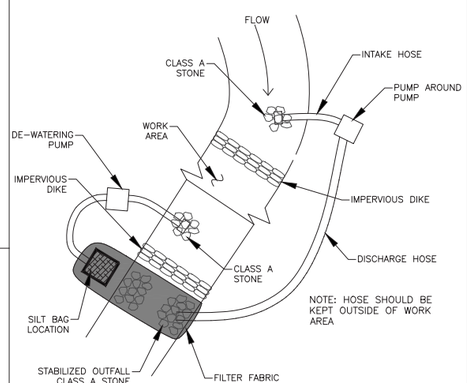
NTS

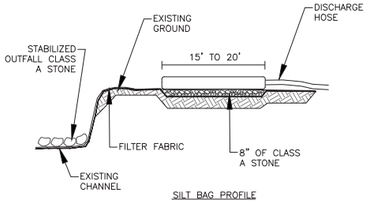
NOTES:

1. EXCAVATION SHALL BE PERFORMED ONLY IN DRY AND/OR ISOLATED 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. A MAXIMUM OF 200 FEET MAY BE DISTURBED AT ANY ONE TIME.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING PUMP SIZE SUFFICIENT TO PUMP BASE FLOW.
5. DIKE MUST BE CONSTRUCTED OF NON–ERODIBLE MATERIALS SUCH AS SANDBAGS.

SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL STILLING BASIN AND STABILIZED OUTFALL USING CLASS A RIP RAP AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR SHALL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK AREA TO THE STABILIZED OUTFALL.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND DEWATERING 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 ALSO BE PUMPED TO AN OUTFALL STABILIZED WITH CLASS A RIP RAP.
5. THE CONTRACTOR SHALL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. WHEN DEWATERING AREA, ALL DIRTY WATER MUST BE PUMPED THROUGH A SILT BAG. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
6. ONCE THE WORKING AREA IS COMPLETED, REMOVE ALL RIP RAP AND IMPERVIOUS DIKES AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.
7. ALL WORK IN CHANNEL MUST BE COMPLETED BEFORE REMOVING IMPERVIOUS DIKE.





SILT BAG PROFILE

PUMP AROUND & DEWATERING DETAIL

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EBX

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR:
PRELIMINARY- NOT FOR CONSTRUCTION

PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

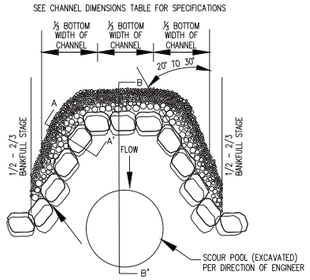
DRAWING TITLE: DETAIL 1

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05–30–13

DRAWING NUMBER:
31

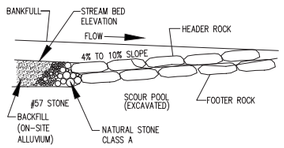
PROJ. NO.:
20120118.00.RA



ROCK CROSS VANE – PLAN VIEW

NOTES

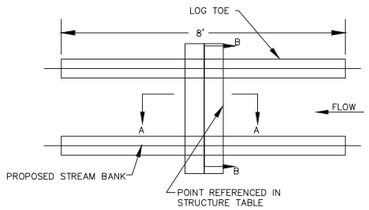
1. HEADER ROCKS MUST HAVE AN INTERMEDIATE DIAMETER OF 12" TO 18". FOOTER ROCKS MUST HAVE AN INTERMEDIATE DIAMETER OF 16" TO 24".
2. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND OWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF THREE FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
4. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
7. USE NATURAL STONE CLASS A TO FILL GAPS ON UPSTREAM SIDE OF ROCKS, AND # 57 STONE TO FILL GAPS ON UPSTREAM SIDE OF NATURAL STONE CLASS A.
8. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH CLASS A STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.
9. START SLOPE AT 1/2 TO 2/3 BANKFULL STAGE.
10. GEOTEXTILE FABRIC SHALL MEET SPECIFICATIONS FOR TYPE 2 NCDOT GEOTEXTILE FABRIC.



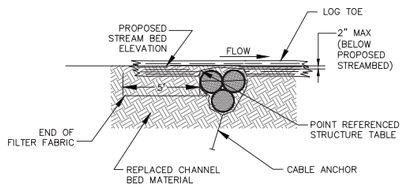
ROCK CROSS VANE – PROFILE B–B'

ROCK CROSS VANE

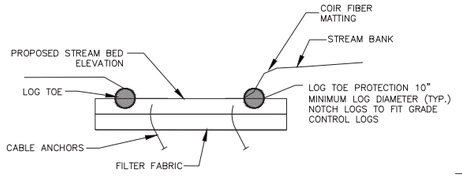
NTS



PLAN VIEW



SECTION A–A

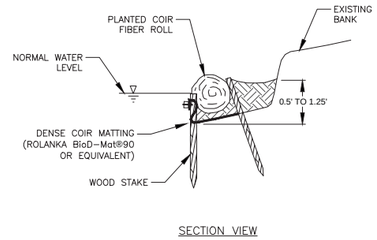


GRADE CONTROL STRUCTURE SECTION B–B

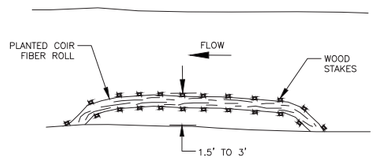
1. LOGS SHOULD BE AT LEAST 8 TO 10 INCHES IN DIAMETER, A MINIMUM OF 15 FEET IN LENGTH (UNLESS OTHERWISE NOTED), AND RELATIVELY STRAIGHT.
2. NAIL FILTER FABRIC USING 3" 10D GALVANIZED COMMON NAIL EVERY 2' ALONG THE LOG.
3. FILTER FABRIC USED SHALL BE NCDOT TYPE 2 ENGINEERING FABRIC OR EQUIVALENT.

