FINAL MITIGATION PLAN

July 31, 2020

PERRY HILL MITIGATION PLAN

Orange County, NC
NCDEQ Contract No. 7744
DMS ID No. 100093

Neuse River Basin
HUC 03020201

USACE Action ID No. SAW-2019-00125
DWR Project No. 2019-0157
RFP #: 16-007576

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
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PREPARED BY:

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August 5, 2020

Mr. Jeremiah Dow
Project Manager
NCDEQ- Division of Mitigation Services
217 West Jones Street, Suite 3000A
Raleigh, NC 27603

Subject: Comment-Response Letter
Perry Hill Mitigation Site – North Carolina Interagency Review Team Comments during 30-day Mitigation Plan Review
Neuse River Basin – CU# 03020201
Orange County, NC
Contract No. 7744

Dear Mr. Dow:

On July 13,2020, Wildlands Engineering received comments from the North Carolina Interagency Review Team (NCIRT) on the Perry Hill Mitigation Plan dated April 27, 2020. The report establishes the proposed mitigation activities on the project site. The following letter documents NCIRT feedback and Wildlands' corresponding responses and revisions to the Mitigation Plan. Following your acceptance of these responses and revisions, we will proceed with Task 2 (Conservation Easement Recordation).

USACE Comments, Kim Browning:

1. Design Sheet 4.0, Planting Plan: Please remove red maple from the wetland planting list.
   Response: Wildlands removed red maple from the wetland planting list on Sheet 4.0.

   a) It would be helpful if the planting tables included a column to show the wetland plant list indicator (FACW, FACU, etc.).
      Response: Wildlands added an 'indicator' column to the plant list (illustrated on Sheet 4.0).

2. Please maintain the same stream and reach names throughout the life of the project. It is difficult to refer to field notes when reach names change from the technical proposal stage to the draft mit plan stage.
   Response: Wildlands will consider this feedback on future projects. Wildlands modified the reach names at this specific site based on data collection and evaluation/design following the initial agency site visit.

3. Section 1: In future mitigation plans, please indicate the temperature regime for credits (cold, cool, warm).
   Response: Wildlands clarified that the anticipated restoration and enhancement activities will provide warm stream credits in Section 1.0 (Introduction) and 12.0 (Determination of Credits).

4. UT1: Given the small watershed size and the amount of agricultural sediment entering the system, there is a concern that raising the channel will result in a loss of jurisdiction in the upper portion of this reach. There is also a concern that the channel near the confluence with Perry Branch may fill in and become more wetland like.

Response: Wildlands appreciates this observation and discussion. The head of this system contains a spring. Wildlands does not intend to adversely impact the spring and rather is proposing a headwater conveyance feature. Due to the slope of this proposed reach, sediment may deposit during more frequent events but should be transported during bankfull and larger events.

5. Please place a veg plot in Wetland Q.
   Response: Wildlands revised Figure 9 to illustrate a vegetation plot in Wetland Q.

6. Please include photo points at crossings.
   Response: Wildlands revised Figure 9 to illustrate photo points near the crossings.

7. Section 7.7.1: Please address how fescue will be removed.
   Response: Wildlands will implement two approaches to manage fescue at the Site. Both approaches are designed to mitigate the adverse effects of fescue (i.e., direct competition and allelopathic impacts) on planted vegetation. Fescue will be mechanically removed in areas proposed for grading. The first (management) approach consists of chemically treating select areas immediately adjacent to planted trees (i.e., tree ring). Via this method a second treatment may be required at the beginning of year two if fescue re-establishes or tree growth is stunted by standing fescue. The second approach entails a chemical application over a broader area (i.e., broadcast spraying) that is designed to eradicate fescue along strips in areas not graded during construction. Following the chemical treatment, Wildlands or their representative will establish temporary and permanent vegetation.

8. Section 7.8: Please add discussion on potential short-term and long-term effects for beaver, utility line maintenance, livestock encroachment, adjacent logging or development, etc.
   Response: Wildlands revised Section 7.8 to include a discussion related to the potential short- and long-term risk as referenced above.

9. Is there a section on the functional uplift potential, or discussion of NCSAM ratings?
   Response: The NCSAM forms were previously enclosed in Appendix 5. A discussion related to these forms has been added to Section 3.5 of the Mitigation Plan.

DWR Comments, Erin Davis

1. Page 8, Section 3.5 -
   a) Please reference the NCSAM evaluation of existing stream conditions.
      Response: The NCSAM evaluation and corresponding results are introduced in Section 3.5 of the final Mitigation Plan and the forms are included in Appendix 5.

   b) Perry Branch Reach 1 states that the reach is a headwater system originating onsite immediately down valley of a wetland. Later, under Section 4.0, it states that an offsite pond regulates discharge to this reach. This was confusing during my initial read through. Can the Section 3.5 existing conditions description please be rephrased or elaborated on in order to clarify and connect to the Section 4.0 discussion.
      Response: Wildlands revised Sections 4.0 and 3.5 to address this feedback from the Division of Water Resources. This (off-site) pond, built between 1964 and 1975, lacks significant surface and groundwater connection with Perry Branch Reach 1 and adjacent

wetlands. As such, Wildlands does not expect this pond to affect the volume or frequency of hydrologic or sediment inputs to Perry Branch. Wildlands determined that the instability observed within Perry Branch Reach 1 is a result of on-site influences such as farming practices and cattle. The greatest potential for downstream impacts from dams is the potential reduction in base hydrologic inputs. However, groundwater inputs have the potential to offset some of this hydrologic loss (McCarthy 2008). For the Site, the existence of active wetland hydrology and associated water table inputs, provides sufficient hydrology to offset potential resulting from dam attenuation. Further, bankfull indicators within Perry Branch Reach 1 are consistent with those found in the downstream reaches, where additional hydrologic inputs are unimpeded by the dam. This would indicate that, while bankfull event frequency may be reduced as a result of the dam, volumetric rates are not adversely altered within this reach. This is likely due to the location of the dam at the headwaters of the stream. Additionally, the dam outfall discharges to a wetland system upslope of Perry Branch Reach 1. This wetland is stable and exhibits no evidence of fine sediment deposition or hydraulic scour that could exist downstream of headwater dams.

2. Page 24, Section 7.6 -
    a) Has the amount of available onsite woody material for proposed stream stabilization and habitat structures been evaluated? If necessary, will offsite woody material be sourced to complete construction of all of the structures shown on the design sheets?
    Response: Wildlands anticipates harvesting materials for in-stream structures on the subject parcel. Off-site materials may be required to supplement the construction of in-stream structures (Class A and/or B stone for constructed riffles). Wildlands will utilize on-site materials to the maximum extent practicable and minimize the use of materials harvested off-site.

    b) During the IRT site meeting, it was requested to investigate whether the Perry Branch crossing could be relocated to the downstream end of project adjacent to the powerline. Please provide an explanation as why relocating this crossing is not feasible.
    Response: Wildlands coordinated with the landowner to minimize the number of crossings proposed at this site. The internal crossing proposed on Perry Branch Reach 4 is required by the owner (at the illustrated location) for on-going farming and agricultural operations.

3. Page 25, Section 7.7.1 -
    a) Please reference the planting window specified in the 2016 NCIRT Mitigation Update Guidance.
    Response: Wildlands revised the Mitigation Plan to constrain planting activities from November 15 to March 15 (i.e., the planting window). The site will be planted during this time, unless otherwise noted in the approved Mitigation Plan or remedial action plan.

    b) Please include a brief description of the headwater forest target community type.
    Response: Wildlands revised Section 7.7.1 to include a description of the forested headwater community.

4. Page 25, Section 7.7.2 – DWR appreciates the discussion of invasive species management, including that multiple species will be treated prior to construction. Will fescue also be treated

prior to or during site construction? DWR recommends early treatment based on observations of fescue impeding planted vegetation establishment and vigor.
Response: Wildlands will implement two approaches to manage fescue at the Site. Both approaches are designed to mitigate the adverse effects of fescue (i.e., direct competition and allelopathic impacts) on planted vegetation. Fescue will be mechanically removed in areas proposed for grading. The first (management) approach consists of chemically treating select areas immediately adjacent to planted trees (i.e., tree ring). Via this method a second treatment may be required at the beginning of year two if fescue re-establishes or tree growth is stunted by standing fescue. The second approach entails a chemical application over a broader area (i.e., broadcast spraying) that is designed to eradicate fescue along strips in areas not graded during construction. Following the chemical treatment, Wildlands or their representative will establish temporary and permanent vegetation.

5. Page 26, Section 7.8 – It appears that the large pond upstream of Perry Branch Reach 1 is located on an adjacent parcel controlled by a different landowner. DWR considers the pond's connection to the project a potential risk for sediment loading, if for example the pond breaches during a super storm event.
Response: Should the pond breach, the forested area above Perry Branch R1 will likely serve as a sediment sink. While sediment deposition and even plugs are expected within Perry Branch, Wildlands sized the channel to support sediment transport and channel maintenance.

6. Page 27, Section 8.3 – Please also reference Table 21, which includes visual assessment of the easement perimeter/fencing and signs of livestock encroachments.
Response: Wildlands revised the Mitigation Plan to reference Table 21 in Section 8.3.

7. Page 27, Section 9.0 – In the baseline monitoring report, please include red-line drawings showing construction deviations from the final mitigation plan design sheets.
Response: Wildlands typically includes red-line drawings with our baseline report. Wildlands revised Section 9.0 to reflect this deliverable.

8. Page 28, Table 21 -
    a) Please reference the vegetation vigor performance standard.
    Response: Wildlands modified Table 21 to reflect the vigor performance standards (i.e., planted canopy species within the standard planting zones must average 7 feet in height in each plot at the end of MY5 and 10 feet in height in MY7) introduced in Section 8.2.

    b) Please reference the 30-day consecutive flow performance standard for intermittent reaches.
    Response: Wildlands modified Table 21 to document the 30-days consecutive flow performance standard for intermittent reaches as introduced in Section 8.1.5. The intermittent channels proposed for restoration or enhancement I activities (UT1 and UT2 Reach 2) will have a stream gage pressure transducer installed in the upper third of the reach to document at least 30 consecutive days of baseflow.

9. Page 30, Section 10 – Please specify an expected maximum duration between "periodic" inspections.

Response: Inspections will be conducted by NCDEQ (or an approved third-party) at a sufficient frequency to support stewardship responsibilities. The narrative in Section 10 aligns with DMS' guidance for stewardship activities and responsibilities.

10. Page 30, Section 11 – DWR's General Water Quality Certification 4134 requires notification for any repairs that result in a change from the approved plans.
    Response: Wildlands revised Section 11 to reflect this requirement.

11. Figure 9 – Please show existing wetlands and label project reaches. Also, DWR requests photo points at the proposed crossings.
    Response: Wildlands revised Figure 9 to illustrate existing wetlands and project reach labels. Photo points are illustrated on Figure 9.

12. Sheet 1.1 –
    a) The DMS response letter indicates that the embankment around the relic pond at the top of Perry Branch will be regraded. Can a callout for this activity please be added, as well as the estimated proposed grading limits?
    Response: Wildlands added a note to Sheet 2.1 In addition, the plans now reflect grading.

    b) There appears to be a drainage path from the adjacent wetland to the channel just downstream of the Station 130+00 bank treatment. Is this area currently stable? Are there any concerns of head-cutting?
    Response: Wildlands added a note on the plans - in the vicinity of station 103+00 – that identifies rip-rap protection at the confluence of this drainage path and channel.

    c) Please indicate approximate locations for proposed channel plugs. Also, it would help our review to see the existing channel areas proposed to be filled as a shaded feature on the plan view sheets.
    Response: Channel plugs are illustrated on the enclosed erosion and soil control plans (sheets 3.0 to 3.12). The contractor will incorporate proposed grades as illustrated on the plans. The existing channel will be filled as illustrated on Sheets 3.0 to 3.12.

13. Sheet 1.9 -
    a) The UT1 and Perry Branch tie-in is proposed to shift approximately 100 feet downstream and immediately adjacent to the proposed ford crossing. Are there any concerns about long-term stability with this design?
    Response: Wildlands evaluated multiple locations for this confluence. The current location was selected based on existing site constraints (i.e., topography) and the NCD methodology for this reach and Perry Branch Reach 4. Wildlands expects the confluence to be stable in the short- and long-term.

    b) Please note in the Station 134+134 callout that it is the end point of Perry Branch stream credit.
    Response: Wildlands added a note to the plans.

14. Sheet 4.0 -
    a) Please remove Red Maple from the Wetland Planting Zone list.

Response: Wildlands revised the plans to exclude Red Maple.

b) DWR understands that quantity substitutions may be necessary based on the nursery's species available. However, we request that no species account for more than 20 percentage of a specified planting zone in order to promote diversity within the designated community type.
Response: To promote vegetation diversity, Wildlands revised the construction documents to state that no bare root species will comprise more than 20% (by area) of the planted buffer, wetland and upland zones. If substitutions are required due to limited availability or required adaptive management, the Engineer will identify a similar species and specify the planting density.

15. Sheets 4.2 & 4.3 – For the proposed culvert crossings, will the fencing overlap the culvert or will cattle have access to the stream upstream and/or downstream of the culvert within the easement break?
Response: The top width of the crossing is 20' as designated on the plans. The fence will be 1' inside the edge of the road for a total width of 18'. Gates are proposed on both sides of the crossing to manage the movement of livestock between pastures. Livestock will be excluded from the stream.

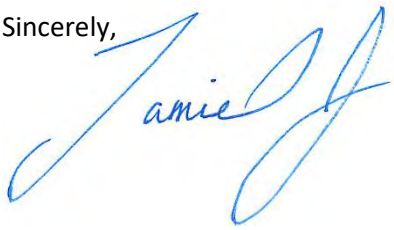
16. Sheet 5.14 – Please include a callout for the black bar icon.
Response: Wildlands labeled this feature, that reflects the limits of grading, on the revised plans.

17. Sheet 5.2 – DWR recommends the use of footer logs on all log sill structures.
Response: Wildlands' detail illustrates the use of a footer log. Wildlands recommends both a footer and header log, but for small streams our construction documents allow the contractor to eliminate footer logs on structures with a header log that has an 18" diameter or greater.

18. Sheet 5.8 – Please confirm whether vernal pools proposed for this site.
Response: Wildlands will utilize vernal pools along Reach 3 and Reach 4 of Perry Branch to optimize earthwork activities. Vernal pools are illustrated via the proposed grading.

Thank you for your review and comment on this submittal. If you have any further questions, please contact me at 843.277.6221 or djohnson@ wildlandseng.com.

Sincerely,



Daniel Johnson, MBA, PE, PH, *Senior Water Resources Engineer*

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).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

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

Contributing Staff:

John Hutton, *Principal in Charge*
Daniel Johnson, MBA, PE, PH, *Project Manager*
Geoff Smith, PE, *Engineer of Record*
Michael Clark, EI*, Environmental Designer*
Alex Pasquini, *Existing Condition Assessment and Permitting*
Win Taylor, PWS, *Wetland Delineation*
Emily Reinicker, PE, CFM, *Quality Assurance*

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1.0 Introduction

The Perry Hill Mitigation Site (Site) is in Orange County approximately three miles northwest of Hillsborough, NC (Figures 1 and 2). The project is located within the North Carolina Division of Mitigation Services (DMS) targeted local watershed for the Neuse River Basin Hydrologic Unit (HU) 03020201030020 and NC Division of Water Resources (DWR) Subbasin 03-04-01. The Site was selected by DMS to provide stream mitigation credits and buffer credits in the Neuse River Basin 03020201 (Neuse 01). The project involves the restoration and enhancement of 5,694 existing linear feet of impaired unnamed tributaries to the Eno River, hereafter referred to as Perry Branch, UT1, UT2, and UT3. Restoration and enhancement of these streams will provide 4,042.400 warm stream credits. The project will also restore and enhance 25 acres of riparian buffer which is currently open pasture and/or severely degraded low-density forested areas. The project will provide 878,894.828 buffer credits. The Buffer Mitigation Plan is in Appendix 1. The Site will be protected by a 26.88-acre conservation easement. The Site Protection Instrument detailing the easement is in Appendix 2. General project information is shown in Table 1.

Table 1: Project Attribute Table Part 1

Project Information	
Project Name	Perry Hill Mitigation Site
County	Orange
Project Area (acres)	27
Project Coordinates (latitude and longitude)	36° 06' 25.81'' N 79° 07' 46.66'' W
Planted Acreage (acres of woody stems planted)	20

2.0 Watershed Approach and Site Selection

The Site contains tributaries which flow directly to Corporation Lake, a water supply reservoir on the Eno River. The Eno River is classified as water supply waters (WS-II) and nutrient sensitive waters (NSW). All water supply waters are considered high quality waters (HQW) by supplemental classification. In addition, all waters in the Neuse River Basin are classified as NSW which is a supplemental classification intended for waters needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation.

Restoration of streams and buffers at the Site will directly and indirectly address goals presented in the watershed planning documents introduced below. These goals will be addressed by excluding livestock, creating stable streambanks, restoring a forest in agriculturally maintained buffer areas, and enhancing existing forested buffers. The project is expected to slow surface runoff, increase retention times, provide shade to streams, and reconnect the streams to their historic floodplains, which will reduce sediment and nutrient loads that contribute to eutrophication of downstream waters.

The 2018 Eno River Watershed Improvement Plan (ERWIP) was developed to achieve and maintain water quality and watershed health in the Eno River watershed and includes primary objectives of identifying and prioritizing water quality improvement projects, stormwater control measures, and stream restoration opportunities that are critical to the protection and restoration of water quality in the Eno River and its tributaries and in downstream Falls Lake (ERWIP, 2018). In the 2015 Division of Environmental Quality Lake & Reservoir Assessments Report for the Neuse River Basin, Corporation Lake was determined to exhibit eutrophic conditions (DEQ, 2015). Eutrophic waters are rich in nutrients resulting in dense algal blooms that deplete dissolved oxygen concentrations when they decompose.

The 2009 Neuse River Basinwide Water Quality Plan lists major stressors in Subbasin 03-04-01 to be total suspended solids (TSS), nutrients, and chlorophyll α (NCDENR, 2009). The 2010 Neuse River Basin Restoration Priorities (RBRP) highlights the importance of riparian buffers for stream restoration projects (NCEEP, 2010). Riparian buffers retain and remove nutrients and suspended sediments. Of the 123 miles of streams in the Middle Eno River watershed (03020201030030), 23% do not have adequate riparian buffers. The RBRP states that "priority [restoration] projects should increase or improve buffers." The RBRP also states that a goal for the Neuse 01 is to, "…promote nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers." Another goal for the Neuse 01 is to support the Falls Lake Watershed Management Plan. The Falls Lake water supply is downstream of the Site and is classified as water supply waters (WS-IV) and nutrient sensitive waters (NSW).

The Neuse River basin is also discussed in the 2015 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP). In the report, non-point source pollution from agriculture and forestry including nutrient loading and erosion has attributed to degraded aquatic habitats in the basin. This report notes the importance of land conservation and preservation as well as programs that help farmers reduce sedimentation/erosion such as livestock exclusion practices. The WAP lists the Site watershed (Sevenmile Creek – Eno River HUC) as a Tier 1 watershed, the highest priority for conservation (NCWRC, 2015).

3.0 Baseline and Existing Conditions

The Site watershed (Table 2 and Figure 3) is in a northwestern HU of the Neuse 01. It is situated in the rural countryside in Orange County near Hillsborough, NC. The following sections describe the existing conditions of the watershed and watershed processes, including disturbance and response.

Table 2: Project Attribute Table Part 2

Project Watershed Summary Information	
Physiographic Province	Piedmont
Ecoregion	Carolina Slate Belt
River Basin	Neuse River
USGS HUC (8 digit, 14 digit)	03020201, 03020201030020
DWR Sub-basin	03-04-01
Project Drainage Area (acres)	174
Project Drainage Area Percentage of Impervious Area	<1%
CGIA Land Use Classification	68% managed herbaceous cover/pasture; 22% forested; 5% shrub; 3% grassland/herbaceous; 2% residential area; <1% impervious

3.1 Landscape Characteristics

3.1.1 Physiography and Topography

The Site is in the Piedmont Physiographic Province of North Carolina. The Piedmont Province is characterized by gently rolling, well rounded hills with long low ridges and elevations ranging from 300-1,500 feet above sea level. The Site topography and relief are typical for this region, as illustrated on the Hillsborough and Efland, NC USGS 7.5-minute topographic quadrangles (Figure 4). The majority of the streams at the Site have a gently sloped alluvial valleys that vary in width throughout the project area. UT1 includes a steeper, more confined valley than the other project reaches.

3.1.2 Geology and Soils

The Site is in a portion of the Piedmont known as the Carolina Slate Belt (NCGS, 1985). The rocks in this region are primarily volcanic and sedimentary rocks that underwent low-grade metamorphism giving them a slaty cleavage. Coarse-grained intrusive granites comprise the rest of the Slate Belt rocks (Rogers, 2006). The geology of this area has important effects on Site hydrology, hydraulics, geomorphology, and sediment transport. Streams in the Carolina Slate Belt tend to go dry during late summer and early fall as a result of geologic, topographic, and climatic factors. A study by Giese and Mason states that the "Carolina slate belt has among the lowest potential for sustaining baseflow in streams" throughout the year as compared to other regions of North Carolina. Median low flows in the Carolina Slate Belt, defined by the study as the 7Q10 (7-day consecutive low flow with a 10-year return frequency, or the lowest stream flow for seven consecutive days that would be expected to occur once in ten years), can be as low as 0.005 $ft^3/s/mi^2$ of drainage area (Giese and Mason, 1993).

If streambank vegetation is not well established it can die back in late summer when flows are low, leaving banks exposed to erosive storm flows. This process appears to happen during the summer months and periods of drought. Existing streambank vegetation is dominated by pasture grasses that die back for a portion of the year. The exposed banks lack the roughness necessary to reduce channel velocities. High channel velocities and shear stress increases bed scour during these times. This has resulted in the process of channel incision followed by widening. There is exposed bedrock and evidence of bank sloughing along portions of Perry Branch, forming temporary benches that eventually mobilize through the system. These erosional processes deliver sediment and its adsorbed nutrients downstream.

The proposed project is mapped by the Orange County Soil Survey (USDA, 2019). Project area soils are described below in Table 3. Figure 5 is a soil map of the Site. Most of the stream reaches are on Georgeville silt loam soils, with Enon loam, Iredell gravelly loam, and Lignum silt within the upper reaches. Enon loam underlies UT2; Iredell gravelly loam underlies UT3; and Iredell gravelly loam and Lignum silt underlies the headwaters of Perry Branch.

Table 3: Project Soil Types and Descriptions

Soil Name	Description
Enon loam (EnB)	This series consists of well-drained soil with a slope of 2 to 6 percent located on broad ridges in the uplands. Typically, the surface layer is loam about 5 inches thick. The subsoil extends to a depth of 25 inches.
Enon loam (EnC)	This series consists of well-drained soil with a slope of 6 to 12 percent located side slopes adjacent to ridges on the uplands. Typically, the surface layer is loam about 5 inches thick. The subsoil extends to a depth of 25 inches.
Georgeville silt loam (GeC)	This series consists of well-drained soil with a slope of 6 to 10 percent located on narrow side slopes in the uplands. Typically, the surface layer is silt loam about 7 inches thick. The extends to a depth of 65 inches.
Herndon silt loam (HrB)	This series consists of well-drained soils on broad ridges on the uplands. The slopes range from 2 to 6 percent. The surface layer is silt loam about 4 inches thick. The subsoil is about 49 inches thick.
Iredell gravelly loam (IrB)	These soils are moderately well drained soils on broad ridges on the uplands with slopes of 1 to 4 percent. The surface layer of the series is gravelly loam about 5 inches thick. The subsurface layer is gravelly loam 3 inches thick. The subsoil is about 21 inches thick.
Lignum silt (Lg)	This series consists of moderately well-drained soil on uplands with a slope of 0 to 3 percent. The surface layer is silt loam about 1 inch thick. The subsurface layer is silt loam about 5 inches thick. The subsoil is about 30 inches thick.
Tarrus silt loam (TaD)	This series consists of well-drained soil on hillslopes of ridges with slopes of 8 to 15 percent. The surface layer is silt loam about 6 inches thick. The subsurface layer is silty clay about 14 inches thick. The subsoil is about 24 inches thick.

3.2 Land Use/Land Cover

Land uses draining to the project reaches are primarily managed herbaceous cover/pasture and forest with some residential area. The watershed areas and current land use are summarized in Table 4, below. The impervious area within the project watershed was calculated to be 0.4 acres, or approximately 0.25% of the watershed.

Aerial photos of the project site and surrounding area from 1938-2017 were reviewed for changes in land use and land cover (Appendix 3). Historic aerial photographs were obtained from the University of North Carolina Archives for 1938, 1955, and 1975. Historical aerials reviewed also include those from the USGS digital imagery viewer, Earth Explorer for 1950, 1960, 1964, 1977, 1980, 1982, 1993, 1999, and 2013. The 2017 aerial imagery is sourced from ESRI. The land use and land cover patterns in this area have stayed consistent over that time period with the most common land uses in the watershed being agriculture for pastureland/hay and row crops.

Aerial photographs from 1938 depict the majority of the project reaches in a cleared condition indicating the land had been used as managed pasture and/or for crop production with portions of the upper watershed forested. The stream crossings which currently exist on Perry Branch were constructed prior to 1938. Forested areas within the headwaters of UT2 and along EC3 were cleared between 1938 and 1950. The high-voltage utility transmission line that crosses the downstream extent of Perry Branch was constructed between 1938 and 1950. Between 1950 and 1955, two ponds were constructed on the project parcel including one within the headwaters of Perry Branch Reach 1 and the other an offline pond adjacent to Perry Branch Reach 4 within the lower portion of the watershed. Between 1955 and 1960 additional forested areas within the headwaters of Perry Branch as well as the area along Perry Branch

within the lower watershed were cleared for agriculture. Between 1964 and 1975 the riparian buffer along Perry Branch Reach 1 and 2 was re-established and has remained forested to date. An additional pond was built on an adjacent property within the headwaters of the watershed between 1964 and 1975. This headwater pond was expanded multiple times between 1975 and 2013. An 8-acre portion of the headwaters was converted from pasture to planted pines prior to 1993. Subsequent land clearing within this planted area for the pond expansion and pasture development occurred by 2013. There are no additional signs of impending land use changes or development pressure that would impact the project in the Perry Hill watershed.

The consistency in land use within the project watershed over the past 81 years indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied extensively over time. With a lack of developmental pressure, watershed processes and stressors from outside the project limits are likely to remain consistent through closeout of this project. These stressors and processes are discussed further in Section 4.

Table 4: Drainage Areas and Associated Land Use

Reach Name	DWR Stream Identification Form Scores	Intermittent / Perennial	Watershed Area (acres)	Watershed Area (sq. mi.)	Land Use
Perry Branch	34	Perennial	175	0.273	68% managed herbaceous cover/pasture; 22% forested; 5% Shrub; 3% grassland/herbaceous; 2% residential area; <1% impervious
UT1	27.25	Intermittent	10	0.015	>99% managed herbaceous cover/pasture; <1% forested
UT2	26.5	Intermittent	23	0.036	66% managed herbaceous cover/pasture; 34% forested
UT3	22	Intermittent	20	0.031	70% managed herbaceous cover/pasture; 30% forested

3.3 Existing Vegetation

The actively grazed fields on the Site are dominated by pasture grasses such as fescue (*Festuca* spp.) with scattered trees along top of bank. Mature canopy species within forested areas along Perry Branch Reach 1 and 2, UT2, and UT3 primarily include shagbark hickory (*Carya ovata*), sugarberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), eastern red cedar (*Juniperus virginiana*), and sweetgum (*Liquidambar styraciflua*). Shrub species are sparse and primarily consist of American hornbeam (*Carpinus caroliniana*), multiflora rose (*Rosa multiflora*), and Chinese privet (*Ligustrum sinense*). In addition to pasture grasses, the herbaceous layer in these areas include New York ironweed (*Vernonia noveboracensis*), false nettle (*Boehmeria cylindrica*), pokeweed (*Phytolacca americana*), dog fennel (*Eupatorium capillifolium*), pigweed (*Amaranthus spp.*), jimsonweed (*Datura stramonium*), knotweed (*Persicaria spp.)*, and Japanese stilt grass (*Microstegium spp*.). Herbaceous species in wetter areas include common rush (*Juncus effusus*) and sedges (*Carex* spp.).

3.4 Existing Conditions - Wetlands

Wildlands investigated on-site jurisdictional waters of the U.S. within the proposed project easement area between March 19 and 20, 2019. Jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and the subsequent Eastern Mountain and Piedmont Regional

Supplement. All jurisdictional waters of the U.S. were mapped with sub-meter GPS or by traditional survey. Wetland determination forms representative of on-site jurisdictional areas as well as non-jurisdictional upland areas are included in Appendix 4. On-site wetlands are summarized in Table 5. Wildlands met with the USACE to conduct a site visit on December 10, 2019. The USACE concurred with all on-site jurisdictional areas as were submitted with the exception of a portion of Wetland A. Wildlands submitted a revised Site Map and Table 1 Summary of On-Site Jurisdictional Waters (Appendix 4) to reflect the on-site verification change. The USACE concurrence and Jurisdictional Determination Request is enclosed (Appendix 4).

There are 17 jurisdictional wetland features located on-site (A-Q). Existing wetland features are best classified as headwater forest using the North Carolina Wetland Assessment Method classification key (NC WAM, 2016) and the evaluator's best professional judgement. The wetlands occur on the side slopes and the floodplains adjacent to Site stream channels. These features exhibit saturation within the upper 12 inches of the soil profile, wetland plant communities, and a low chroma matrix. Common hydrophytic vegetation includes green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), broad-winged sedge (*Carex alata*), marsh marigold (*Caltha palustris*), and common rush (*Juncus effuses*). Wetlands throughout the Site are impacted by livestock trampling and grazing.

Table 5: Existing Wetlands

Wetland Summary Information						
Wetland ID	**A**	**B**	**C**	**D**	**E**	**F**
Size of Wetland (acres)	1.153	0.113	0.310	0.121	0.030	0.009
Wetland Type (non riparian, riparian riverine or riparian non-riverine)	Riparian Non-Riverine		Non-Riparian & Riparian Non-Riverine		Riparian Non-Riverine	
Mapped Soil Series	Lignum (Lg) / Iredell (IrB)	Lignum (Lg)	Georgeville (GeC)	Georgeville (GeC) / Iredell (IrB)	Iredell (IrB)	Iredell (IrB)
Drainage Class	Moderately Well Drained	Moderately Well Drained	Well Drained	Well Drained / Moderately Well Drained	Moderately Well Drained	Moderately Well Drained
Soil Hydric Status	Yes	Yes	No	No / Yes	Yes	Yes
Source of Hydrology	Hillside Groundwater Seep					
Restoration or enhancement method (hydrologic, vegetative, etc)	N/A					
Wetland ID	**G**	**H**	**I**	**J**	**K**	**L**
Size of Wetland (acres)	0.235	0.240	0.007	0.192	0.121	0.001
Wetland Type (non riparian, riparian riverine or riparian non-riverine)	Riparian Non-Riverine	Non-Riparian & Riparian Non-Riverine	Riparian Non-Riverine	Non-Riparian & Riparian Non-Riverine	Riparian Non-Riverine	
Mapped Soil Series	Georgeville (GeC)	Georgeville (GeC)	Georgeville (GeC)	Enon (EnB)	Enon (EnB)	Enon (EnC)
Drainage Class	Well Drained	Well Drained	Well Drained	Well Drained	Well Drained	Well Drained
Soil Hydric Status	No	No	No	Yes	Yes	No
Source of Hydrology	Hillside Groundwater Seep					
Restoration or enhancement method (hydrologic, vegetative, etc)	N/A					
Wetland ID	**M**	**N**	**O**	**P**	**Q**	
Size of Wetland (acres)[1]	0.006	0.049	1.961	0.196	0.189	
Wetland Type (non riparian, riparian riverine or riparian non-riverine)	Riparian Non-Riverine		Non-Riparian & Riparian Non-Riverine			
Mapped Soil Series	Enon (EnC)	Enon (EnC)	Enon (EnC)	Georgeville (GeC)	Georgeville (GeC)	
Drainage Class	Well Drained	Well Drained	Well Drained	Well Drained	Well Drained	
Soil Hydric Status	No	No	No	No	No	
Source of Hydrology	Hillside Groundwater Seep					
Restoration or enhancement method (hydrologic, vegetative, etc)	N/A					

3.5 Existing Conditions - Streams

Stream assessments were conducted by Wildlands on August 14, 2018. Perry Branch is classified as a perennial stream and the unnamed tributaries (UT1, UT2, and UT3) are considered intermittent. The DWR stream identification forms are included in Appendix 5. Stream features are described in detail below. Tables 6 and 7 provide a summary of existing stream conditions within the project limits. Existing conditions are also illustrated in Figure 2.

Wildlands conducted rapid assessments using the NC SAM methodology for onsite streams. The NC SAM forms are provided in Appendix 5. It should be noted that NC SAM scores were only generated for one reach along UT1. Only one reach was proposed for UT1 when the assessments were conducted. Design constraints associated with valley width and channel slope for this reach resulted in the division, however NC SAM ratings would be comparable between reaches. Additionally, two forms were completed for Perry Branch R4 to account for some differences in existing conditions. These evaluations show the Site conditions are generally rated low, with medium scores for Perry Branch R2 and UT2 R2, with only UT3 reflecting a high score. The lower scores for Perry Branch Reach R1, R3, and R4; UT1 and UT2 R1 are reflective of disturbed buffers and stream condition resulting from historical and current agricultural land use practices. While UT2 R1 is proposed for Enhancement II activities with limited intervention, the low score is primarily the result of degraded conditions associated with livestock impacts. Proposed restoration and enhancement activities including livestock exclusion practices is expected to result in significant uplift.

Further details pertaining to expected functional lift at the Site are included in Section 6.0 Mitigation Site Goals and Objectives.

<u>Perry Branch – Reach 1</u>

Perry Branch Reach 1 is a headwater system that originates onsite at a headcut immediately down valley from a riparian non-riverine wetland. An off-line spring fed pond exists up valley of the non-riverine wetland system on an adjacent property. Detailed investigation of the pond was not completed for this project, but the pond does appear to provide limited hydrology to the downstream receiving waters through seepage as well as direct discharge via a surface withdrawal standpipe during large precipitation events. Based on the ponds location within the upper limits of the watershed and the presence of sufficient hydrology within the wetland system below the pond, the hydrology and sediment transport within the project reaches is not expected to be affected. The upper portion of this reach historically had an online impounded open water source which has been breached. This reach is buffered by riparian wetlands and forest but livestock currently have access to the stream, further impairing existing conditions. Beyond the forested buffer, land use includes open pasture and row-crop agriculture. The stream banks along the majority of this reach are vertical and the stream is disconnected with the floodplain. This reach of Perry Branch most closely classifies as a G4c stream type with a width to depth ration ranging from 5.2 to 6.8 and bank height ratios ranging from 2.1 to 2.7. The reach has low entrenchment ratios ranging from 1.3 to 1.4 and a channel slope of 1.3%. The bed material in this reach is a mix of sand and gravel, with bedrock visible in a few locations as a result of the stream's incision.

<u>Perry Branch – Reach 2</u>

Perry Branch Reach 2 is relatively stable, has natural meandering pattern, and does not exhibit signs of scouring and incision. This reach does have a few headcuts but grade control features such as tree roots that are preventing further downcutting of the channel. Buffer conditions and composition are similar to that along Reach 1. Livestock impacts are evident within this reach, including bank trampling and hoof shear. The width to depth ratio on this reach ranges from 12.8 to 13.8, a bank height ratio of 1.3, and most closely classifies as a C4 stream type. It has a channel slope of 1.0% and very high entrenchement ratios ranging from 9.8 to 19.5. The bed matariel consists of silt, sand, and gravel.

Perry Branch – Reach 3

Downstream of an existing ford crossing, Perry Branch Reach 3 becomes severely impaired again. Perry Branch Reach 3 exhibits a right bank with a wide mature forest buffer, though livestock have extensively impacted the vegetative community. Mature trees along the streams have roots exposed in the eroding stream bank. The vegetative buffer along the left bank is primarily comprised of open pasture with isolated mature trees distributed along the stream bank. This reach has bankfull width to depth ratios ranging from 8.7 to 8.8 with bank height ratios from 1.9 and 2.3 and is most closely associated with a G4c stream type. Its entrenchment ratios range from 2.1 to 2.2 and its channel slope is 1.6%. This reach's substrate consists of sand, cobble, and gravel in riffles with an abundance of accumulated fines from bank erosion and livestock trampling in overly wide sections. Perry Branch Reach 3 terminates at the confluence with UT2.

Perry Branch – Reach 4

Downstream of the confluence with UT2, Perry Branch Reach 4 remains impaired due to poor land use practices. Riparian buffers are primarily limited to active livestock pasture with isolated trees. Stream conditions along this reach alternate between areas of incision where the channel is narrow and stream banks are eroding to areas where the stream is overly wide and severely trampled by livestock. This reach is deeply incised with bank height ratios from 1.2 and 3.0 and width depth ratios ranging from 9.3 to 9.5, most closely classifying as a F4 stream type. Its channel slope is 1.1% and its entrenchement ratios range between 1.4 and 2.7. The bed material along this reach is a mix of sand, gravel, and cobble. In addition, excessive silt is present due to bank erosion and livestock trampling.