LOG GRADE CONTROL

NTS



SECTION VIEW

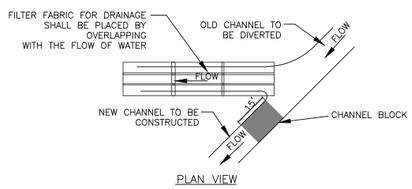


PLAN VIEW

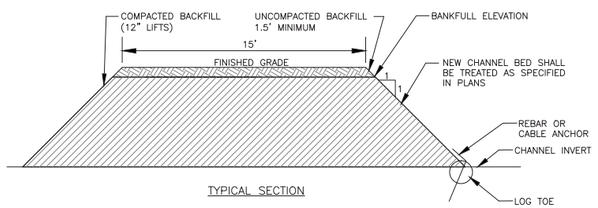
NOTES:
DESIGNER TO MARK LOCATIONS AND DIMENSIONS OF SILLS IN THE FIELD PRIOR TO CONSTRUCTION.

VEGETATED SILL DEFLECTOR

NTS



PLAN VIEW



TYPICAL SECTION

CHANNEL PLUG

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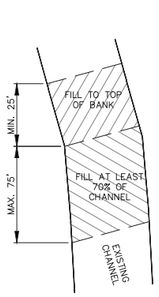
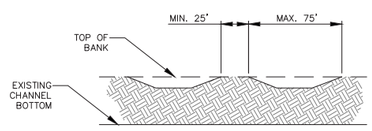


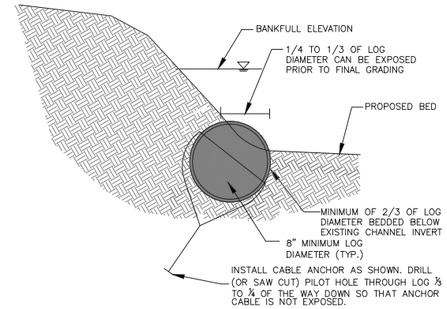


NOTES:
1. FILL EXISTING CHANNEL TO BANKFULL ELEVATION WHEN POSSIBLE.
2. IF CHANNEL CANNOT BE COMPLETELY FILLED TO BANKFULL, FILL TO BANKFULL EVERY 75' FOR AT LEAST 25'.

CHANNEL BACKFILL

NTS

NOTES:
1. LOGS SHOULD BE AT LEAST 10 INCHES IN DIAMETER, 6–10 FEET LONG, RELATIVELY STRAIGHT, AND HARDWOOD.
2. CABLE ANCHORS SHOULD BE PLACED 1' TO 3' FROM EACH END OF LOG. REBAR (5/8" MINIMUM DIAMETER 3' MIN. LENGTH TYPICAL) MAY BE USED AS A SUBSTITUTION FOR CABLE ANCHORS PER DIRECTION OF ENGINEER.
3. IF REBAR IS USED, PRE–DRILL HOLES WITH 5/8" DRILL BIT.



LOG TOE PROTECTION

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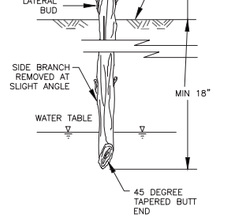
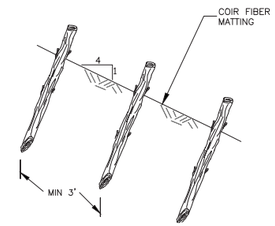


DETAIL
LIVE STAKES SHOULD BE LONG ENOUGH TO REACH BELOW THE GROUNDWATER TABLE. (GENERALLY, A LENGTH OF 2 TO 3 FEET IS SUFFICIENT.) ADDITIONALLY, THE STAKES SHOULD HAVE A DIAMETER IN THE RANGE OF 0.75 TO 2 INCHES.

SECTION VIEW
LIVE STAKES SHALL BE SPACED 3 FEET APART, ALTERNATE SPACING.



NOTE:
1. ACCEPTABLE SPECIES INCLUDE BLACK WILLOW (SALIX NIGRA), SILKY WILLOW (SALIX SERICEA) AND SILKY DOGWOOD (CORNUS AMMOMUM).
2. LIVE STAKES SHALL BE PLANTED IN AN AREA EXTENDING 3 FEET OUT FROM TOP OF BANK TO JUST BELOW BANKFULL.