UT1 – Reach 1

UT1 is an intermittent channel that originates at a large headcut where the land use transitions from row crops to livestock pasture. There are no trees along UT1 Reach 1, the lower banks are generally bare, and riparian vegetation consists of pasture grasses. The majority of the reach is deeply incised with some segments that are widening due to livestock trampling. The undersized and crushed culvert at an existing crossing within the lower portion of this reach has resulted in an additional headcut and bed and bank scouring. This reach has the highest channel slope on the property, 4.7%, and has a bank height ratio of 1.9. UT1 Reach 1 is closest to an E6b stream type with an entrenchment ratio of 3.3 and a width to depth ratio of 2.1.

The existing UT1 tributary derives base hydrology from an existing on-site spring. Modifications to the spring, primarily through livestock influences, has expanded an open depression around the spring. The particle composition of this depression is very fine silts and clays, which is highly erosive during runoff events from off-site agricultural areas. The fine substrate does not have sufficient competency to maintain a stable bed and has resulted in downcutting of the channel.

UT1 – Reach 2

Both the instream and riparian degradation of this reach are similar to that along Reach 1. Reach 2 flows southeast into Perry Branch Reach 4. Livestock access has resulted in widespread bank trampling as well as instream sedimentation resulting in impaired bed form and habitat diversity. UT1 Reach 2 is closest to a F4b stream type with entrenchment ratios from 1.6 to 2.0 and width to depth ratios from 12.3 to 13.5. Its channel slope reduces from Reach 1 to 2.0%, and its bank height ratio ranges from 2.6 to 3.0.

UT2 – Reach 1

UT2 originates from a wetland on the project parcel and flows southeast to Perry Branch. Several headcuts are migrating upstream through the reach. This reach is located within a mature forest, but livestock impacts have altered the understory and herbaceous communities along the reach. Additionally, livestock have caused sedimentation within the existing channel. While the channel has natural, meandering pattern, the banks are impaired due to trampling and hoof shear. The excessive sedimentation in

conjunction with debris jams along the reach have resulted in impaired bed form diversity and the channel lacks overall habitat diversity. With an entrenchment ratio of 2.6 and width to depth ratio of 28.7, this reach best classifies as a C6 stream type. It has a low channel slope of 0.6% and a bank height ratio of 1.1.

UT2 – Reach 2

Along UT2 Reach 2, the right bank has a deficient buffer that ranges from 0 to 30 feet wide. Livestock impacts are evident throughout. UT2 Reach 2 has multiple active headcuts and is moderately incised. Bank erosion and sloughing due to livestock crossings is pervasive. With entrenchment ratios from 6.2 to 17.3 and width to depth ratios from 5.1 to 5.3, this reach most closely qualifies as a low sinuosity E4 stream type. It exhibits a channel slope of 1.9%, and bank height ratios ranging from 1.2 to 1.6.

UT3

UT3 originates from an ephemeral channel (EC3) with a limited woody buffer of approximately 5-10 feet on each side which is surrounded by active livestock pasture. UT3 becomes an intermittent stream feature that flows through a forested area upstream of the confluence with Perry Branch Reach 3. Livestock impacts are evident within the forested area, including bank trampling and hoof shear. Mature trees are present, but the understory and herbaceous vegetation are severely degraded. A headcut is migrating up UT3 from Perry Branch Reach 3. Above this, UT3 is vertically stable but widespread fine sediment covers the streambed and hoof shear is prevalent throughout. The channel most closely resembles a C4 stream type with width to depth ratios from 12.2 to 14.8 and entrenchment ratios from 18.3 to 18.5. Its channel slope is 1.4% and bank height ratios are 1.2. The substrate in this reach is silt, sand, and gravel, with some cobbles near the confluence with Perry Branch.

Table 6: Stream Resources – Perry Branch

Parameter	Perry Branch Reach 1	Perry Branch Reach 2	Perry Branch Reach 3	Perry Branch Reach 4
Length of Reach (lf)	326	417	732	2,061
Valley Confinement (confined, moderately confined, unconfined)	Unconfined	Unconfined	Moderately Confined	Moderately Confined
Drainage Area (acres)	58	66	117	175
Perennial, Intermittent, Ephemeral	Perennial			
DWR Water Quality Classification	WS-II, HQW, NSW			
Stream Classification[1]	G4c	C4	G4c	F4
Evolutionary Trend (Simon)	III Degradation	V Aggradation and Widening	IV Degradation and Widening	III/IV Degradation and Widening
FEMA Classification	N/A			

1. The Rosgen classification system (Rosgen, 1994) is for natural streams. These channels have been heavily manipulated by livestock and man and therefore may not fit the classification category as described by this system. Results of the classification are provided as a basis for discussion of existing channel form.

Table 7: Stream Resources - Tributaries

Parameter	UT1 Reach 1	UT1 Reach 2	UT2 Reach 1	UT2 Reach 2	UT3
Length of Reach (lf)	388	213	226	974	357
Valley Confinement (confined, moderately confined, unconfined)	Confined to Moderately Confined	Moderately Confined	Confined	Moderately Confined	Unconfined
Drainage Area (acres)	9	10	15	23	20
Perennial, Intermittent, Ephemeral	Intermittent				
DWR Water Quality Classification	WS-II, HQW, NSW				
Stream Classification[1]	E6b	F4b	C6	E4	C4
Evolutionary Trend (Simon)	III/IV Degradation and Widening	III/IV Degradation and Widening	V Aggradation and Widening	III/IV Degradation and Widening	III Degradation (lower) V Aggradation and Widening (upper)
FEMA Classification	N/A				

1. The Rosgen classification system (Rosgen, 1994) is for natural streams. These channels have been heavily manipulated by livestock and man and therefore may not fit the classification category as described by this system. Results of the classification are provided as a basis for discussion of existing channel form.

4.0 Watershed and Channel Disturbance and Response

As discussed in Section 3.2, there has been very little change in the watersheds of the project reaches for several decades. Some clearing of small forested areas has occurred but these minor disturbances are the not the main driver of the degradation of the Site. The primary causes of degradation on the Site are historical and current agricultural activities, primarily a decrease in runoff detention (due to agricultural activities). An increase in runoff volume increases in-stream shear stress, promoting incision. Over time, incision has decreased the channel slope (and reduced bed form variability), decreasing stream power. As a result of the decreased stream power (and presence of bedrock control), incision ceased, and the channels began to widen through fluvial erosion and livestock trampling. Signs of on-going bank scour are apparent along much of the project reaches. The proposed restoration reaches are severely incised, over-widened, and have on-going lateral erosion. They have not yet stabilized and begun to reform a bankfull channel at the lower elevation through aggradation processes.

An existing off-site pond is located north of Perry Branch Reach 1. This (off-site) pond, built between 1964 and 1975, lacks significant surface and groundwater connection with Perry Branch Reach 1 and adjacent wetlands. As such, Wildlands does not expect this pond to affect the volume or frequency of hydrologic or sediment inputs to Perry Branch. Wildlands determined that the instability observed within Perry Branch Reach 1 is a result of on-site influences such as farming practices and livestock. The greatest potential for downstream impacts from dams is the potential reduction in base hydrologic inputs. However, groundwater inputs have the potential to offset some of this hydrologic loss (McCarthy 2008). For the Site, the existence of active wetland hydrology and associated water table inputs, provides sufficient hydrology to offset potential resulting from dam attenuation.

Bankfull indicators within Perry Branch Reach 1 are consistent with those found in the downstream reaches, where additional hydrologic inputs are unimpeded by the dam. This would indicate that, while bankfull event frequency may be reduced as a result of the dam, volumetric rates are not adversely altered

within this reach. This is likely due to the location of the dam at the headwaters of the stream. Additionally, the dam outfall discharges to a wetland system upslope of Perry Branch Reach 1. This wetland is stable and exhibits no evidence of fine sediment deposition or hydraulic scour that could exist downstream of headwater dams.

5.0 Regulatory Considerations

Table 8, below, is a summary of regulatory considerations for the Site. These considerations are explained in more detail in Sections 6.1-6.3.

Table 8: Regulatory Considerations

Parameters	Applicable?	Resolved?	Supporting Docs?
Water of the United States[1]	Yes	No	Section 404 Permit
	Yes	No	Section 401 Permit
Endangered Species Act	Yes	Yes	Categorical Exclusion Docs
Historic Preservation Act	Yes	Yes	Categorical Exclusion Docs
Coastal Zone Management Act	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

1. PCN to be provided to DMS with Final Mitigation Plan.

5.1 Biological and Cultural Resources

A Categorical Exclusion was submitted on May 31, 2019 and approved by the Federal Highway Administration (FHWA) on June 6, 2019. This document included investigation into the presence of threatened and endangered species on Site protected under the Endangered Species Act of 1973, as well as any historical resources protected under the National Historic Preservation Act of 1966. The US Fish and Wildlife Service (USFWS) does concur with the "no effect" or "not likely to adversely affect" determinations for proposed and listed species and proposed and designated critical habitat. The USFWS applied a "may affect" determination for northern long-eared bat and a "no Eagle Act permit required" determination for eagles. All correspondence with USFWS and a list of threatened and endangered species in Orange County, NC is included in Appendix 6. The conclusion for cultural resources according to the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. For additional information and regulatory communications please refer to the Categorical Exclusion document.

5.2 FEMA Floodplain Compliance and Hydrologic Trespass

Perry Branch and the unnamed tributaries are within Zone X, an area of minimal flood hazard. The Site location is included on the Orange County Flood Insurance Rate Map Panel 9865. The map's effective date is February 2, 2007. Because the Site is in Zone X, no modeling or map revisions will be required. Wildlands will coordinate with Orange County to obtain a floodplain development permit, if necessary.

5.3 401/404

As part of the existing conditions assessment at the Site, Wildlands documented and classified the on-site wetlands. Classifications were applied based on wetland function and potential for wetland improvement through the stream design approach. Based on these classifications, Wildlands designers used this information to prioritize higher quality wetlands for avoidance and minimization and to incorporate stream design approaches to improve hydrologic and vegetative conditions of impaired wetlands.

Floodplain grading and temporary construction access will result in temporary impacts to wetlands while channel realignment will result in permanent impacts. Table 9 shows estimates of the anticipated impacts to wetland areas on this project. Final impacts will be provided in the Pre-Construction Notification, after proposed floodplain grading has been completed.

Table 9: Estimated Impacts to Wetlands

Jurisdictional Feature	Classification	Acreage	Permanent Impact		Temporary Impact	
			Type of Activity	Impact Area (acres)	Type of Activity	Impact Area (acres)
Wetland A	Headwater Forest	1.153	Stream Restoration	0.021	Floodplain Grading	0.072
Wetland B	Headwater Forest	0.113	Stream Restoration	0.113	-	-
Wetland C	Headwater Forest / Seep	0.310	Stream Restoration	0.004	Floodplain Grading	0.044
Wetland D	Headwater Forest	0.121	-	-	-	-
Wetland E	Headwater Forest	0.030	-	-	-	-
Wetland F	Headwater Forest	0.009	-	-	Floodplain Grading	0.003
Wetland G	Headwater Forest	0.235	Stream Restoration	0.001	Floodplain Grading	0.016
Wetland H	Headwater Forest / Seep	0.240	Stream Restoration	0.003	Floodplain Grading	0.024
Wetland I	Headwater Forest	0.007	Stream Restoration	0.007	-	-
Wetland J	Headwater Forest / Seep	0.192	Stream Restoration	0.001	-	-
Wetland K	Headwater Forest	0.121	Stream Restoration	0.001	Floodplain Grading	0.030
Wetland L	Headwater Forest	0.001	-	-	-	-
Wetland M	Headwater Forest	0.006	Stream Restoration	0.001	-	-
Wetland N	Headwater Forest	0.049	-	-	-	-
Wetland O	Headwater Forest / Seep	1.961	-	-	-	-
Wetland P	Headwater Forest / Seep	0.196	-	-	Floodplain Grading	0.056
Wetland Q	Headwater Forest / Seep	0.189	-	-	Floodplain Grading	0.013
			Total Permanent Impact	**0.152**	**Total Temporary Impact**	**0.258**

6.0 Mitigation Site Goals and Objectives

The project will improve stream functions as described in Section 7 through stream restoration and enhancement as well as riparian buffer re-vegetation. The project goals and related objectives and outcomes are described in Table 10. Project goals are desired project outcomes and are verifiable through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 9.

Table 10: Mitigation Goals and Objectives

Goal	Objective	Expected Outcomes	Function Supported
Exclude livestock (i.e. cattle) from project streams and adjacent riparian areas.	Exclude livestock from streams and riparian areas by installing fencing around project area and/or removing livestock from the Site.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve the stability of stream channels.	Restore and enhance stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.	Reduce sediment inputs; Contribute to protection of or improvement to a Water Supply Waterbody.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes on restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Improve aquatic communities in project streams.	Geomorphology, Biology
Reconnect channels with floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody;	Hydraulic, Geomorphology, Physicochemical, Biology
Restore and enhance native floodplain vegetation.	Convert active livestock pasture to forested riparian buffers along all Site streams. Protect and enhance existing forested riparian buffers. Treat invasive species during monitoring period to permit establishment of native plantings.	Reduce sediment inputs; Reduce nutrient inputs; Provide a canopy to shade streams and reduce thermal loadings; Contribute to protection of or improvement to a Water Supply Waterbody.	Hydraulic, Geomorphology, Physicochemical, Biology
Permanently protect Site from harmful uses.	Establish a conservation easement on the Site.	Ensure that development and agricultural uses that would damage the Site or reduce the benefits of the project are prevented.	Hydraulic, Geomorphology, Physicochemical, Biology

7.0 Design Approach and Mitigation Work Plan

7.1 Design Approach Overview

The design approach for this Site was developed to meet the goals and objectives described in Section 6 which were formulated based on the potential for uplift described in Section 5. The design is also intended to provide the expected outcomes in Section 6, though these are not tied to performance criteria. The project streams will be reconnected with an active floodplain and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. The adjacent floodplain will be planted with native tree species where necessary. Instream structures will be constructed in the channels to help maintain stable channel morphology and improve aquatic habitat. The entire project area will be protected in perpetuity by a conservation easement.

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on many successful Piedmont and Slate Belt restoration projects and is appropriate for the goals and objectives for this Site.

7.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. A total of seven reference reaches were identified for this Site and used to support the design of Perry Branch and tributaries (Figure 7). These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. The reference reaches are all located within the Piedmont region of North Carolina. Geomorphic parameters for these reference reaches are summarized in Appendix 7. The references to be used for the specific streams are shown in Table 11. A description of each reference reach is included below.

Table 11: Stream Reference Data Used in Development of Design Parameters

	Agony Acres	UT to Sandy Run	UT to Mine Creek	UT to Richland Creek	UT to Wells Creek	UT4 (UT to Cedar Creek)	UT to Cane Creek
Stream Type:	**B3**	**E4**	**B4**	**C4/E4**	**C4**	**C4**	**C4/E4**
Perry Branch Reach 1	Q	Q	-	Q	ALL	ALL	Q
Perry Branch Reach 2	Q	Q	-	Q	ALL	ALL	Q
Perry Branch Reach 3	Q	ALL	-	Q	ALL	Q	Q
Perry Branch Reach 4	Q	Q	-	ALL	Q	Q	Q-PRO-XS
UT1 Reach 1	Q-XS	Q	PAT-PRO	Q	Q	Q	Q
UT1 Reach 2	Q-XS	Q	-	Q	ALL	Q	Q
UT2 Reach 1	Q	Q	-	Q	ALL	ALL	Q
UT2 Reach2	Q	Q	-	Q	ALL	ALL	Q
UT3	Q	Q	-	Q	ALL	ALL	Q

Q – Discharge PAT – Pattern PRO – Profile XS – Cross-Section

7.2.1 Agony Acres

The Agony Acres on-site reference reach is in northeast Guilford County, NC. It was identified by Wildlands as a high-quality preservation component of the nearby Agony Acres Mitigation Site in the March 2014 Mitigation Plan (Wildlands Engineering, 2014) and was used as a reference reach for that project. It was selected as a reference reach due to its similarity in slope (4.9%) and drainage area (0.15 sq. mi.) to UT1 Reach 1. A detailed survey was conducted in March of 2013 and the stream is classified as a B3 stream type.

7.2.2 UT to Sandy Run

The UT to Sandy Run reference reach is located approximately 10 miles southwest of Shelby, NC in Cleveland County. This reference reach has a watershed similar in size (0.15 sq. mi.) and geomorphic characteristics to Perry Branch Reach 3 and was used as a reference for this stream. It is an E4 stream type with a steeper slope (1.5%).

7.2.3 UT to Mine Creek

UT to Mine Creek is located within the city limits of Raleigh, NC north of the downtown area. The reach is classified as a B4 channel with a step-pool system and other associated morphologic characteristics necessary for B-type channel design. Its slope is 2.2% and it has a drainage area of 0.17 sq. mi. This reach was identified as a reference for UT1 Reach 1 for pattern and profile only.

7.2.4 UT to Richland Creek

UT to Richland Creek is located approximately 10 miles west of Carthage, NC in north-central Moore County. This reference reach was surveyed by Wildlands in January 2012. UT to Richland Creek is a C4/E4 stream type with a slope between 1.3-1.8% and a drainage area 0.28 sq. mi. This reach was used for design reference for Perry Branch Reach 4.

7.2.5 UT to Wells Creek

The UT to Wells Creek reference reach is in south central Alamance County, NC. Wildlands visited UT to Wells Creek in September 2014 and visually confirmed that the land use is unchanged from reported conditions and that the stream is laterally and vertically stable. UT to Wells Creek has a drainage area of 0.13 square miles and is classified as a Rosgen C4 stream type with a slope of 1.99%. This reach was used as a source of design information for Perry Branch Reach 1, Reach 2, Reach 3, UT1 Reach 2, UT2 Reach 1, UT2 Reach 2, and UT3.

7.2.6 UT4 (UT to Cedar Creek)

UT4 (UT to Cedar Creek) is in eastern Stanly County, NC. The site has a drainage area of 0.11 square miles that is mostly wooded. UT4 (UT to Cedar Creek) was classified as a Rosgen C4 stream type, with a channel slope of 1.6%. This reach was used to design Perry Branch Reach 1, Reach 2, UT1 Reach 2, UT2 Reach 1, UT2 Reach 2, and UT3.

7.2.7 UT to Cane Creek

UT to Cane Creek, is in southern Alamance County. This stream is classified as an C4/E4 stream type and has a drainage area of 0.29 sq. mi. This reach also flows through a mature forest and has a channel slope of 1.5%. This reach was used to design Perry Branch Reach 4 for discharge, profile, and cross-section.

7.3 Design Channel Morphological Parameters

Reference reaches were a primary source of information used to develop the cross-section, pattern, and profile design parameters for the streams. Ranges of pattern parameters were developed within the reference reach parameter ranges with some exceptions based on best professional judgement and knowledge from previous projects. The full range of reference reach data is in Appendix 7. We found the lower limit of some of these parameters to be too low to build a stable system. They are likely low in reference reaches due to the presence of a mature forest and established vegetation that both influence

and stabilize channel pattern and profile. For example, radius of curvature ratio in reference data has a lower limit of 0.3 and the meander width ratio had a minimum of 0.4, however we have found that for C/E channels, these ratios should be above 1.8 and 2.4 respectively to naturally dissipate energy through meander bends during high flow events to limit impacts of shear stress on streambanks. The lower limits of the radius of curvature ratio and meander width ratio are based on values used for many years and on many successful designs.

The streams were designed with pool widths to be 1.3-1.5 times the width of riffles to provide space for point bars and riffle pool transition zones. Pool depths were designed to be a minimum of 2.2 times deeper than riffles to provide habitat variation. Cross-section parameters such as area, depth, and width were designed based on the design discharge and stable bank slopes. Key morphological parameters for the Site are listed in Tables 12 through 17 for Perry Branch and the tributaries where restoration or enhancement is to occur, respectively. Complete morphological tables for existing, reference, and proposed conditions are in Appendix 7.

Table 12: Summary of Morphological Parameters for Perry Branch Reaches 1 and 2

Parameter	Existing Parameters				Reference Parameters				Proposed Parameters	
	Perry Branch Reach 1		Perry Branch Reach 2		UT4 (UT to Cedar Creek)		UT to Wells Creek		Perry Branch Reach 1	Perry Branch Reach 2
Contributing Drainage Area (ac)	58		66		70		83		58	66
Channel/Reach Classification	G4c		C4		C4		C4		C4	C4
Bankfull Width (ft)	2.7	3.1	5.1	5.5	7.3		6.2	8.6	8.0	8.6
Mean Depth (ft)	0.4	0.6	0.4		0.6		0.6	1.0	0.63	0.65
Cross-Sectional Area (ft^2)	1.1	2.0	2.3	2.4	4.2		3.9	6.3	5.0	5.6
Average Velocity (ft/s)	2.5	3.0	1.8		5.2	6.1	3.8		3.0	2.9
Discharge (cfs)	2.8	5.9	4.2	4.5	21.7	25.8	15.0		14.9	16.3
Channel Slope (ft/ft)	0.0129		0.0104		0.0156		0.0199		0.0127	0.0114
Sinuosity	1.10		1.10		1.10		1.40		1.16	1.09
Width/Depth Ratio	5.2	6.8	12.8	13.8	12.6		6.1	12.6	12.8	13.2
Bank Height Ratio	2.1	2.7	1.3		1.0		1.0	1.8	1.0 - 1.1	1.0 - 1.1
Entrenchment Ratio	1.3	1.4	9.8	19.5	2.7		1.9	4.1	7.6	6.4

Table 13: Summary of Morphological Parameters for Perry Branch Reach 3

Parameter	Existing Parameters		Reference Parameters				Proposed Parameters
	Perry Branch Reach 3		UT to Sandy Run		UT to Wells Creek		Perry Branch Reach 3
Contributing Drainage Area (acres)	117		96		83		117
Channel/Reach Classification	G4c		E4		C4		C4
Bankfull Width (ft)	5.3	6.1	7.3	7.8	6.2	8.6	9.6
Mean Depth (ft)	0.6	0.7	0.7	0.8	0.6	1.0	0.75
Cross-Sectional Area (ft^2)	3.4	3.6	5.7	6.2	3.9	6.3	7.2
Average Velocity (ft/s)	2.7	2.9	3.4		3.8		3.5
Discharge (cfs)	9.1	10.2	20.0		15.0		25.1
Channel Slope (ft/ft)	0.0155		0.0150		0.0199		0.0135
Sinuosity	1.15		1.60		1.40		1.12
Width/Depth Ratio	8.7	8.8	6.6	9.8	6.1	12.6	12.8
Bank Height Ratio	1.9	2.3	1.7	2.6	1.0	1.8	1.0 - 1.1
Entrenchment Ratio	2.1	2.2	1.6	2.1	1.9	4.1	16.3

Table 14: Summary of Morphological Parameters for Perry Branch Reach 4

Parameter	Existing Parameters		Reference Parameters				Proposed Parameters
	Perry Branch Reach 4		UT to Richland		UT to Cane Creek		Perry Branch Reach 4
Contributing Drainage Area (acres)	175		179		186		175
Channel/Reach Classification	F4		C4/E4		C4/E4		C4
Bankfull Width (ft)	5.7	9.3	8.8	10.4	11.5	12.3	11.4
Mean Depth (ft)	0.6	1.0	0.8	0.9	0.8	1.0	0.88
Cross-Sectional Area (ft^2)	4.0	5.9	7.8	8.5	8.9	12.2	10.1
Average Velocity (ft/s)	2.7	3.5	4.1	5.2	3.8		3.5
Discharge (cfs)	10.8	20.7	29.1	32.0	40.0		35.5
Channel Slope (ft/ft)	0.0109		0.0131	0.0178	0.0150		0.0111
Sinuosity	1.11		1.00		1.40		1.14
Width/Depth Ratio	9.3	9.5	10.0	12.8	12.3	14.4	12.9
Bank Height Ratio	1.2	3.0	1.4	2.1	-		1.0 - 1.1
Entrenchment Ratio	1.4	2.7	2.5	4.0	>2.5		10.8

Table 15: Summary of Morphological Parameters for UT1 Reach 1

Parameter	Existing Parameters	Reference Parameters		Proposed Parameters
	UT1 Reach 1	Agony Acres	UT to Mine Creek	UT1 Reach 1
Contributing Drainage Area (acres)	9	96	109	9
Channel/Reach Classification	E6b	B3	B4/1	B4
Bankfull Width (ft)	1.7	11.1	10.1 - 10.5	6.0
Mean Depth (ft)	0.8	0.7	0.8 - 1.1	0.42
Cross-Sectional Area (ft^2)	1.4	7.4	8.9 - 10.9	2.5
Average Velocity (ft/s)	5.4	4.9	4.5 - 5.6	3.7
Discharge (cfs)	7.5	37.0	51.1	9.4
Channel Slope (ft/ft)	0.0473	0.0490	0.0220	0.0522
Sinuosity	1.04	1.04	1.2	1.06
Width/Depth Ratio	2.1	16.6	9.0 - 12.0	14.3
Bank Height Ratio	1.9	1.0	-	1.0 - 1.1
Entrenchment Ratio	3.3	2.3	1.2 - 2.2	1.8

Table 16: Summary of Morphological Parameters for UT1 Reach 2

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters
	UT1 Reach 2		Agony Acres	UT to Wells Creek		UT1 Reach 2
Contributing Drainage Area (acres)	10		96	83		10
Channel/Reach Classification	F4b		B3	C4		C4b
Bankfull Width (ft)	3.2	3.7	11.1	6.2	8.6	6.0
Mean Depth (ft)	0.3	0.4	0.7	0.6	1.0	0.48
Cross-Sectional Area (ft^2)	1.4	1.6	7.4	3.9	6.3	2.9
Average Velocity (ft/s)	2.0	2.5	4.9	3.8		2.6
Discharge (cfs)	3.2	3.7	37.0	15.0		7.6
Channel Slope (ft/ft)	0.0204		0.0490	0.0199		0.0221
Sinuosity	1.14		1.04	1.40		1.15
Width/Depth Ratio	12.3	13.5	16.6	6.1	12.6	12.5
Bank Height Ratio	2.6	3.0	1.0	1.0	1.8	1.0 - 1.1
Entrenchment Ratio	1.6	2.0	2.3	1.9	4.1	18.8

Table 17: Summary of Morphological Parameters for UT2 Reach 1, UT2 Reach 2, and UT3

Parameter	Existing Parameters					Reference Parameters				Proposed Parameters		
	UT2 Reach 1	UT2 Reach 2		UT3		UT4 (UT to Cedar)		UT to Wells Creek		UT2 Reach 1	UT2 Reach 2	UT3
Contributing Drainage Area (acres)	15	23		20		70		83		15	23	20
Channel/Reach Classification	C6	E4		C4		C4		C4		C6	C4	C4
Bankfull Width (ft)	8.6	3.2	4.1	5.9	6.1	7.3		6.2	8.6	-	6.0	5.6
Mean Depth (ft)	0.3	0.6	0.8	0.4	0.5	0.6		0.6	1.0	-	0.46	0.44
Cross-Sectional Area (ft^2)	2.9	2.0	3.3	2.4	3.0	4.2		3.9	6.3	-	2.7	2.5
Average Velocity (ft/s)	1.1	2.3	4.5	2.5	2.8	5.2	6.1	3.8		-	3.0	2.7
Discharge (cfs)	3.2	6.2	10.9	5.9	8.6	21.7	25.8	15.0		-	8.2	6.5
Channel Slope (ft/ft)	0.0058	0.0187		0.0144		0.0156		0.0199		0.0060	0.0177	0.0161
Sinuosity	1.14	1.13		1.20		1.10		1.40		-	1.11	1.18
Width/Depth Ratio	28.7	5.1	5.3	12.2	14.8	12.6		6.1	12.6	-	13.2	12.8
Bank Height Ratio	1.1	1.2	1.6	1.2		1.0		1.0	1.8	-	1.0 - 1.1	1.0 - 1.1
Entrenchment Ratio	2.6	6.2	17.3	18.3	18.5	2.7		1.9	4.1	-	7.3	9.6

7.4 Design Discharge Analysis

Multiple methods were used to develop bankfull discharge estimates for each of the project restoration reaches: the NC Rural Piedmont Regional Curve (Harman et al., 1999), NC Piedmont/Mountain Regional Curve (Walker, unpublished), a Regional Flood Frequency Analysis, a Site-Specific Reference Reach Curve, existing bankfull indicators using Manning's Equation, and data from previous successful design projects. The resulting values were compared and best professional judgment was used to determine the specific design discharge for each restoration reach.

7.4.1 Published Regional Curve Data

Discharge was estimated using the published NC Rural Piedmont Curve (Harman et al., 1999) as well as the updated curve for rural Piedmont and mountain streams, referred to as the NRCS Curve (Walker, unpublished).

7.4.2 Wildlands Regional Flood Frequency Analysis

Wildlands developed a regional flood frequency analysis tool based on methodology described in the USGS publication *Magnitude and Frequency of Rural Floods in the Southeastern United States,* through 2006 (USGS, 2009). Of the 103 stations referenced in the publication, 28 were used in the development of the tool. The applicable stations were selected based on several criteria such as geographic region, drainage area, watershed characteristics, extent of available data, and dates of data collection.

The data from these 28 gage stations were used to develop flood frequency curves for the 1-year, 1.2-year, 1.5-year, 1.8-year, and 2-year recurrence interval discharges. These relationships can be used to

estimate discharge of those recurrence intervals for ungauged streams in the same hydrologic region and were solved for each project reach's discharge with the drainage area as the input.

7.4.3 Site Specific Reference Reach Curve

A total of seven reference reaches were identified for this project (Section 8.2). Each reference reach was surveyed to develop information for analyzing drainage area-discharge relationships as well as development of design parameters. Stable cross-sectional dimensions and channel slopes were used to compute a bankfull discharge with the Manning's equation for each reference reach. The resulting discharge values were plotted with drainage area and compared to other discharge estimation methods.

7.4.4 Existing Bankfull Indicators (Manning's Equation)

Two riffle cross-sections were surveyed on the majority of the reaches on Site. UT1 Reach 1 and UT2 Reach 1 only have one existing riffle cross-section. Bankfull indicators were identified in the field during this survey. Manning's equation was used to calculate a corresponding discharge using a field verified measurement for roughness and the survey data for channel slope.

7.4.5 Design Discharge Analysis Summary

The results of the design discharge analysis provided a range of discharge values. Final design discharges are based on a strategic weighting of the methods discussed in this section. For both Perry Branch and the unnamed tributaries, the Piedmont Regional Curve, the USGS regression equation, and the reference reach curve were weighted most heavily. The regional flood frequency analysis, existing bankfull indicators and Alan Walker curve were weighted minimally due to their perceived accuracy. These methods produced a wide range of discharges, both above and below the other heavily weighted calculations. Final design discharges were also selected to keep in mind the constructability of the Site's small reaches. This Site is comprised of headwater reaches with small drainage areas. Discharges were selected to create channels with a max depth of at least 0.6 feet to reduce the chances of aggrading and filling in with vegetation.

Tables 18 and 19 give a summary of the discharge analysis. Figure 8 illustrates the design discharge data.

Table 18: Summary of Design Discharge Analysis for Perry Branch

		Perry Branch Reach 1	Perry Branch Reach 2	Perry Branch Reach 3	Perry Branch Reach 4
DA (acres)		58	66	117	175
DA (sq. mi.)		0.090	0.103	0.182	0.273
NC Rural Piedmont Regional Curve (cfs)		16	17	26	35
USGS Regression Curve (1.5-year) (cfs)		22	24	36	47
Regional Flood Frequency Analysis (cfs)	**1.2-year event**	4	4	7	10
	1.5-year event	6	7	11	15
Site Specific Reference Reach Curve		20	21	30	38
***Selected Design Discharge**		**15**	**16**	**25**	**34**

*Note: Discharge values identified in Tables 12-14 are calculated using design parameters and are within 5% of selected design discharge

Table 19: Summary of Design Discharge Analysis for Tributaries

		UT1 Reach 1	UT1 Reach 2	UT2 Reach 1	UT2 Reach 2	UT3
DA (acres)		9	10	15	23	20
DA (sq. mi.)		0.014	0.015	0.023	0.036	0.031
NC Rural Piedmont Regional Curve (cfs)		4	4	6	8	7
USGS Regression Curve (1.5-year) (cfs)		6	6	9	12	11
Regional Flood Frequency Analysis (cfs)	**1.2-year event**	1	1	1	2	2
	1.5-year event	1	1	2	3	2
Site Specific Reference Reach Curve		7	7	9	12	11
***Selected Design Discharge**		**7**	**7**	**6**	**8**	**7**

*Note: Discharge values identified in Tables 12-14 are calculated using design parameters and are within 5% of selected design discharge

7.5 Sediment Transport Analysis

Based on information presented in Section 3.2, the existing watershed conditions have been static in this rural area over an extended period and the potential for future land use change is likely to be inconsequential with respect to sediment supply. Sediment contributions from the watershed are deemed to be constant and are expected to remain stable in the future. The sediment load impacts from the off-site pond have likely stabilized due to the age of the pond. This means that sediment contributions to Perry Branch Reach 1 will likely remain consistent with data collected during the site assessment, which has been incorporated into the design parameters. The watershed and site assessment for all reaches suggest that local factors, specifically livestock impacts and agricultural practices, contribute sediment within the project streams and that the sediment load contributed by the upstream watershed (beyond the project limits) is stable. Sediment deposition observed in the existing channels is attributed to local bank erosion and livestock disturbance within the project streams and input of fine sediment from adjacent pastures. In the case of UT1 Reaches 1 and 2, discharge is primarily driven by the on-site spring at the head of the system. Additional inputs from off-site agriculture activities has resulted in a very fine subpavement and bed substrate. Observed channel incision in this reach indicates shear stress impacts within the bedload. This reach will be augmented with larger bed material to stabilize the system.

The design approach will address the major sediment source (i.e., bank erosion) within the project area by stabilizing stream banks and increasing shear resistance via the construction of in-stream structures. The focus of the sediment transport analysis for the constructed streams was to verify that the designed channels will be stable over time and provide the competence to pass the sediment delivered by the stream network.

7.5.1 Competence Analysis

In natural streams, the shear stress in a channel increases corresponding to an increase in flow depth until the point at which the stream gains access to the floodplain. The floodplain access disperses the flow and prevents further increases in shear stress within the channel. This relationship of shear stress, channel dimension, and discharge influences sediment entrainment within the channels. The proposed channels were modeled using their design bankfull flow. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1980) equation described by Rosgen (2001). Channel slope and design dimensions were varied until the resulting design verified that the stream reach

could move the bed load supplied to the stream. The competence analysis for each project reach is summarized in the tables below.

Table 20: Results of Competence and Capacity Analysis - Restoration Reaches

	Perry Branch				UT1		UT2		UT3
	Reach 1	Reach 2	Reach 3	Reach 4	Reach 1	Reach 2	Reach 1	Reach 2	
Dbkf (ft)	0.6	0.7	0.8	0.9	0.4	0.5	0.5	0.5	0.4
Schan (ft/ft)	0.0127	0.0114	0.0135	0.0111	0.0522	0.0221	0.006	0.0177	0.0161
Bankfull Shear Stress (lb/sq ft)	0.47	0.44	0.61	0.60	1.40	0.67	0.25	0.49	0.43
Existing Dmax Subpavement (mm)	18.30	18.30	22.20	19.10	15.88	15.88	17.78	17.78	16.93
Dcrit (ft)	0.64	0.71	0.63	0.88	0.34	0.42	2.29	0.77	0.48
Scrit (ft/ft)	0.0135	0.0116	0.0107	0.0109	0.0443	0.0184	0.0275	0.0273	0.0193
Movable Particle Size (mm)	36	34	46	46	111	51	19	37	32
Predicted Shear Stress to Move Dmax	0.78	0.78	0.78	0.78	1.51	1.15	1.09	1.09	0.78

1. Reported numbers are based on the Shield's curve.
2. Where a range is reported, the higher number reported was utilized for calculations.
3. The maximum and D_{50} for Class A stone are 152.4mm and 101.6mm, respectively (NCDOT standard specification).
4. The maximum and D_{50} for Class B are 304.8mm and 203.2mm, respectively (NCDOT standard specification).

The competence analysis was based on the size material naturally found in the stream in order to represent the potential bed load. The results of the analysis show excess shear stress in every reach. This indicates that there is enough shear stress to move the naturally occurring material. However, it also indicates that scour could be a problem. Therefore, the results of the analysis were used to size material that would not be mobile so that constructed riffles can be designed to provide grade control. The larger rock material along with log sills and other grade control structures were used in the design to prevent downcutting of the proposed channels. The results of the analysis indicate that particles of 46.0 mm (0.15 feet) would not be mobile in the Perry Branch reaches, particles of 111.0 mm (0.36 feet), 37 mm (0.12 feet) and 32 mm (0.10 feet) would not be mobile in UT1, UT2 and UT3 respectively. Multiple riffles in each of these streams will be constructed with material larger than these sizes. The larger particle size in UT1 is attributed to the B4 channel type and channel slope of UT1 Reach 1.

7.6 Project Implementation

Perry Branch Reach 1, Reach 3, and UT1 Reach 2 will be restored through Priority 1 restoration. The restored streams will be reconstructed on flat areas on the historic floodplains. Perry Branch Reach 4 will primarily be Priority 1 restoration; however, the downstream extent (150 lf) will be Priority 2 restoration to tie back into existing grade. UT1 Reach 1 will consist of a combination of Priority 1 and 2 restoration, with the establishment of a new floodplain valley on either side of the channel. Grading activities will also include the connection of the existing on-site spring at the headwaters of UT1 Reach 1 through the establishment of a stable headwater conveyance feature. This headwater conveyance will consist of grading and vegetative planting to stabilize the erosive depression and sideslopes around the existing spring. The design proposes to establish a small pool area to reduce the erosion potential along the sideslopes adjacent to the spring and set grade control for the headwater channel of UT1. The restoration reach design minimized impacts to existing wetlands and existing trees to the extent possible. The restored profiles will consist of alternating riffle-pool bed morphology.