LIVE STAKE

NTS

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DRAWING TITLE:
DETAIL 2

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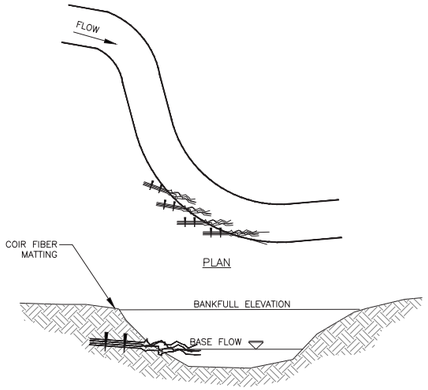
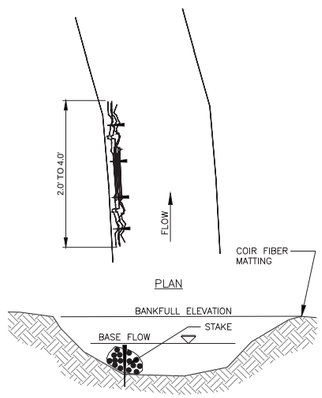


TYPICAL SECTION

NOTE:
WATTLES ARE TO BE INSTALLED 4' O.C. BY CUTTING AN APPROXIMATELY 4" WIDE TRENCH PERPENDICULAR TO THE STREAM BANK JUST ABOVE BASEFLOW ELEVATION. INSERT THE WATTLES, ANCHORING WITH STAKES, AND TIGHTLY BACKFILL WITH TOPSOIL. WATTLES SHALL CONSIST OF 5 TO 10 STEMS, 0.25" TO 0.5" IN DIAMETER. MINIMUM LENGTH IS 4.5 FEET. AT LEAST 3.0 FEET SHALL BE INSTALLED WITHIN THE BANK. WATTLES SHOULD BE INSTALLED AT AN ANGLE OF 20° TO 30° TO THE STREAM BANK AND SHOULD POINT DOWNSTREAM. FILL VOIDS OF EXPOSED PORTION OF WATTLE WITH PINE STRAW (IF READILY AVAILABLE ON-SITE).

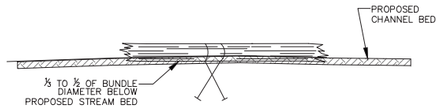
WATTLE



TYPICAL SECTION

NOTE: USE DEAD BRUSH AND TOPS 0.5 TO 2.0 INCHES IN DIAMETER. TIE BUNDLES WITH TWINE AND STAKE TO THE CHANNEL BED. IF PINE STRAW IS READILY AVAILABLE ON-SITE, ADD TO BUNDLE.

DEAD BRUSH

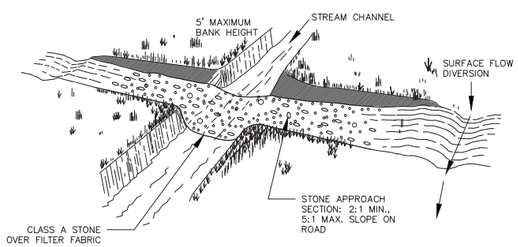


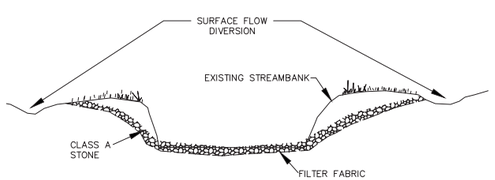
USE STICKS AND LOGS OF VARYING SIZES 1"-4" DIAMETER AND 1'-4' LONG. WOODY DEBRIS SHALL BE HELD IN PLACE USING TWINE AND WOODEN STAKES AND SHALL BE PLACED ACCORDING TO DESIGN PLANS AND AS DIRECTED BY ENGINEER.

WOODY DEBRIS BUNDLE

NOTE:
WHEN INSTALLING SMALL WOODY DEBRIS STRUCTURES AS LOCATED ON THE PLAN SHEETS, CONTRACTOR SHALL ALTERNATE BETWEEN WATTLE, SMALL LOG, AND DEAD BRUSH STRUCTURES BASED ON READILY AVAILABLE MATERIALS AND PER DIRECTION OF THE ENGINEER.

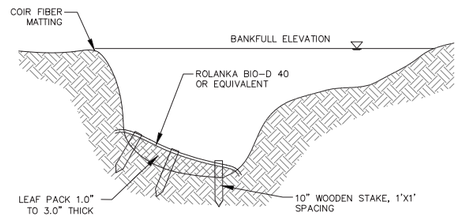
SMALL WOODY DEBRIS & HABITAT STRUCTURES
NTS



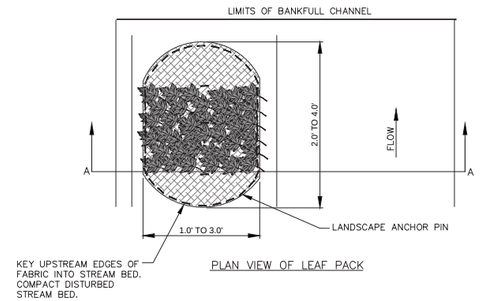


NOTES:
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING PERPENDICULAR TO FLOW.
5. GRADE SLOPES TO A MINIMUM OF 2:1 SLOPE, MAXIMUM
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. A STABILIZED PAD OF NATURAL CLASS A STONE, 6 INCHES THICK, LINED WITH FILTER FABRIC SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
8. FILTER FABRIC USED SHALL BE NCDOT TYPE 2 ENGINEERING FABRIC OR EQUIVALENT.
9. WIDTH OF THE CROSSING SHALL BE SUFFICIENT (8' MIN.) TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL.
10. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.
11. TEMPORARY CROSSINGS ARE TO BE ABANDONED IN PLACE.