A variety of structures will be used in restoration reaches to maintain restored bed grades, protect banks, add wood and rock into channels, and provide a variety of habitat types. Multiple types of constructed riffles are proposed including native material riffles, woody riffles, and chunky riffles. Other types of structures will include brush toe bank revetments, boulder toe, angled log sills, rock sills, and vegetated soils lifts.

Riffle grade control material will be quarried from weathered parent material on-site for construction of riffles and other structures. Use of this material, along with the introduction of woody debris, will provide a heterogeneous mixture of riffle material that increases channel roughness and improves channel hydraulics and geomorphology.

Enhancement I is proposed for UT2 Reach 2. The treatment for this reach includes raising the channel bed using constructed riffles and/or sills and bank revetments where needed. Enhancement II is proposed for Perry Branch Reach 2, UT2 Reach 1, and UT3. The treatments for these reaches include livestock exclusion and minor bank repairs where necessary. Bank repairs will primarily include regrading banks in isolated locations to flatter, more stable side slopes along with matting and live staking repaired areas.

Two culvert crossings will be constructed on the project streams. One internal culvert crossing will be constructed along Perry Branch Reach 4. A second internal culvert crossing will be constructed between Perry Branch Reach 2 and Reach 3. A ford crossing will also be constructed at the terminus of Perry Branch Reach 4 in the overhead powerline easement.

Riparian buffer mitigation will also be performed on the Site. The Buffer Mitigation Plan is included in Appendix 1.

7.7 Vegetation, Planting Plan, and Maintenance Activities

7.7.1 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a riparian buffer primarily composed of native tree species associated with a headwater forest community type. Trees and shrub species within headwater forest communities typically include [swamp chestnut oak (*Quercus michauxii*), hackberry (*Celtis laevigata*), sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), American hornbeam (C*arpinus caroliniana*), tulip-tree (*Liriodendron tulipifera*), American elm (*Ulmus americana*), American holly (*Ilex opaca*), silky dogwood (*Cornus amomum*), and spicebush (*Lindera benzoin*)].

This restored buffer will improve riparian habitat, provide streambank stability, shade the streams, and provide a source for LWD and organic material to the streams. Non-forested areas as well as areas with limited, existing tree densities within the conservation easement will be planted, as illustrated in the plans. Riparian buffers will be seeded and planted with native vegetation (a mixture of trees and shrubs). The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the Site, best professional judgement on species establishment and anticipated Site conditions in the early years following project implementation, and the requirement of a minimum of four species according to Rule 0295. Species chosen for the planting plan are listed on Sheet 4.0 of the plan sheets in Appendix 8. The draft plans also contain additional guidance on planting zones, site preparation, and site stabilization during construction. The planted riparian buffer area within the conservation easement will be approximately 20 acres.

The riparian buffer areas will be planted with bare root seedlings from top of bank to a minimum of 50 feet on either side of the stream. Planting zones within the riparian corridor have been delineated based on existing and proposed post construction conditions. The areas currently forested but at low densities and with limited understory species diversity due to livestock impacts will receive a supplemental planting.

In addition, stream banks of the larger restoration and enhancement channels (Perry Branch Reaches 2 – 4) will be planted with live stakes on channel banks above base flow elevation. Live stakes planted along channels with bankfull widths of less than 8 feet will be planted 1 to 2 feet beyond the top of bank. This includes Perry Branch Reach 1, UT1, UT2, and UT3. The channel toe of restoration and enhancement reaches will be planted with plugs of multiple herbaceous species. Permanent herbaceous seed will be spread on streambanks, floodplain areas, and all disturbed areas within the project easement.

Vegetation planting and replanting should be conducted between November 15 and March 15, unless otherwise noted in the approved Mitigation Plan or remedial action plan.

Wildlands will implement two approaches to manage fescue at the Site. Both approaches are designed to mitigate the adverse effects of fescue (i.e., direct competition and allelopathic impacts) on planted vegetation. The first approach consists of chemically treating select areas immediately adjacent to planted trees. A second treatment may be required at the beginning of year two based on fescue re-establishment and tree growth. The second approach entails a chemical application over a broader area that is designed to eradicate fescue in those areas not graded during construction. Following the chemical treatment, temporary and permanent vegetation will be established.

To help ensure tree growth and survival, soil amendments may be added to areas of the floodplain where overburden material is removed. Soil tests will be performed in areas of cut and fertilizer and lime will be applied based on the results. Additionally, topsoil will be stockpiled, reapplied, and disked before permanent seeding and planting activities take place.

Mature sweetgum (*Liquidambar styraciflua*) trees have been identified on the Site. While sweetgum has been identified as a nuisance species, it is in the project's best interest for the trees to remain. These mature trees provide appropriate shading, habitat, and slow stormwater runoff. Since sweetgums are a native, early successional species that provide many benefits, the vegetative performance success criteria will not be dependent on treating and removing, unless it is determined that volunteers are affecting the survival of planted species.

7.7.2 Land Management

Land management activities on the Site will largely focus on controlling invasive plant populations. Existing invasive plant populations on the Site include large areas of Chinese privet, Japanese honeysuckle (*Lonicera japonica*), and marsh dewflower (*Murdannia keisak*). Limited populations of multiflora rose and English ivy (*Hedera helix*) also exist on the Site. Major invasive plant populations will be treated prior to construction. This will include a fall/winter treatment of Chinese privet and Japanese honeysuckle and at least one treatment of marsh dewflower during the growing season of 2020. Wildlands will work to include other invasive plant populations in these pre-construction treatments as well. Invasive plant populations will continue to be monitored and treated as necessary during the monitoring period. Wildlands will also monitor the Site for future land management issues, such as floodplain erosion, bare areas, and damaged infrastructure, that arise during the monitoring period.

The Chinese privet populations existing on the Site, though well established, will likely be effectively controlled due to the specie's short seed viability period. Chinese privet seeds are only viable in the seed bank for up to twelve months (USDA, 2012) which reduces recruitment once the mature individuals on Site are effectively treated. Effective treatment for marsh dewflower will likely be more difficult. Thus, effective control of marsh dewflower will rely on intensive initial treatment of existing populations and frequent monitoring for new populations. The other major invasive plant present on the Site, Japanese honeysuckle, currently has low (< 5%) percent cover. However, it is widespread throughout the forested areas and can greatly increase in coverage if it is exposed to higher light conditions following construction. Post-construction monitoring and treatment for Japanese honeysuckle will focus on areas exposed to

higher levels of light. Wildlands will also monitor for additional invasive plants not currently found on the Site and treat as necessary. Additional monitoring and maintenance issues regarding vegetation can be found in Sections 9 and 10 and Appendix 9.

7.8 Project Risk and Uncertainties

This project is low risk. Due to the rural location of this project and the location of the stream in the watershed, there is very little risk that development or changes in land use (upstream and within the contributing watershed) would adversely impact the hydrology to this project. The (land)owner of this mitigation site has not communicated the intent to harvest timber adjacent to the easement or identified the intent of neighboring properties to harvest within the watershed. Thus, adjacent logging and land development are low risk.

Foreseeable problems that may arise on the site include easement encroachments, sediment plugs, and invasive species growth and establishment.

There are two easement breaks for landowner crossings (Section 5.7). Photo points are located at each crossing to not only assess the stability of the stream crossings, but to also document potential encroachment. The owner is aware of the easement restrictions and understands their responsibility to exclude livestock from the easement boundary.

Additional signage will be installed adjacent to the (downstream) overhead utility easement to discourage easement encroachments through utility line maintenance. If necessary, Wildlands will install horse tape between signs to indicate the easement boundary.

Large floods will occur at the site. Grade control structures and bank revetments are designed to dissipate energy and manage bank and bed shear stress. Sediment plugs are anticipated between less frequent events. The channel design will facilitate sediment transport and maintenance, specifically in conjunction with bankfull events.

Wildlands has not documented beaver activity at the site. If necessary, Wildlands will contract with the USDA Animal and Plant Health Inspection Service (APHIS) to manage invasive animal species. There are invasive species on site as noted in other sections of this report. Wildlands will conduct both pre-construction and post-construction chemical treatments to manage invasive species.

8.0 Performance Standards

The stream performance standards for the project will follow approved performance standards presented in the DMS Mitigation Plan Template (June 2017), the Annual Monitoring Template (June 2017), and the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. Annual monitoring and routine site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring period.

8.1 Streams

8.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per NCIRT guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored C channels and between 1.4 and 2.2 for B channels. All riffle cross-sections should fall within the parameters defined for channels of the designed stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced

habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

8.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

8.1.3 Substrate

Channel substrate materials will be sampled with the pebble count method along restoration and enhancement I reaches. These reaches should show maintenance of coarser materials in the riffle features and smaller particles in the pool features. A reach-wide pebble count will be performed in each restoration reach each monitoring year for classification purposes. A pebble count will be performed at each surveyed riffle cross-section, only during the as-built survey to characterize the pavement.

8.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent of mid-channel bars or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

8.1.5 Hydrology

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented on restoration and enhancement I streams during the seven-year monitoring period. The four bankfull events must occur in separate years. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented. In addition, the intermittent channels proposed for restoration or enhancement I activities (UT1 and UT2 Reach 2) will have a stream gage pressure transducer installed in the upper third of the reach to document at least 30 consecutive days of baseflow.

8.2 Vegetation

The success criteria for riparian buffers associated with the standard planting zones of the stream restoration component of the project is an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre at the end of monitoring year 5 (MY5) and a final vegetation survival rate of 210 stems per acre at the end of monitoring year 7 (MY7). Additionally, planted canopy species within the standard planting zones must average 7 feet in height in each plot at the end of MY5 and 10 feet in height in MY7. Subcanopy species within the standard planting zones at the Site will be excluded from the height requirements. Vegetation monitoring will be conducted between July 1st and the end of the of the growing season. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. In fixed vegetation plots planted woody stems will be marked annually as needed and given a coordinate, based off a known origin, so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current years living planted stems.

A separate buffer monitoring report will be submitted to NCDWR as discussed in Appendix 1.

The extent of invasive species coverage will be monitored and controlled as necessary throughout the required monitoring period.

8.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above. Visual assessment monitoring metrics can be found in Table 21 below.

9.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met and project goals and objectives are achieved. Annual monitoring data will be reported using the DMS Annual Monitoring Reporting Template (June 2017). The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes and assist in close-out decision making.

Using the DMS As-Built Baseline Monitoring Report Template (June 2017), a baseline monitoring document and as-built record drawings of the project will be developed within 60 days of the planting completion and monitoring installation on the restored Site. Red-line drawings (as-builts) will be included as part of the baseline monitoring report to identify construction deviations from the final mitigation plan design sheets. Monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS by November 30. These reports will be based on the DMS Annual Monitoring Template (June 2017) and Closeout Report Template (January 2016). Full monitoring reports will be submitted to DMS in monitoring years 1, 2, 3, 5, and 7. Abbreviated monitoring reports will be submitted in monitoring years 4 and 6. Closeout monitoring period will be seven years beyond completion of construction or until performance standards have been met.

A separate buffer monitoring report will be submitted annually to DMS as described in Appendix 1.

Table 21, below, describes how the monitoring plan is set up in order to verify project goals and objectives have been achieved.

Table 21: Monitoring Plan

Goal	Objective	Performance Standard	Monitoring Metric
Exclude livestock from project streams and adjacent riparian areas.	Exclude livestock from streams and riparian areas by installing fencing around project area and/or removing livestock from the Site.	Exclusion fencing will be installed and maintained if livestock are present. Livestock should not be within the conservation easement area.	Visual inspections of fencing and signs of livestock encroachment.
Improve the stability of stream channels.	Construct and enhance stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.	Bank height ratios remain 1.2 or less. Visual assessments showing stability.	Cross-section monitoring and visual inspections.
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	There is no required performance standard for this metric.	Visual assessments and pebble counts.

Goal	Objective	Performance Standard	Monitoring Metric
Reconnect channels with floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Four bankfull events in separate years within monitoring period. 30-days of continuous surface water flow will be documented annually along intermittent reaches in which restoration or enhancement I activities are proposed.	Crest gages and/or pressure transducers recording flow elevations. Pressure transducers to document at least 30-days of consecutive flow.
Restore and enhance native floodplain vegetation.	Convert active livestock pasture to forested riparian buffers along all Site streams. Protect and enhance existing forested riparian buffers. Treat invasive species during monitoring period to permit establishment of native plantings.	Standard planting zone areas will have survival rates of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7. The vegetation plots will average 7-ft in height in MY5 and 10-ft in height at MY7.	One hundred square meter vegetation plots will be placed on 2% of the standard planted area of the project and monitored annually.
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.

9.1 Monitoring Components

Project monitoring components are listed in more detail in Table 22. Approximate locations of the proposed monitoring components are illustrated in Figure 9.

Table 22: Monitoring Components

Parameter	Monitoring Feature	Quantity/ Length by Restoration Reach					Frequency	Notes
		Perry Branch Reach 1	Perry Branch Reach 3	Perry Branch Reach 4	UT1 Reach 1	UT1 Reach 2		
Dimension	Riffle Cross-Sections	1	1	2	1	1	Year 1, 2, 3, 5, and 7	1
	Pool Cross-Sections	0	1	2	0	0		
Pattern	Pattern	N/A					N/A	2
Profile	Longitudinal Profile	N/A					N/A	
Substrate	Reach Wide Pebble Count	1	1	1	1	1	Year 1, 2, 3, 5, and 7	3
Hydrology	Stream Gage (SG) / Flow Gage (FG)	1 SG	1 SG		1 SG/FG		Semi-Annual	4
Vegetation	CVS Level 2 Vegetation Plots	10 Fixed, 2 Random					Year 1, 2, 3, 5, and 7	5
Visual Assessment		Y					Semi-Annual	
Exotic and Nuisance Vegetation							Semi-Annual	6
Project Boundary							Semi-Annual	7
Reference Photos	Photographs	12					Annual	

Parameter	Monitoring Feature	Quantity/ Length by Enhancement Reach				Frequency	Notes
		Perry Branch Reach 2	UT2 Reach 1	UT2 Reach 2	UT3		
Dimension	Riffle Cross-Sections	N/A	N/A	1	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-Sections	N/A	N/A	1	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach Wide Pebble Count	N/A	N/A	1	N/A	Year 1, 2, 3, 5, and 7	3
Hydrology	Stream Gage (SG) / Flow Gage (FG)	N/A	N/A	1 SG, 1FG	N/A	Semi-Annual	4
Vegetation	CVS Level 2 Vegetation Plots	2 Fixed				Year 1, 2, 3, 5, and 7	5
Visual Assessment		Y				Semi-Annual	
Exotic and Nuisance Vegetation						Semi-Annual	6
Project Boundary						Semi-Annual	7
Reference Photos	Photographs	7				Annual	

1. Cross-sections will be permanently marked with rebar to establish location. Surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate lack of stability and profile survey is warranted in additional years.
3. Reach wide pebble counts will be conducted each year a monitoring report is submitted. Riffle cross-section pebble counts will be conducted during as-built baseline monitoring only, unless observations indicate otherwise.
4. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every 3 hours. The transducer will be inspected and downloaded semi-annually.
5. Vegetation monitoring will follow CVS protocols, separate monitoring reports will be submitted to DMS.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

10.0 Long-Term Management Plan

The Site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program (or 3rd party if approved). This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the Site to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

The Site Protection Instrument can be found in Appendix 2.

11.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 9 and 10. Project maintenance will be performed during the monitoring years to address issues if necessary (Appendix 9). If, during the course of annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify DMS of the need to develop a Plan of Corrective Action. Once the Plan of Corrective Action is prepared and finalized Wildlands will:

- Notify the USACE as required by the Nationwide 27 permit general conditions;
- Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE;
- Obtain other permits as necessary;
- Implement the Corrective Action Plan;
- Notify DWR of any repairs that may result in a change from the approved Plans, in accordance with DWR General Water Quality Certification 4134; and
- Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

12.0 Determination of Credits

The final credits associated with the Site are listed in Table 23. Stream mitigation crediting is based on consultation with the IRT as summarized in meeting minutes dated February 2019. The Site contains two internal easement crossings and the stream within the crossings is excluded from the restored footage and proposed warm stream credits in the table below. Restoration activities were generally assigned a

ratio of 1:1. Perry Branch R2 is classified as enhancement II, but the activities along this forested reach are predominantly related to livestock exclusion. As such, this reach was assigned a ratio of 3.5:1. UT1 is a restoration reach, but this reach was assigned a ratio of 1.5:1 based on consultation with the IRT during the February 2019 site visit. UT2 consists of enhancement I and II activities. This reach was assigned a ratio of 2.5:1 along the entirety of the reach due to the limited extent of activities along this forested reach.

The credit ratios and mitigation areas for buffer credits were approved by NCDWR in a letter dated April 2019. This project will serve as the beneficiary of a wider buffer (average buffer width in excess of 100-feet) and a proposed buffer mitigation bank. Approximately 97% of the total stream length or 5,226-linear feet will have a buffer width of 50-feet or more. The last 57 liner feet at the downstream extent of Perry Branch maintains a buffer width less than 15-feet due to an external (overhead utility) easement. This segment of channel will be restored but is excluded from the restored footage and proposed warm stream credits in the table below. The credit release schedule is enclosed in Appendix 10.

Table 23: Stream Asset Table

Mitigation Credits								
	Stream		Riparian Wetland		Non-Riparian Wetland		Riparian Buffer[2]	
Type	R	RE	R	RE	R	RE	R	RE
Totals	4,042.400	N/A	N/A	N/A	N/A	N/A	878,894.828	N/A
Project Components								
Project Component or Reach ID	**Existing Footage/ Acreage**	**Proposed Stationing Location**	**Restoration Level**	**Approach**	**Restoration Footage/ Acreage for Credit**	**Mitigation Ratio**	**Proposed Credit[1]**	
Perry Branch Reach 1	326	100+00 - 103+21	R	P1	321	1.0	321.000	
Perry Branch Reach 2	417	103+21 - 106+85	EII	N/A	364	3.5	104.000	
Internal Crossing		106+85 – 107+45	Internal Crossing					
Perry Branch Reach 3	732	107+45 - 114+36	R	P1	691	1.0	691.000	
Perry Branch Reach 4	2,061	114+36 – 120+90	R	P1	654	1.0	654.000	
Internal Crossing		120+90 – 121+50	Internal Crossing					
Perry Branch Reach 4	-	121+50 – 134+34	R	P1/P2	1,284	1.0	1,284.000	
UT1 Reach 1	388	200+00 - 202+85	R	P1/P2	285	1.5	190.000	
UT1 Reach 2	213	202+85 - 205+76	R	P1	291	1.5	194.000	
UT2 Reach 1	226	300+00 - 302+21	EII	N/A	221	2.5	88.400	
UT2 Reach 2	974	302+21- 311+68	EI	N/A	947	2.5	378.800	
UT3	357	400+19 - 403+62	EII	N/A	343	2.5	137.200	

Component Summation (for Credits)				
Restoration Level	**Proposed Stream (lf)**	**Riparian Wetland (ac)**	**Non-Riparian Wetland (ac)**	**Buffer (sq.ft.)**
Restoration	3,526	N/A	N/A	1,079,355
Enhancement I	947	N/A	N/A	
Enhancement II	928	N/A	N/A	

1. Mitigation credits are the total amount of credit based on reach lengths (excluding 60-ft wide internal crossings and segments in which the buffer is less than 15ft) divided by the mitigation ratio.
2. Buffer credits are described in Appendix 1: Buffer Mitigation Plan.

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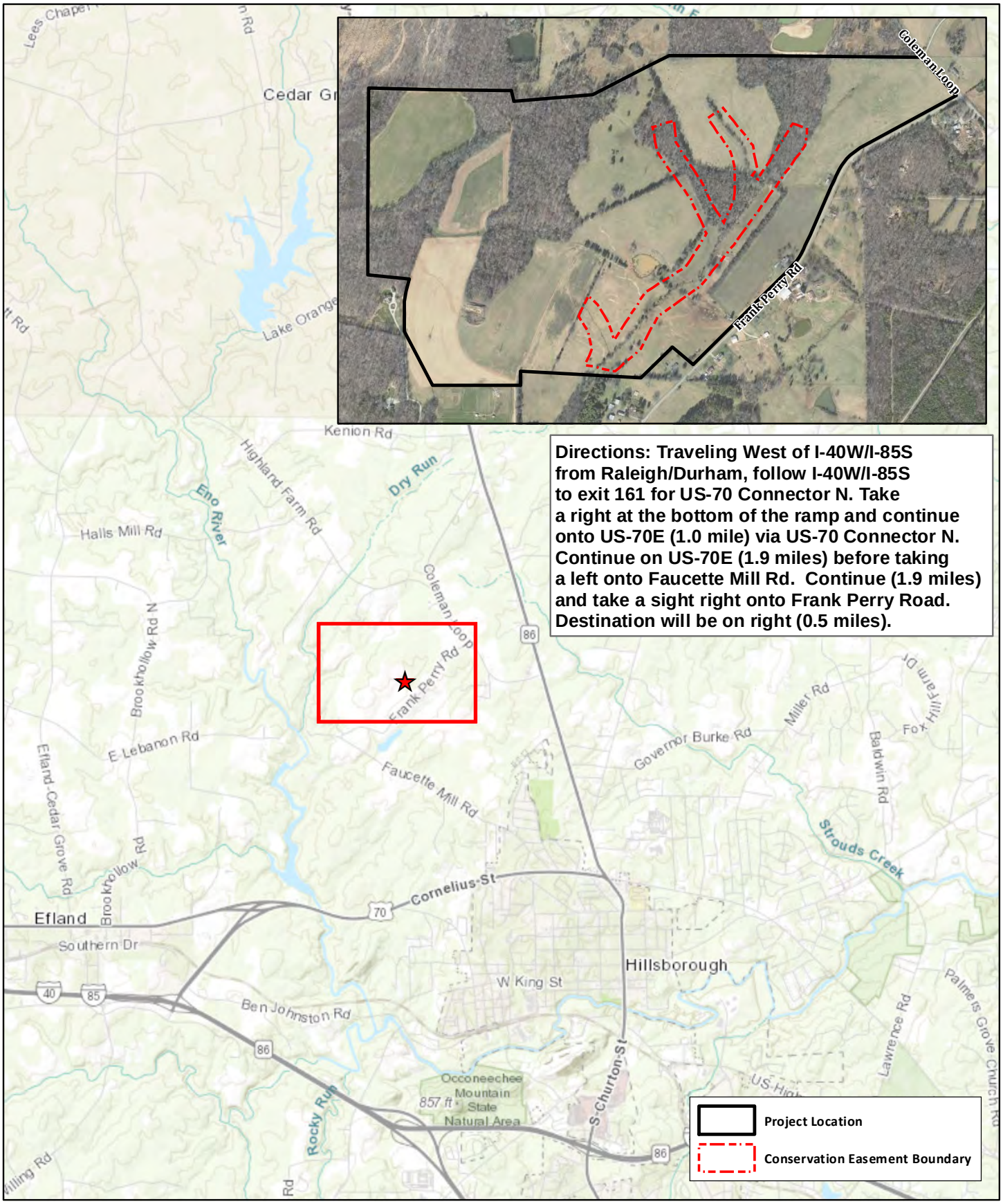

WILDLANDS ENGINEERING

0 0.5 1 2 Miles

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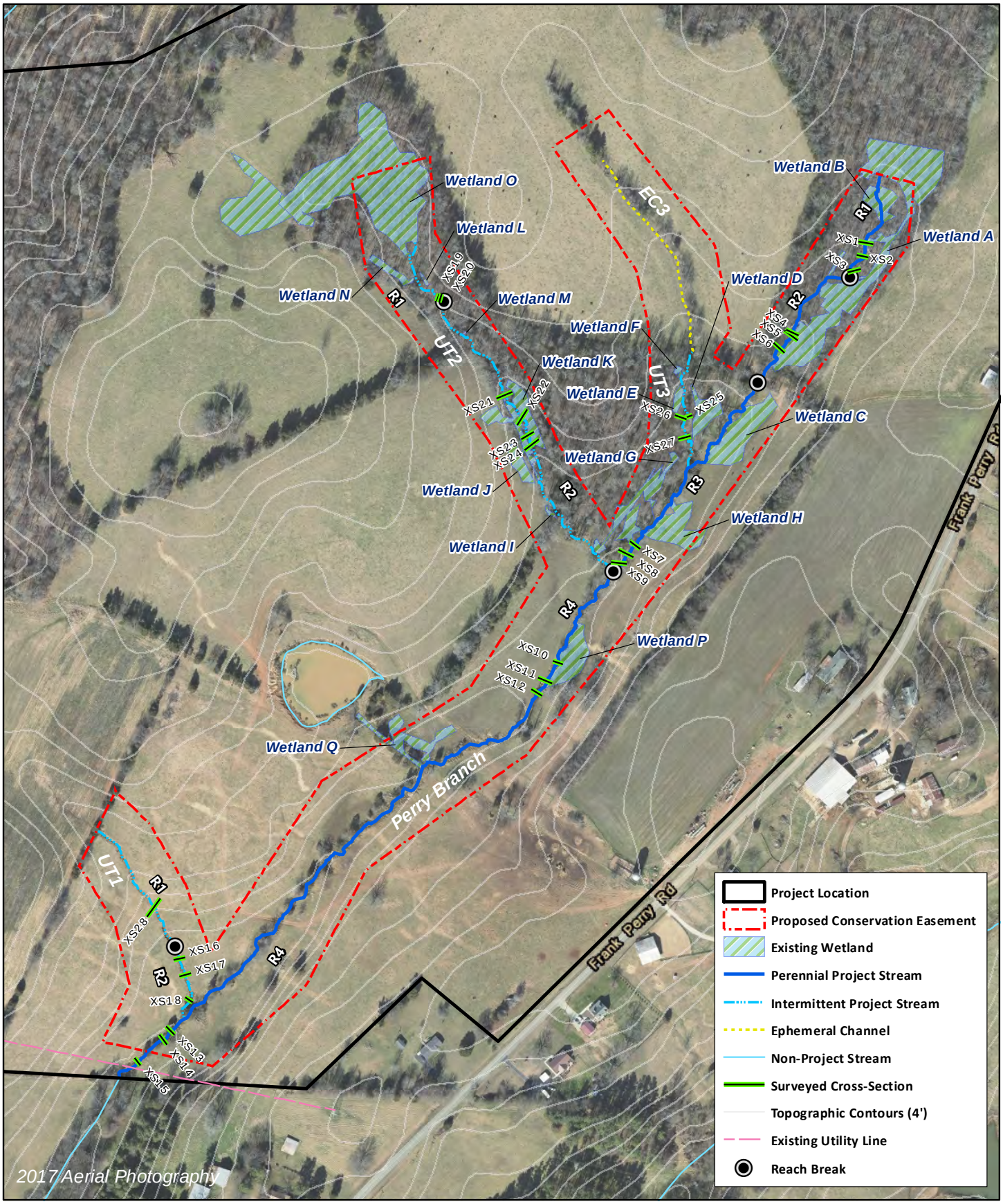
Figure 1 Vicinity Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 175 350 700 Feet

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Figure 2 Site Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

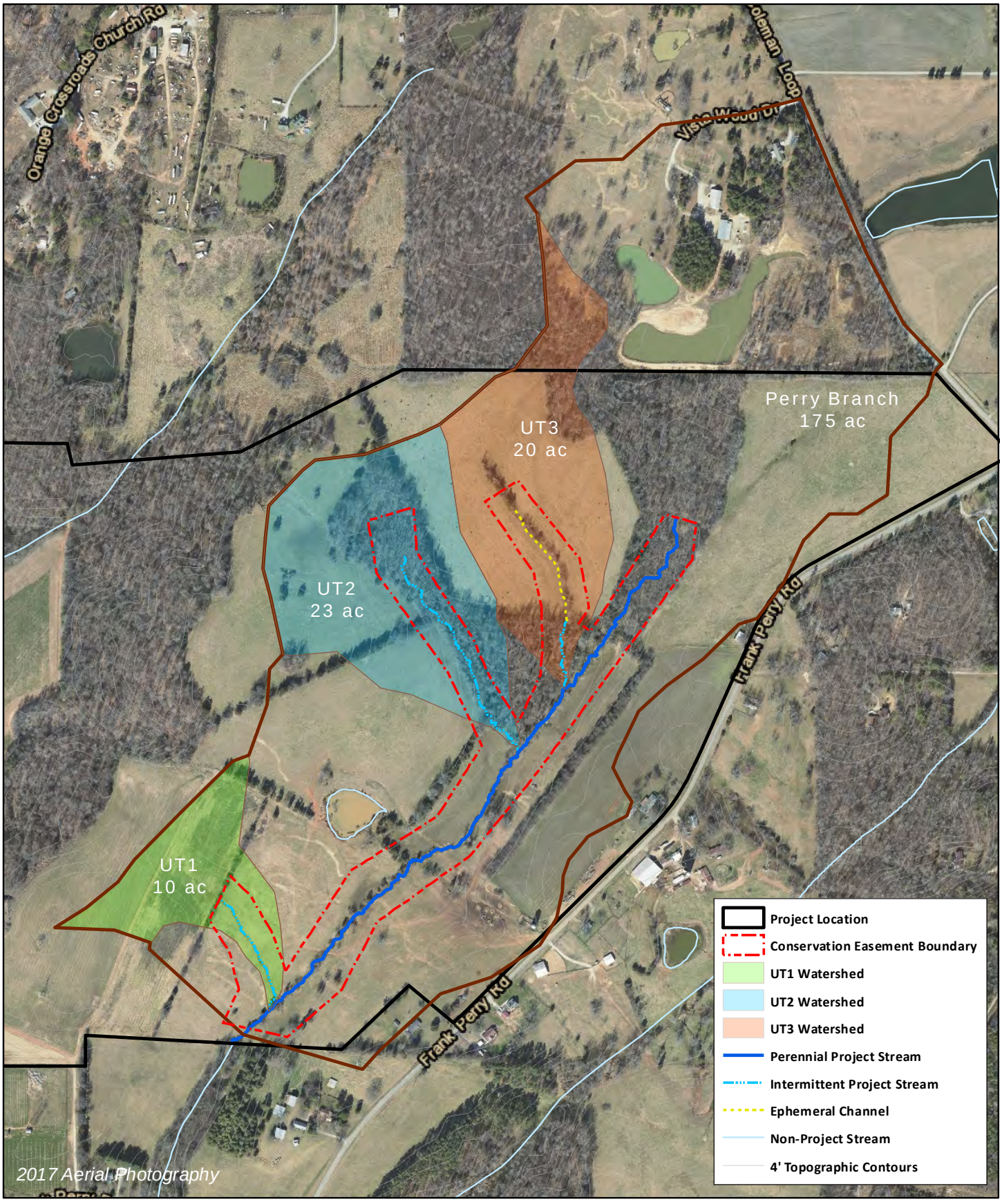

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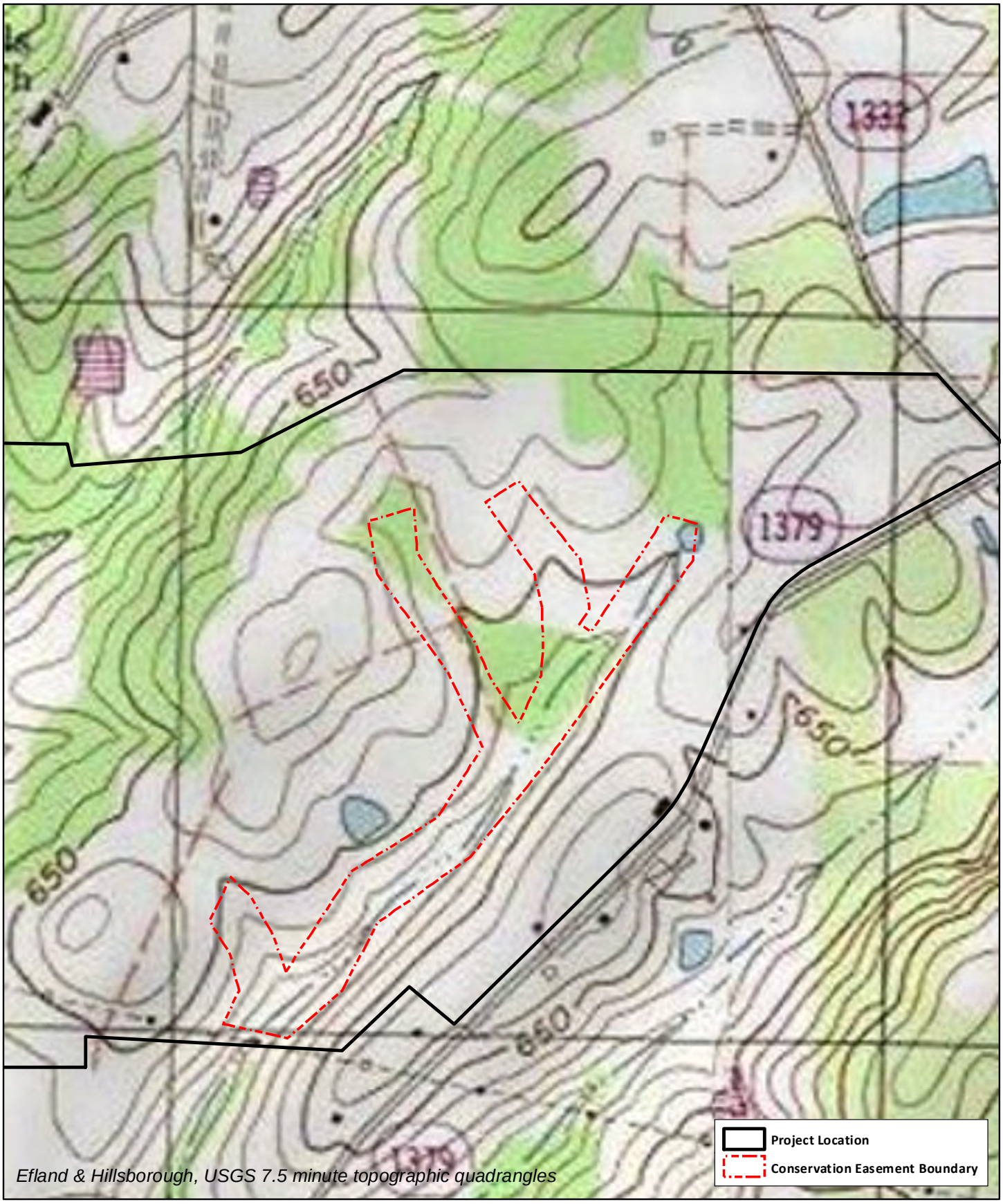
Figure 3 Watershed Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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Figure 4 USGS Topographic Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