FORD CROSSING
NTS

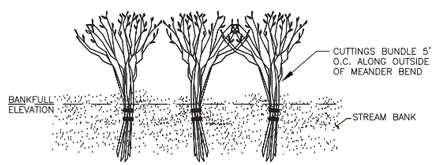


SECTION A-A

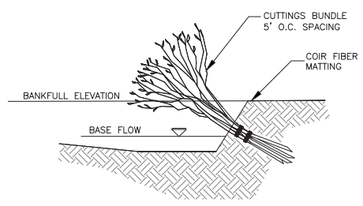


PLAN VIEW OF LEAF PACK

LEAF PACK
NTS



LIVE CUTTINGS BUNDLE TYPICAL PROFILE

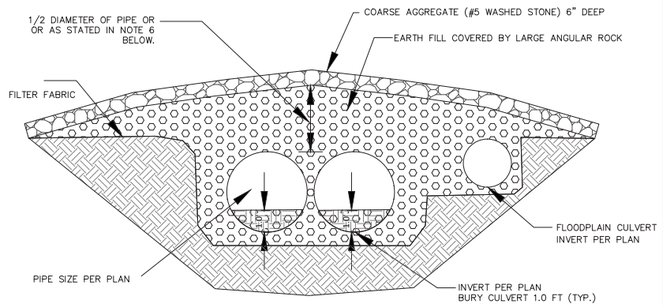


LIVE CUTTINGS BUNDLE TYPICAL SECTION

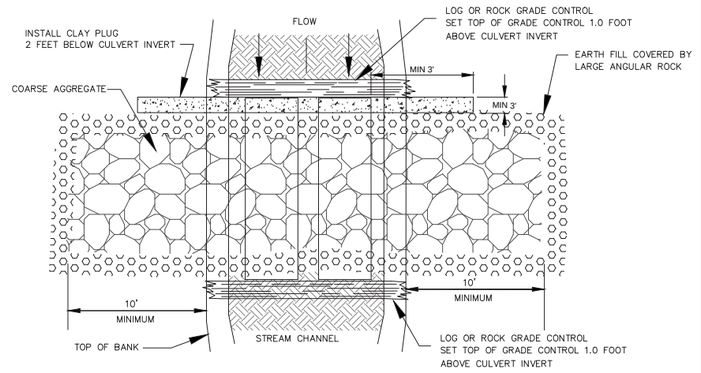
NOTE: ACCEPTABLE SPECIES INCLUDE BLACK WILLOW (SALIX NIGRA), SILKY DOGWOOD (CORNUS AMOMUM) AND SILKY WILLOW (SALIX SERICEA). CUTTINGS BUNDLES ARE TO BE INSTALLED (AFTER SOD MAT HAS BEEN PLACED) BY DRILLING AN APPROXIMATE 4" DIAMETER HOLE INTO THE STREAM BANK FROM AN ELEVATION SLIGHTLY ABOVE BANKFULL ELEVATION. INSERTING THE CUTTINGS AND TIGHTLY BACKFILLING WITH TOPSOIL. WILLOW CUTTINGS SHOULD BE RINSED AT CUTTING POINT TO ALLOW BETTER ROOTING. ALDER TRANSPLANTS CAN BE SUBSTITUTED FOR CUTTINGS BUNDLES WITH APPROVAL OF ENGINEER

LIVE CUTTINGS BUNDLE
NTS

ELEVATION

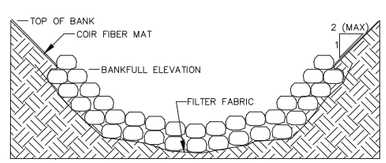


PLAN

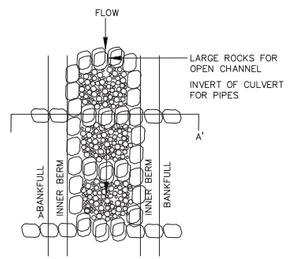


NOTES:
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. INSTALL STREAM CROSSING PERPENDICULAR TO FLOW.
3. CONTRACTOR TO COORDINATE APPROPRIATE BEDDING MATERIAL WITH MANUFACTURER.
4. FILTER FABRIC USED SHALL BE NCDOT TYPE 2 ENGINEERING FABRIC OR EQUIVALENT.
5. WIDTH OF TYPICAL FARM CROSSINGS SHALL BE PER PLAN OR A MINIMUM OF 12'.
6. SEE PLAN SHEET FOR CULVERT SIZE, LENGTH, MATERIAL, AND USE OF FLOODPLAIN CULVERT OR TWIN PIPE.
7. FLOODPLAIN CULVERTS TO BE INSTALLED AT EACH UT2 PROPOSED CROSSING.

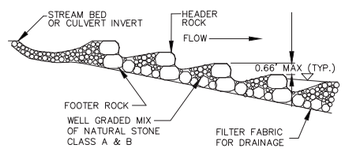
PROPOSED CULVERT CROSSING
NTS



STEP POOL - SECTION A-A'



STEP POOL - PLAN VIEW



STEP POOL - PROFILE VIEW

1. STEP POOL ROCKS MUST HAVE AN INTERMEDIATE DIAMETER OF 12" TO 20" FOR HEADERS AND 16" TO 24" FOR FOOTERS.
2. INSTALL FILTER FABRIC THE FULL LENGTH OF THE STRUCTURE STARTING AT THE DOWNSTREAM END, AND THEN UPSTREAM PAST THE LAST STEP POOL ROCK TO A MINIMUM OF THREE FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF STEP POOL ARM, BETWEEN THE ARM AND STREAM BANK.
4. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. USE CLASS A AND CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF STEP POOL ROCKS.
7. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH CLASS A AND CLASS B STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.
8. FILTER FABRIC SHALL MEET SPECIFICATIONS FOR TYPE 2 NCDOT FILTER FABRIC.

STEP POOL
NTS

WK DICKSON
community infrastructure consultants
Transportation + Water Resources
Urban Development + Geomatics
720 Corporate Drive
Raleigh, NC 27607
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(f) 919.782.9672
www.wkdickson.com
NC. LICENSE NO. F-0374

EBX

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR:
PRELIMINARY- NOT FOR CONSTRUCTION

PLOT DATE: 2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

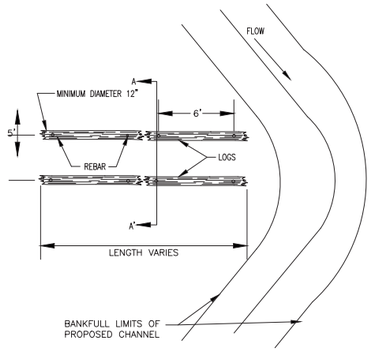
DRAWING TITLE: DETAIL 3

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

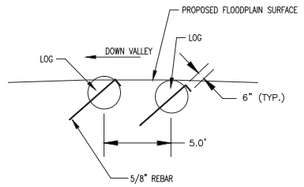
DRAWING NUMBER:
33

PROJ. NO.:
20120118.00.RA



PLAN VIEW

NOTE:
REBAR (1/2" MINIMUM DIAMETER 3' MIN. LENGTH TYPICAL) SHOULD BE PLACED 1' TO 3' FROM END OF LOG. ADDITIONAL REBAR TO BE PLACED AT 6' OFFSETS. LAST REBAR SHOULD BE PLACED 1' TO 3' FROM END OF LOG. DUCK BILL ANCHORS MAY BE USED AS A SUBSTITUTION FOR REBAR, 2 PER LOG.



SECTIONAL VIEW A – A'

FLOODPLAIN SILL

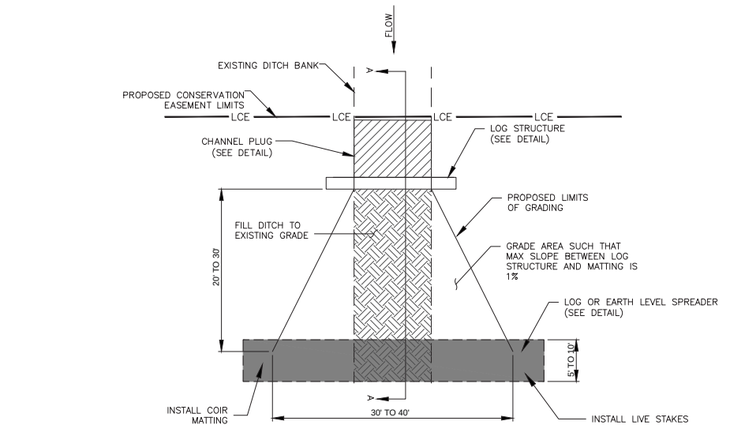
NTS

SIGN SPECIFICATIONS:
- MATERIAL: ALUMINUM
- GAUGE: .032
- SIZE: 6" X 6"
- BACKGROUND COLOR: COATED CHROME YELLOW
- PRINT COLOR: BLACK
- MOUNTING HOLES: 2 HOLES CENTER TOP AND BOTTOM 3/8" DIAMETER 6" ON CENTER AND 2 HOLES CENTER TOP AND BOTTOM 3/16" DIAMETER 7 3/8" ON CENTER
- ROUND CORNERS: 1/4" RADIUS

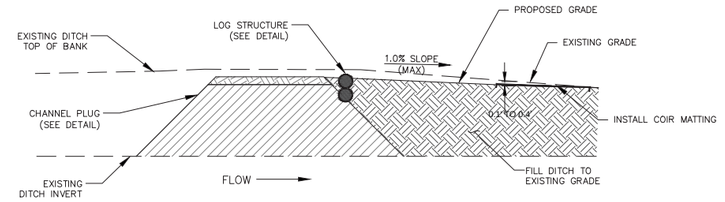
NOTES:
1. CONSERVATION AREA SIGNS SHALL BE ATTACHED TO A TREE, T-POST, U-CHANNEL POST, OR SQUARE STEEL POST.
2. ALL POSTS MUST HAVE A LENGTH OF 6.0 FEET AND BE BURIED TO A DEPTH OF 2.0 FEET.
3. SIGNS SHALL BE INSTALLED ON POSTS USING ⅜" ALUMINUM DRIVE RIVETS.
4. THE TOP 0.5 FEET OF T-POSTS OR U-CHANNEL POSTS SHALL BE PAINTED YELLOW.
5. USE 3½"ALUMINUM NAILS TO INSTALL SIGN ON TREES, LEAVING ½" OF THE NAIL EXPOSED.

CONSERVATION EASEMENT SIGN

NTS



PLAN VIEW

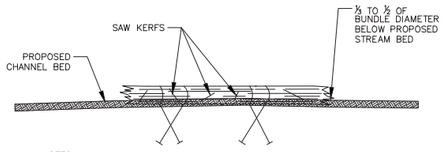


SECTION A–A

NOTES:
1. LOGS SHOULD BE AT LEAST 10'–20' LONG AND AT LEAST 8 INCHES IN DIAMETER, AND HARDWOOD.