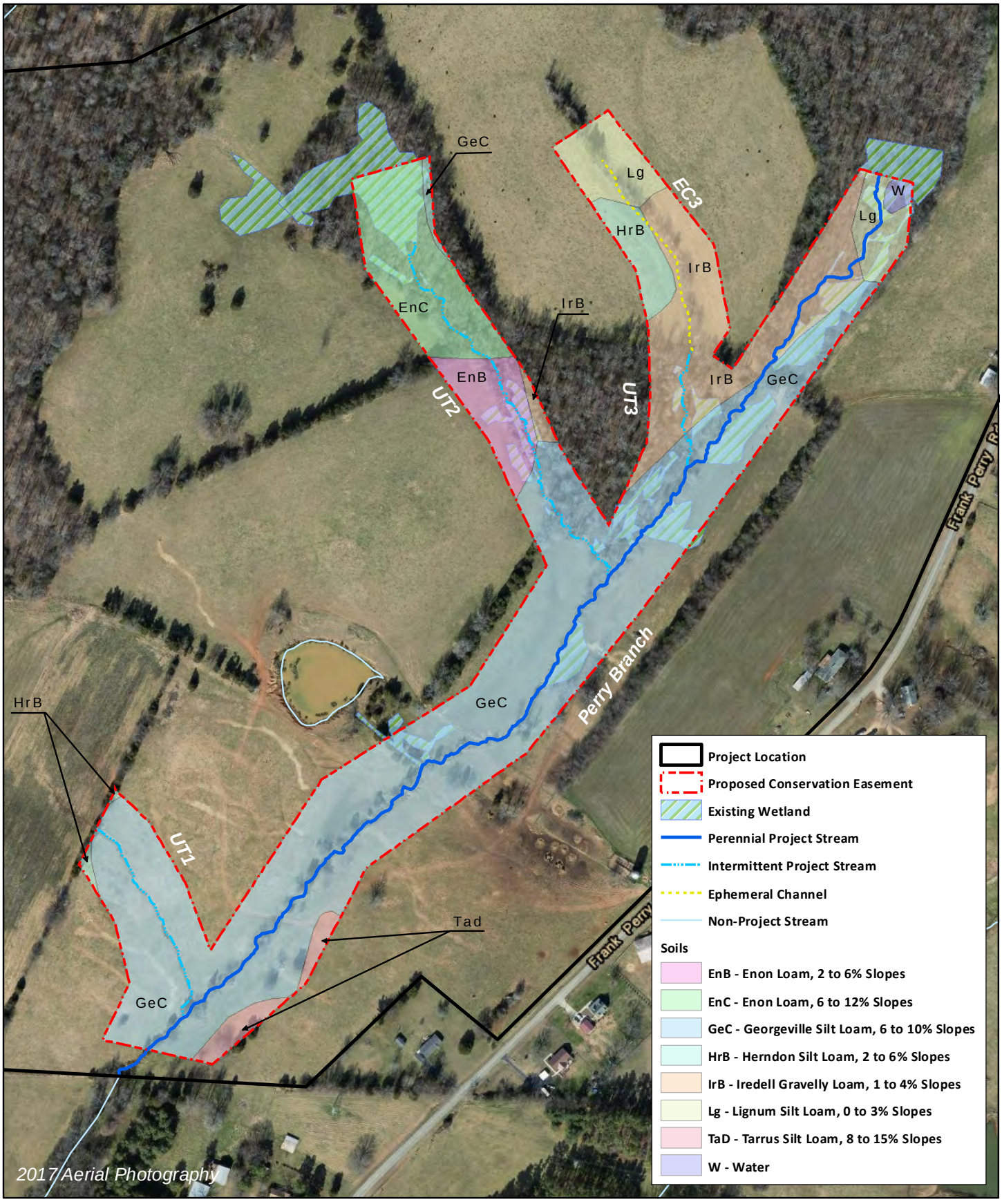

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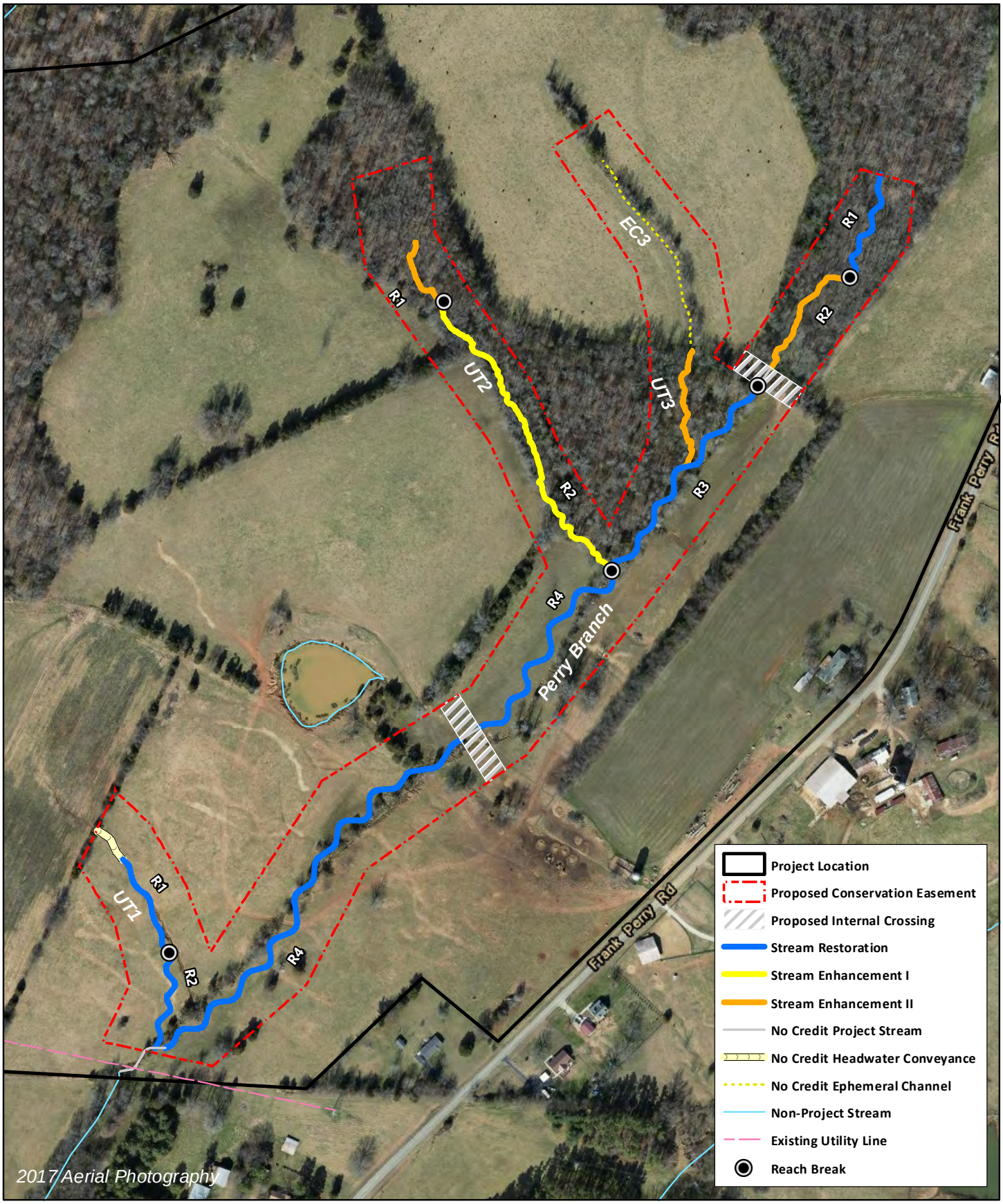
Figure 5 Soils Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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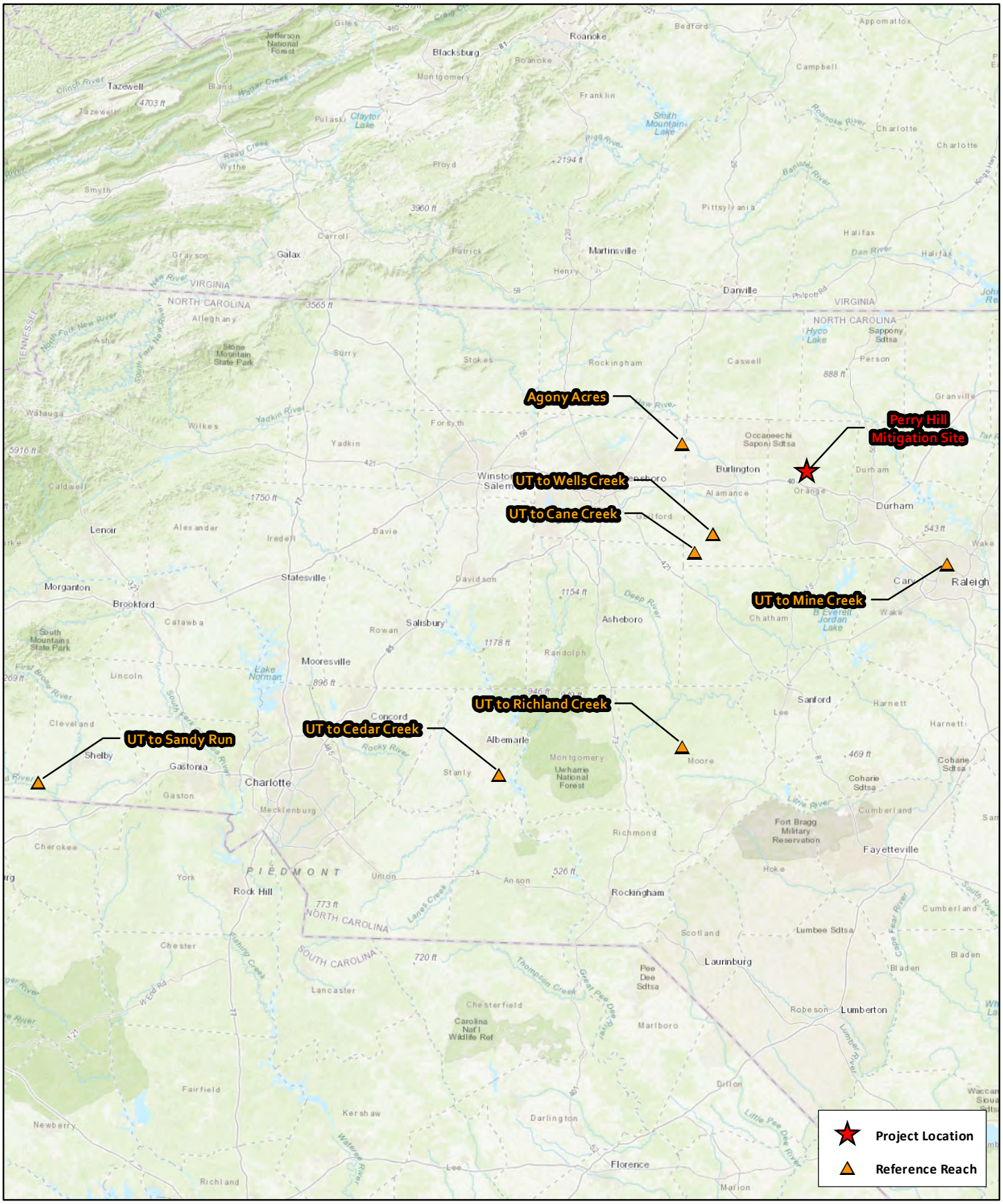
Figure 6 Concept Design Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

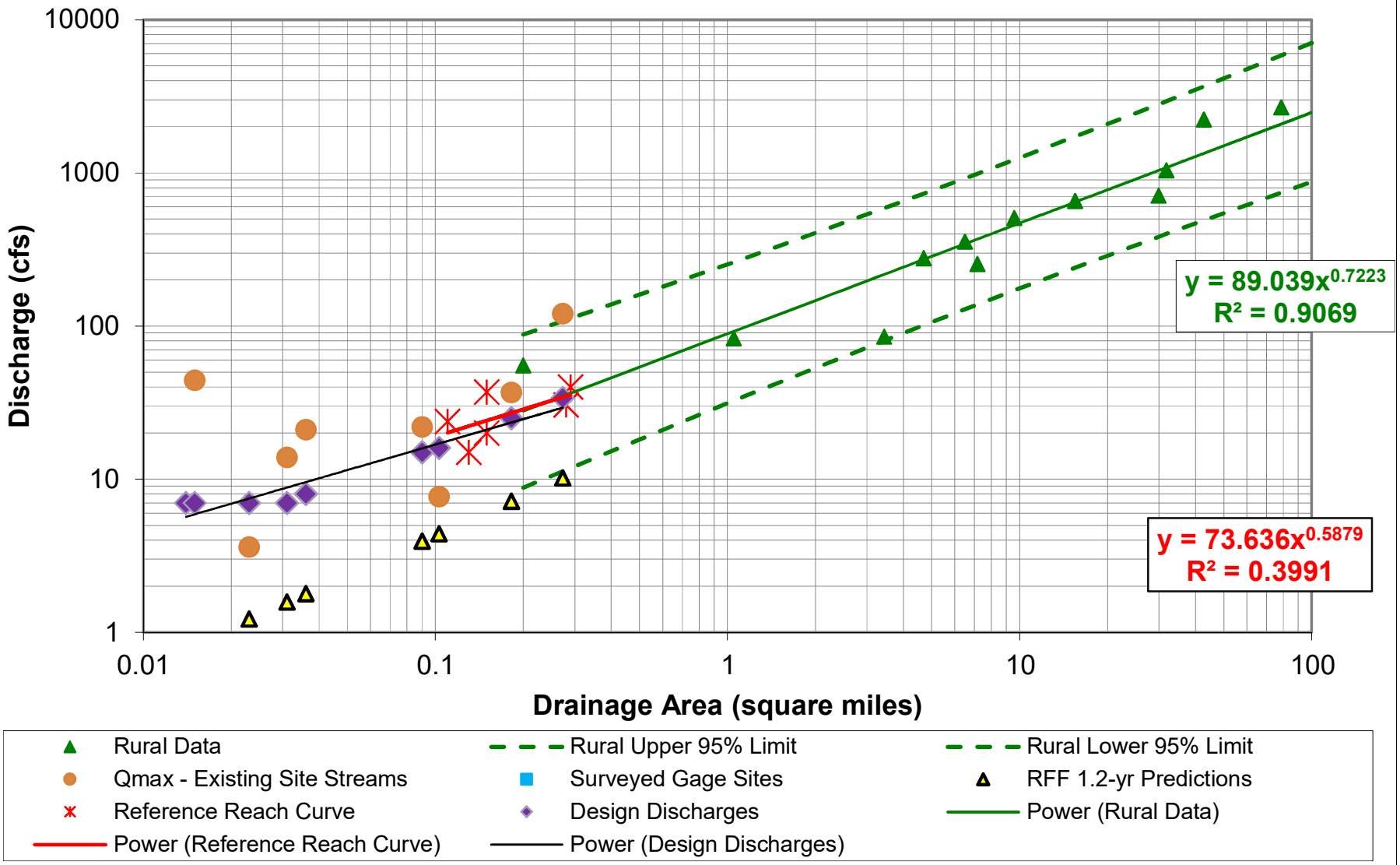


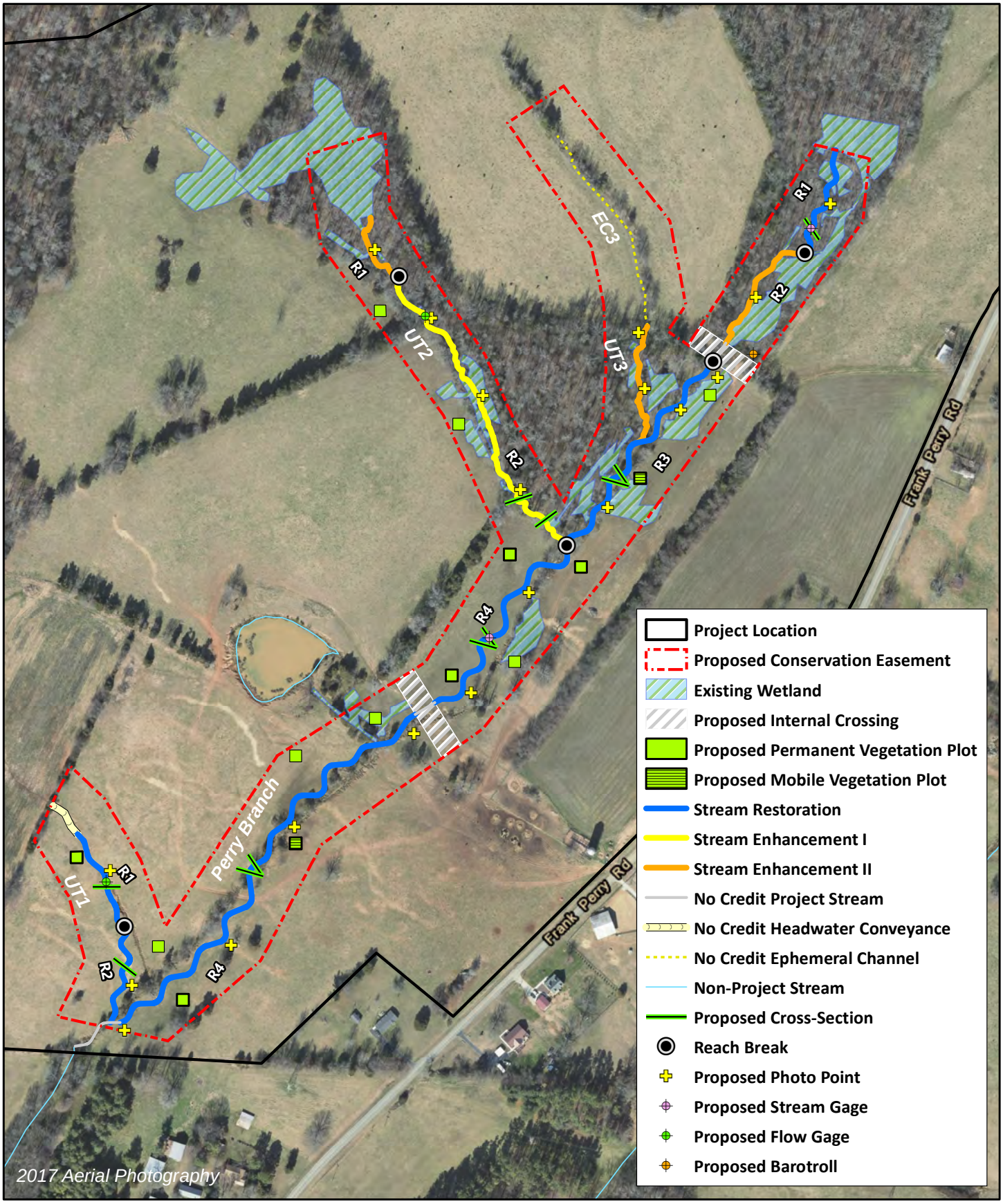
WILDLANDS ENGINEERING

Figure 7 Reference Reach Vicinity Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

Figure 8: Discharge Analysis Curves





WILDLANDS ENGINEERING

0 175 350 700 Feet

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Figure 9 Monitoring Components Map
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

Appendix 1

RIPARIAN BUFFER MITIGATION PLAN

Final

July 2020

PERRY HILL MITIGATION SITE

Orange County, NC
NCDEQ Contract No. 7744
DMS ID No. 100093

Neuse River Basin
HUC 03020201

USACE Action ID No. SAW-2019-00125
DWR Project No. 2019-0157
RFP #: 16-007576

PREPARED FOR:

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Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

PREPARED BY:

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Mount Pleasant, SC 29464
Phone: (843) 277-6221

August 5, 2020

Mr. Jeremiah Dow
Project Manager
NCDEQ- Division of Mitigation Services
217 West Jones Street, Suite 3000A
Raleigh, NC 27603

Subject: Comment-Response Letter
Perry Hill Mitigation Site – North Carolina Interagency Review Team Comments during 30-day Mitigation Plan Review
Neuse River Basin – CU# 03020201
Orange County, NC
Contract No. 7744

Dear Mr. Dow:

On July 27,2020, Wildlands Engineering received comments from DWR related to the Perry Hill Riparian Buffer Mitigation Plan dated April 2020. The report establishes the proposed buffer mitigation activities at the project site. The following letter documents DWR's feedback and Wildlands' corresponding responses and revisions to the plan. Following your acceptance of these responses and revisions, we will proceed with Task 2 (Conservation Easement Recordation).

DWR Comments, Katie Merritt:

1. **Title Page – Cited Regulations**: Replace 0233 with .0714. Effective Date is June 15, 2020. Also replace .0240 with .0703 and rename the rule to "Nutrient Offset Credit Trading" with effective date is April 1, 2020.
   Response: Wildlands revised the title page per the comment above.

2. **Section 1.0** – In reviewing the stream mitigation plan as well as this plan, it was unclear whether DMS is seeking wider buffers for both stream & buffer credit. Please state whether or not buffers restored beyond 50' are being used towards stream credit.
   Response: The buffer adjacent to the stream and within 50-ft of the proposed top of bank will be restored. However, Wildlands is not proposing buffer restoration for stream credit generation.

3. **Table 1** – Clarify that fencing will at least be installed around all areas where buffer enhancement credit is requested, since this is a requirement in 0295 (o)(6).
   Response: The 'entire' project area will be fenced. Wildlands clarified in the objective language and the bullet list in Section 2.2 that the entire area will be fenced.

4. **Section 2.1 & Appendix 1a –** Site photos are dated May 2019 and do not depict existing conditions as of the time the Mit Plan was submitted. Provide more recent photos of the riparian area conditions and describe any changes to the proposed mitigation areas from what was observed during the 2019 site visit.
   Response: Wildlands revised Section 2.1 and revised the photolog. Landuse activities within the proposed mitigation area have remained consistent since the initial agency site visit.

5. **Table 2 –** Add that the site is located in the Upper Falls Watershed.
   Response: Wildlands revised Table 2.

6. **Section 2.2, 1st paragraph** – Correct rule reference here to be .0295 (o).
   Response: Wildlands revised Section 2.2 to reference the appropriate rule.