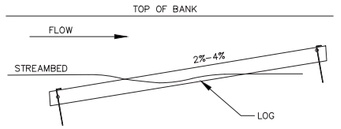
DIFFUSE FLOW STRUCTURE

NTS



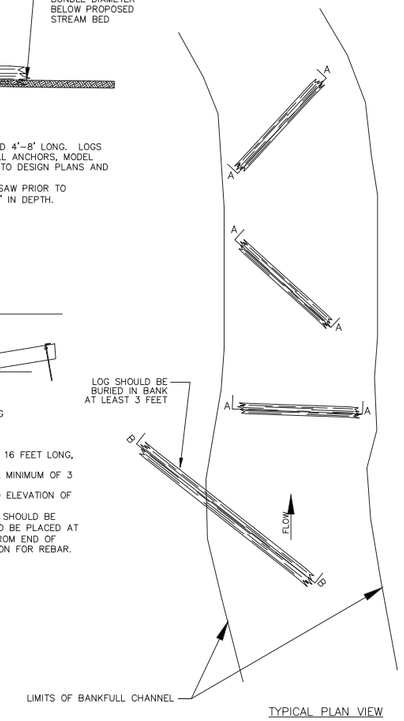
NOTES:
1. USE LOGS OF VARYING SIZES 6"–15" DIAMETER AND 4'–8' LONG. LOGS SHALL BE HELD IN PLACE WITH REBAR OR DUCKBILL ANCHORS, MODEL 68-DB1 OR EQUIVALENT, AND PLACED ACCORDING TO DESIGN PLANS AND AS DIRECTED BY ENGINEER.
2. ALL LOGS SHALL BE "ROUGHED UP" WITH A CHAINSAW PRIOR TO INSTALLATION. SAW KERFS SHALL BE 0.25" TO 2.0" IN DEPTH.

TYPICAL SECTION A–A



NOTES:
1. LOGS SHOULD BE AT LEAST 6 INCHES IN DIAMETER, 10 TO 16 FEET LONG, RELATIVELY STRAIGHT, AND HARDWOOD.
2. LOG ARMS SHOULD BE BURIED INTO THE BANK AND BED A MINIMUM OF 3 FEET.
3. SET ELEVATION OF TOP OF LOG CROSS PIECES TO DESIRED ELEVATION OF PROPOSED GROUND OR STREAMBED.
4. REBAR (5/8" MINIMUM DIAMETER 3' MIN. LENGTH TYPICAL) SHOULD BE PLACED 1' TO 3' FROM END OF LOG. ADDITIONAL REBAR TO BE PLACED AT 5' OFFSETS. LAST REBAR SHOULD BE PLACED 1' TO 3' FROM END OF LOG. DUCK BILL ANCHORS MAY BE USED AS A SUBSTITUTION FOR REBAR.
5. PRE-DRILL HOLES FOR REBAR WITH 5/8" DRILL BIT.
6. DRIVE REBAR THROUGH LOGS AND BEND ENDS AS SHOWN.

TYPICAL SECTION B–B



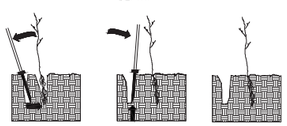
TYPICAL PLAN VIEW

LARGE WOODY DEBRIS

NTS

DIBBLE PLANTING METHOD
USING THE KBC PLANTING BAR

1. INSERT PLANTING BAR AS SHOWN AND PULL HANDLE TOWARD PLANTER.
2. REMOVE PLANTING BAR AND PLACESEEDING AT CORRECT DEPTH.
3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDING.



4. PULL HANDLE OF BAR TOWARD PLANTER, FIRMING SOIL AT BOTTOM.
5. PUSH HANDLE FORWARD FIRMING SOIL AT TOP.
6. LEAVE COMPACTION HOLE OPEN. WATER THOROUGHLY.

PLANTING NOTES:

PLANTING BAG
DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT THE ROOT SYSTEMS FROM DRYING.

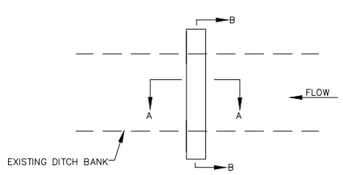
KBC PLANTING BAR
PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.

ROOT PRUNING
ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.

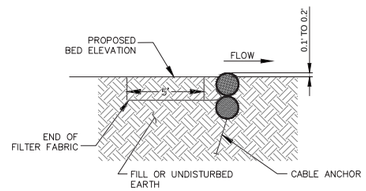
NOTES:
BARE ROOTS SHALL BE PLANTED 6 FT. TO 10 FT. ON CENTER, RANDOM SPACING, AVERAGING 8 FT. ON CENTER, APPROXIMATELY 680 PLANTS PER ACRE.

BARE ROOT PLANTING

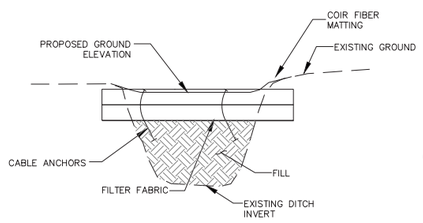
NTS



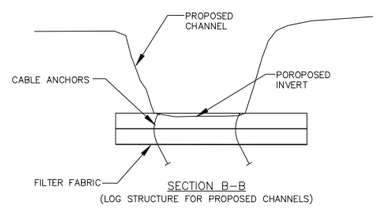
PLAN VIEW



SECTION A–A



SECTION B–B
(LOG STRUCTURE FOR DIFFUSE FLOW STRUCTURE)



SECTION B–B
(LOG STRUCTURE FOR PROPOSED CHANNELS)

1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, HARDWOOD SPECIES (EXCLUDING TULIP POPLAR AND SWEET GUM), A MINIMUM OF 10 TO 20 FEET IN LENGTH (UNLESS OTHERWISE NOTED), AND RELATIVELY STRAIGHT.
2. NAIL FILTER FABRIC USING 3" 10D GALVANIZED COMMON NAIL EVERY 3' ALONG THE LOG.
3. FILTER FABRIC USED SHALL BE NCDOT TYPE 2 ENGINEERING FABRIC OR EQUIVALENT.

LOG STRUCTURE

NTS

WK DICKSON
community infrastructure consultants
Transportation + Water Resources
Urban Development + Geomatics
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www.wkdickson.com
NC. LICENSE NO. F-0374

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MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR:
PRELIMINARY- NOT FOR CONSTRUCTION

PLOT DATE:
2/25/14

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

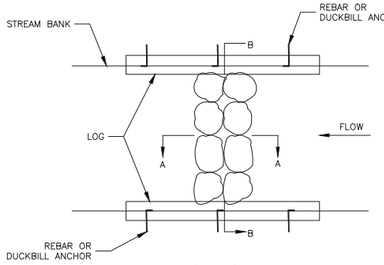
DRAWING TITLE:
DETAIL 4

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

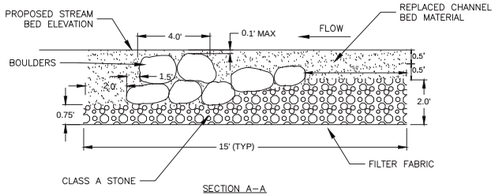
PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05-30-13

DRAWING NUMBER:
34

PROJ. NO.:
20120118.00.RA

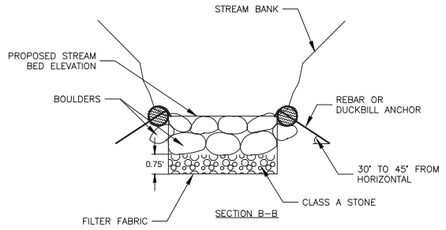


PLAN VIEW



SECTION A–A

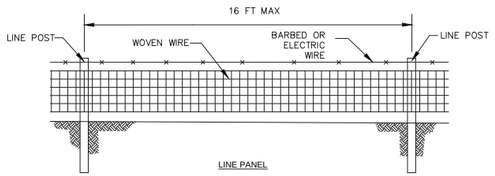
NOTES:
1. ALL BOULDERS SHALL HAVE AN INTERMEDIATE DIAMETER OF 1.5' TO 2.0' AND SHALL NOT EXCEED 2.5' AS MEASURED THROUGH ANY AXIS.
2. BOULDERS (TYP.) ARE TO BE LOCALLY QUARRIED KEY–IN COIR MATTING PER DIRECTION OF ENGINEER.
3. LOG TOES ARE OPTIONAL PER DIRECTION OF ENGINEER.
4. LOGS MUST BE OF HARDWOOD SPECIES AND HAVE A 12" MINIMUM DIAMETER.
5. LOGS ARE TO BE SALVAGED FROM PROJECT AREA. SIZE AND SPECIES MAY VARY.
6. REBAR (5/8" MIN. DIAMETER, 4' MIN. LENGTH) OR DUCKBILL ANCHORS INSTALLED PER MANUFACTURERS INSTRUCTIONS SHALL BE USED TO ANCHOR LOG TOES.
7. FILTER FABRIC SHALL MEET SPECIFICATIONS FOR TYPE 2 NCDOT FILTER FABRIC.



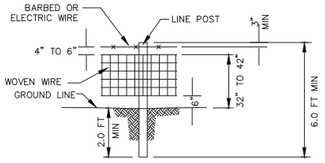
SECTION B–B

ROCK GRADE CONTROL

NTS



LINE PANEL



WOVEN WIRE WITH ONE BARB DETAIL

WOVEN WIRE:
ASTM CLASS 3 GALVANIZED.
TOP AND BOTTOM WIRES MIN. 12 GAUGE.
INTERMEDIATE AND STAY WIRES MIN. 12 1/2 GAUGE.

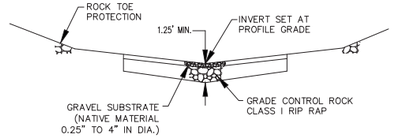
LINE POSTS (WOODEN): MIN. 4 IN. DIAM. OR 4 IN. SQUARE.

LINE POSTS (STEEL): STUDDED OR PUNCHED T, U, OR Y SHAPED, WITH ANCHOR PLATES. MIN. WEIGHT 1.3 LBS./FT. (EXCLUDING ANCHOR PLATE). POSTS SHALL BE DRIVEN A MINIMUM OF 18" DEEP AND MUST BE AT LEAST 5.5 FT IN LENGTH

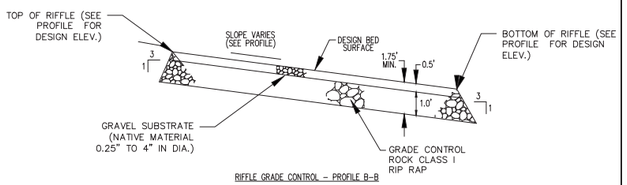
SPECIES AND TREATMENT FOR ALL WOOD: USE UNTREATED DURABLE POSTS OF SPECIES SUCH AS RED CEDAR, BLACK LOCUST OR OSAGE–ORANGE WITH BARK REMOVED, OR NON–DURABLE WOOD THAT IS PRESERVATIVE PRESSURE TREATED (0.40 LBS./CUBIC FOOT CCA, OR EQUIVALENT NON–CCA TREATMENT). DO NOT USE RED PINE.

WOVEN WIRE FENCE (NRCS DETAIL 382A)

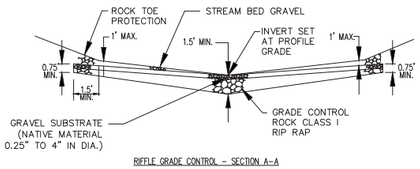
NTS



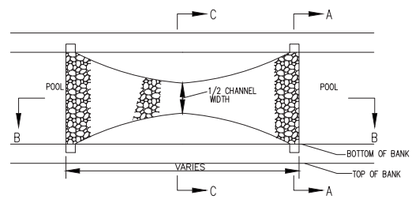
RIFFLE GRADE CONTROL – SECTION C–C



RIFFLE GRADE CONTROL – PROFILE B–B

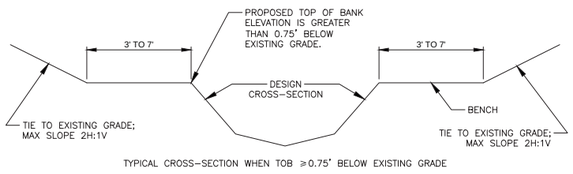


RIFFLE GRADE CONTROL – SECTION A–A

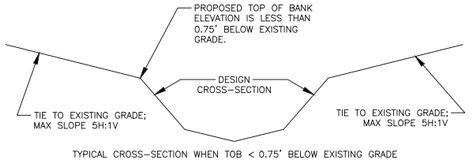


RIFFLE GRADE CONTROL

NTS



TYPICAL CROSS–SECTION WHEN TOB ≥ 0.75' BELOW EXISTING GRADE

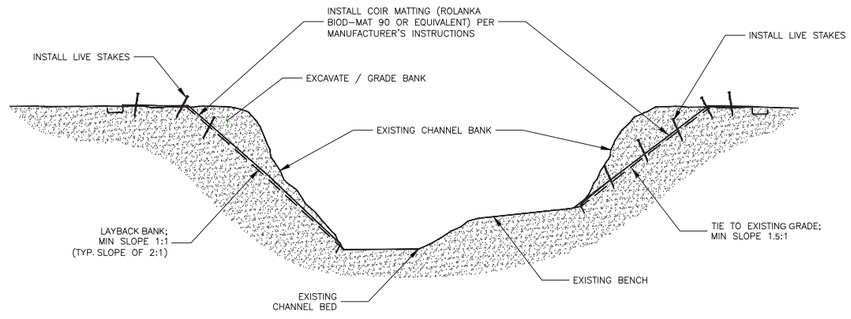


TYPICAL CROSS–SECTION WHEN TOB < 0.75' BELOW EXISTING GRADE

REACH	MINIMUM BENCH WIDTH	CUMULATIVE BENCH WIDTH
UT1–1	NA	NA
UT1–2	5'	≥ 10'
UT1–3	5'	≥ 10'
UT1–4	NA	NA
UT2–1	NA	NA
UT2–2	NA	NA
UT2–3	6'	≥ 12'
UT2–4	6'	≥12'

TYPICAL CROSS–SECTION GRADING

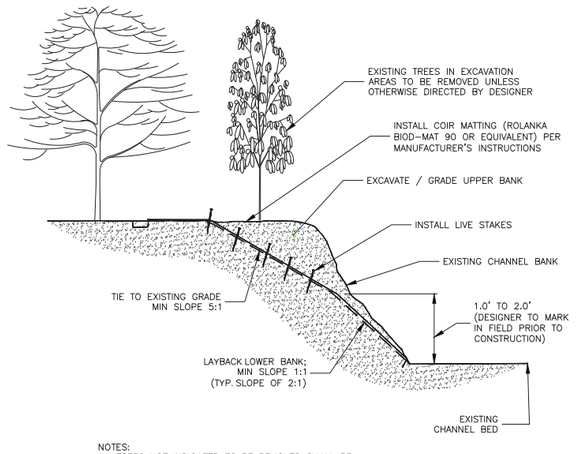
NTS



NOTES:
1. KEY–IN COIR MATTING PER DIRECTION OF ENGINEER.
2. SEED AND MULCH ALL BANKS PRIOR TO INSTALLING COIR MATTING.

TYPICAL BANK GRADING (OPT 2) REACH UT1–4

NTS



NOTES:
1. TREES NOT INDICATED TO BE REMOVED SHALL BE PROTECTED DURING CONSTRUCTION IN ACCORDANCE WITH PLANS AND SPECIFICATIONS.
2. KEY–IN COIR MATTING PER DIRECTION OF ENGINEER.
3. SEED AND MULCH ALL BANKS PRIOR TO INSTALLING COIR MATTING.

TYPICAL BANK GRADING (OPT 1)

NTS

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www.wkdickson.com
NC. LICENSE NO. F-0374

EBX

PLOT DATE: 2/25/14

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR: PRELIMINARY- NOT FOR CONSTRUCTION

PROJECT NAME:
POPLIN RIDGE STREAM AND WETLAND RESTORATION PROJECT
DUPLIN CO. NORTH CAROLINAENVIRONMENTAL BANC & EXCHANGE, LLC

DRAWING TITLE: DETAIL 5

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: JUNE 2013
Q.C.: FM
Q.C. DATE: 05–30–13

DRAWING NUMBER: 35

PROJ. NO.: 20120118.00.RA