7. **Section 2.2, Buffer Restoration on Ephemeral Channels 15A NCAC 02B .0295 (o)(7) –** Explain how you determined Bullet #2 and include a reference (maybe table 5?). Explain how you concluded bullet #3. For Bullet #4 correct the rule reference here by excluding subchapter "o."
   Response: Wildlands revised Section 2.2 and referenced Table 7a and Figure 3. Wildlands revised the reference in the fourth bullet.

8. **Section 2.2, Enhancement via Cattle Exclusion 15A NCAC 02B .0295 (o)(6) –** Explain how bullet #1 (livestock exclusion) is achieved. Bullet #2, what is the "enhancement plan?" Is there a particular section/s where the plan is described? Explain how Bullet #3 was determined. I recommend referencing Section 2.8 and the Appendix where you have the site viability letter.
   Response: Wildlands will exclude livestock via the construction of a perimeter fence that will be located 2-ft outside the proposed (and illustrated) easement boundary. Wildlands enclosed the DWR site viability letter in Appendix 1b.

9. **Section 2.8** – Please replace "Katie Merritt" with "DWR."
   Response: Wildlands revised the mitigation plan to remove the reference to Katie Merritt.

10. **Section 5.0** – Add a reference to Figure 10 and explain in the text that nutrient offset credits can service only the Falls Lake Watershed while buffer credits can serve Neuse 03020201, including the Falls Lake Watershed.
    Response: Wildlands revised Section 5.0 to reflect the service area limitations.

11. **Table 7a** – I may have many comments to make on this table. I have to delay providing these comments until I receive clarification from other DWR staff. I will provide those comments separately to DMS as soon as I'm able.
    Response: Wildlands revised Table 7a.

12. **Section 6.0, 1st paragraph** – Reference the Plan sheets that show the stream mitigation activities.
    Response: Wildlands revised Section 6.0 and referenced the plan sheets (illustrating the stream mitigation activities) that are enclosed with the Mitigation Plan in Appendix 8.

13. **Section 6.1 –** Parcel preparation is more intense on stream mitigation sites, but this section is very vague. Add a reference to the Stream Plan where details can be found regarding grading, mowing, ripping, etc., or please provide more details here regarding site prep work, especially soil preparations.
    Response: Wildlands revised Section 6.1 to include more information related to parcel preparation.

Please indicate that no top soil will be removed from the riparian areas slated for riparian restoration. The source of fill material for stream mitigation activities should come from another part of the site where buffer credits are not being sought. With the riparian areas mostly in compact pasture soils and dense in fescue vegetation, both mowing and ripping should be proposed for this site.
Response: Wildlands revised Section 6.1.

The Site Viability letter calls out a drainage conveyance B below the ag pond. How will diffuse flow by this conveyance be addressed.
Response: Wildlands added a floodplain sill downstream of drainage conveyance B to act as a level spreader and to diffuse flow to the restored stream channel. This will allow for dispersed overland flow through the restored buffer and into the stable riffle section of Perry Branch.

In the 3rd sentence, please describe "chemical" treatment.
Response: Wildlands will use a select targeted chemical (i.e., glyphosate 2.5%) to treat undesirable growth and invasive species.

14. **Section 6.2** – Even though it isn't spelled out here, I appreciate the use of pollinator species in your seed mixes. Please call this out in the text within this section.
Response: Wildlands revised Section 6.2 to state that pollinator species were included in the permanent seed mix.

Reference the applicable Plan Sheets where the planting plan is provided in more detail.
Response: Wildlands revised Section 6.2 to reference Section 4 (Planting Plan) of the plan sheets that are enclosed with the Mitigation Plan, Appendix 8.

Remove tag alder and Red Maple from the Planting Plan. These trees are proposed to be planted within areas receiving buffer credit, and DWR does not support including these in this planting plan.
Response: Wildlands removed this species from the planting plan.

A plan to address how fescue will be treated before initial planting efforts should be included in this section.
Response: Wildlands revised Section 6.2 to include language that details fescue management activities.

Last paragraph of Section 6.2 references vegetation management. What type of management is anticipated? please explain this in detail
Response: Wildlands revised Section 6.2 to reference specific vegetation measures. Wildlands will develop and implement adaptive measures in the event that other invasive species compete with targeted vegetative communities.

15. **Section 6.3** – The Plan sheets showing the fence boundaries should be referenced in this section. Also, add a note that the Bank is "being proposed to DWR" since it hasn't yet been reviewed or approved.
Response: Wildlands revised Section 6.3 to reference Section 5 of the plan sheets which illustrate the fencing plan.

16. **Section 7**.1 – Address how fescue will be controlled during the monitoring period.
    Response: Wildlands revised Section 7.1. Wildlands intends to treat and control fescue via chemical and mechanical activities prior to and during construction. Wildlands will monitor fescue re-establishment and potential adverse impacts to planted vegetation communities during the monitoring period. Wildlands will implement chemical treatments in the event that fescue prevents the establishment of the targeted vegetation communities.

17. **Section 8.2** – Add height to the parameters that will be evaluated annually. DWR expects the heights to be included in the reports.
    Response: Wildlands revised Section 8.2 and Section 7.1 to include height as a parameter.

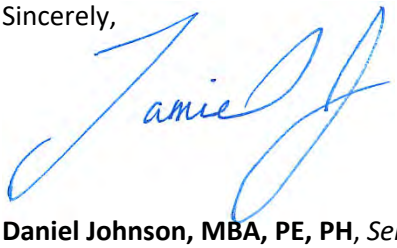
18. **Figure 2** – Call out start of ephemeral streams as "DWR Ephemeral Point." Call out intermittent stream start location "DWR Intermittent Point." Label Drainage Conveyance B. Call out start of intermittent stream on UT1 as "DWR E/I Point."
    Response: Wildlands revised Figure 2.

19. **Figure 6** – Show the proposed easement boundary for the Perry Hill Mitigation Bank.
    Response: Wildlands revised Figure 6 to illustrate the bank boundary.

20. **Appendix -** No DWR Stream determination letter was included. Please add to Appendix and reference in Section 2.8 or in other more appropriate sections.
    Response: Wildlands enclosed the determination letter in Appendix 1b and included a reference in Section 2.8.

Thank you for your review and comment on this submittal. If you have any further questions, please contact me at 843.277.6221 or djohnson@wildlandseng.com.

Sincerely,



Daniel Johnson, MBA, PE, PH, *Senior Water Resources Engineer*

This Mitigation Plan has been written in conformance with the requirements of the following:

- 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers.
- 15A NCAC 02B .0714 Neuse River Basin Buffer Rule, effective June 15, 2020.
- 15A NCAC 02B .0703, Nutrient Offset Credit Trading, effective April 1, 2020.
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

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

Contributing Staff:

John Hutton, *Principal in Charge*
Daniel Johnson, MBA, PE, PH, *Project Manager*
Daniel Johnson, MBA, PE, PH, Plan Development/*Quality Check*
Carolyn Lanza, *Monitoring Lead*
Andrea Eckardt*, Quality Assurance*

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APPENDICES

1.0 Introduction

The Perry Hill Mitigation Site (Site) is a riparian buffer and stream mitigation project located in the rural countryside of Orange County, approximately three miles northwest of Hillsborough, NC (Figure 1). The Site encompasses approximately 26.877 acres of Perry Branch, three additional unnamed tributaries, and two ephemeral channels. Currently, the Site is characterized by a mix of active pastures, fields, and woodlands. The project will restore or enhance via livestock exclusion the riparian area within the project area, which will provide 878,894.828 buffer credits or 24.896 acres of buffer mitigation.

The Site is located within the Hydrologic Unit Code (HUC) 03020201030020 and North Carolina Department of Water Resources (NCDWR) Sub-basin 03-04-01. Perry Branch and the three unnamed tributaries on the Site flow directly to Corporation Lake, a water supply reservoir on the Eno River. The Eno River is classified as water supply waters (WS-II) and nutrient sensitive waters (NSW). The Eno river subsequently flows to Falls Lake, which is also classified as water supply waters (WS-IV) and nutrient sensitive waters (NSW). All water supply waters are considered high quality waters (HQW) by supplemental classification. In addition, all waters in the Neuse River Basin are classified as NSW which is a supplemental classification intended for waters needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation.

The 2009 Neuse River Basinwide Water Quality Plan lists major stressors in Subbasin 03-04-01 to be total suspended solids (TSS), nutrients, and chlorophyll α (NCDENR, 2009). The 2010 Neuse River Basin Restoration Priorities (RBRP) highlights the importance of riparian buffers for stream restoration projects (NCEEP, 2010). Riparian buffers retain and remove nutrients and suspended sediments. Of the 123 miles of streams in the Middle Eno River watershed (03020201030030), 23% do not have adequate riparian buffers. The RBRP states that "priority [restoration] projects should increase or improve buffers." The RBRP also states that a goal for the Neuse 01 is to, "…promote nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers." Another goal for the Neuse 01 is to support the Falls Lake Watershed Management Plan.

This riparian buffer mitigation project will reduce sediment and nutrient loading, improve terrestrial and in stream habitats, and improve stream and bank stability. The area surrounding the streams proposed for mitigation is a mixture of active pasture, fields, and woodlands. By removing livestock access to onsite tributaries and restoring and enhancing a forested riparian area; the project will reduce nutrient and sediment inputs to project streams, and ultimately to Falls Lake. The restored floodplain areas will filter sediment during rainfall events. The establishment of riparian areas will create shading to minimize thermal pollution. Finally, invasive vegetation will be treated within the project area as needed and the proposed native vegetation will provide cover and food for wildlife.

2.0 Mitigation Project Summary

The major goals of this proposed riparian buffer mitigation project are to provide ecological and water quality enhancements to the Falls Lake watershed of the Neuse River Basin by creating a functional riparian corridor and restoring the riparian area. Specific riparian area enhancements to water quality and ecological processes are outlined below in Table 1.

Table 1: Ecological and Water Quality Goals

Goal	Objective	CU-Wide and RBRP Objectives Supported
Exclude livestock from project streams and adjacent riparian areas.	Exclude livestock from streams and riparian areas by installing fencing around the entire project area and/or removing livestock from the Site.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Restore and enhance native floodplain vegetation.	Convert active livestock pasture to forested riparian areas along all Site streams. Protect and enhance existing forested riparian areas. Treat invasive species during monitoring period to permit establishment of native plantings.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Provide a canopy to shade streams and reduce thermal loadings; Contribute to protection of or improvement to a Water Supply Waterbody.
Permanently protect the project Site from harmful uses.	Establish a conservation easement on the Site.	Ensure that development and agricultural uses that would damage the Site or reduce the benefits of the project are prevented.

2.1 Existing Site Conditions

This proposed riparian buffer mitigation project will place 26.877 acres of agricultural fields and woodlands along Perry Branch and three unnamed tributaries that drain into the Falls Lake watershed, part of the Neuse River Basin, under a conservation easement. Out of the 26.877 acres, 24.896 are proposed for a combination of riparian area restoration or enhancement via livestock exclusion.

In general, this area has maintained its rural, farming character over the last 81 years with only minor changes in land cover. This consistency in land use within the project watershed indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied widely over this time period. With a lack of developmental pressure, watershed processes and stressors from outside the project limits are likely to remain consistent throughout the implementation, monitoring, and closeout of this project. Additionally, landuse within the proposed mitigation areas at the Site have remained consistent since the project proposal was submitted. Photos of existing riparian areas onsite are included in Appendix 1a.

The Site contains one perennial stream Perry Branch (Reach 1,2,3, and 4); three intermittent streams UT1 (Reach 1 and 2); UT2 (Reach 1 and 2); and UT3; and two ephemeral channels EC1 and EC3. Perry Branch is a headwater system that originates onsite. At the upstream extent, this reach is buffered by riparian wetlands and forest but livestock currently have access to the stream, further impairing existing conditions via bank trampling and hoof shear. Downstream reaches of Perry Breanch exhibit floodplains primarily comprised of open pasture with isolated areas of vegeation along the stream bank.

UT1 originates from an ephemeral channel (EC1) and is classified as an intermittent channel that originates at a knickpoint where the land use transitions from row crops to livestock pasture. There are no trees along the banks of UT1 Reach 1, the banks are generally bare, and riparian vegetation consists of pasture grasses. Livestock access has resulted in areas of significant bank erosion as well as significant instream sedimentation resulting in impaired bed form and habitat complexity.

UT2 originates from a wetland on the project parcel and flows southeast to Perry Branch. This reach originates in a mature forest, but livestock impacts have significantly altered the understory and

herbaceous communities. The lower extent of UT2 has a deficient buffer that ranges from 0 to 30 feet wide along the right bank and Livestock impacts are evident throughout.

UT3 originates from an ephemeral channel (EC3) with a limited woody buffer of approximately 5 - 10 feet on each side which is surrounded by active livestock pasture. UT3 becomes an intermittent stream feature that flows through a forested area prior to the confluence with Perry Branch Reach 3. Livestock impacts are evident within the forested area, including bank trampling and hoof shear. Mature trees are present, but the understory and herbaceous vegetation are severely degraded.

Table 2: Buffer Project Attributes

Project Name	Perry Hill Mitigation Site
Hydrologic Unit Code	03020201030020
River Basin / Watershed	Neuse River / Upper Falls
Geographic Location (Lat, Long)	36.108078, -79,128361
Site Protection Instrument (DB, PG)	To be recorded
Total Credits (BMU)	878,894.828
Types of Credits	Riparian Buffer
Mitigation Plan Date	April 2020
Initial Planting Date	February 2021
Baseline Report Date	March 2021
MY1 Report Date	November 2021
MY2 Report Date	November 2022
MY3 Report Date	November 2023
MY4 Report Date	November 2024
MY5 Report Date	November 2025

2.2 Alternative Mitigation

In addition to buffer restoration on subject streams, per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o), alternative mitigation is proposed on the Site in the form of buffer restoration on ephemeral channels and enhancement via livestock exclusion. The proposed project complies with these rules in the following ways:

Buffer Restoration on Ephemeral Channels 15A NCAC 02B .0295 (o)(7):

- The ephemeral channel is directly connected to intermittent or perennial stream channels and will be protected under the same contiguous easement boundary (Figure 2).
- The area of the mitigation site on ephemeral channels compromises less than 14 percent of the total area of buffer mitigation, Table 7a.
- The mitigation area on the Site's ephemeral channels drains to the ephemeral channel (Figure 3) or is located completely within its drainage area.
- The proposed area meets all applicable requirements of Paragraph (n) of (15A NCAC 02B .0295), for restoration or enhancement.

Enhancement via Livestock Exclusion 15A NCAC 02B .0295 (o)(6)

- Wildlands will permanently exclude livestock from the riparian area via the construction of a perimeter fence 2-ft outside the proposed and illustrated easement.
- An enhancement plan must be provided in accordance by Paragraph (n) of 15A NCAC 02B .0295

- Grazing must be the predominant land use since the effective date of the applicable buffer rule. See Section 2.8 and Appendix 1b for additional details.

2.3 Watershed Characterization

The Site is located in Orange County approximately three miles northwest of Hillsborough, NC (Figure 1). The Site is located within the Hydrologic Unit Code (HUC) 03020201030020 and North Carolina Department of Water Resources (DWR) Sub-basin 03-04-01. Site topography, as indicated on the Hillsborough and Efland, NC USGS 7.5-minute topographic quadrangles, includes mostly gently sloped alluvial valleys with some steeper slopes along UT1 (Figure 4).

Drainage areas for the streams and riparian areas were determined by delineating watersheds on the Hillsborough and Efland USGS 7.5-minute topographic quadrangles. Figure 3 shows the watershed boundaries for each area. Existing riparian buffers within the watersheds includes a mix of active pastures, fields, and woodlands. The watershed drainage areas and current land use are summarized in Table 3.

Table 3: Drainage Areas and Associated Land Use

Reach Name	DWR Stream Designation	Watershed Area (acres)	Land Use
Perry Branch	Perennial	175	68% managed herbaceous cover/pasture; 22% forested; 5% Shrub; 3% grassland/herbaceous; 2% residential area; <1% impervious
UT1	Intermittent	10	>99% managed herbaceous cover/pasture; <1% forested
UT2	Intermittent	23	66% managed herbaceous cover/pasture; 34% forested
UT3	Intermittent	20	70% managed herbaceous cover/pasture; 30% forested
EC1	Ephemeral	7	>99% managed herbaceous cover/pasture; <1% forested
EC3	Ephemeral	17	85% managed herbaceous cover/pasture; 15% forested

2.4 Soils

The proposed project is mapped by the 1977 Soil Survey of Orange County (Figure 5). Project area soils are described in Table 4. Most of the stream reaches are on Georgeville silt loam soils, with Enon loam, Iredell gravelly loam, and Lignum silt within the upper reaches. Enon loam underlies UT2; Iredell gravelly loam underlies UT3; and Iredell gravelly loam and Lignum silt underlies the headwaters of Perry Branch. These streams are small headwater systems and due to the scale of the soil mapping exercise, these specific reaches are not discernable based on the soil mapping results.

Table 4: Project Soil Types and Descriptions

Soil Name	Description
Enon loam (EnB)	This series consists of well-drained soil with a slope of 2 to 6 percent located on broad ridges in the uplands. Typically, the surface layer is loam about 5 inches thick. The subsoil extends to a depth of 25 inches.
Enon loam (EnC)	This series consists of well-drained soil with a slope of 6 to 12 percent located side slopes adjacent to ridges on the uplands. Typically, the surface layer is loam about 5 inches thick. The subsoil extends to a depth of 25 inches.
Georgeville silt loam (GeC)	This series consists of well-drained soil with a slope of 6 to 10 percent located on narrow side slopes in the uplands. Typically, the surface layer is silt loam about 7 inches thick. The subsoil extends to a depth of 65 inches.
Herndon silt loam (HrB)	This series consists of well-drained soils on broad ridges on the uplands. The slopes range from 2 to 6 percent. The surface layer is silt loam about 4 inches thick. The subsoil is about 49 inches thick.
Iredell gravelly loam (IrB)	These soils are moderately well drained soils on broad ridges on the uplands with slopes of 1 to 4 percent. The surface layer of the series is gravelly loam about 5 inches thick. The subsurface layer is gravelly loam 3 inches thick. The subsoil is about 21 inches thick.
Lignum silt (Lg)	This series consists of moderately well-drained soil on uplands with a slope of 0 to 3 percent. The surface layer is silt loam about 1 inch thick. The subsurface layer is silt loam about 5 inches thick. The subsoil is about 30 inches thick.
Tarrus silt loam (TaD)	This series consists of well-drained soil on hillslopes of ridges with slopes of 8 to 15 percent. The surface layer is silt loam about 6 inches thick. The subsurface layer is silty clay about 14 inches thick. The subsoil is about 24 inches thick.

Source: *Orange County Soil Survey, USDA-NRCS, http://efotg.nrcs.usda.gov*

2.5 Geology

The project is located in the Ecoregion 45c - Carolina Slate Belt of the Piedmont physiographic province (NCGS, 1985). The Carolina Slate Belt extends from southern Virginia, across the Carolinas, and into Georgia. The rocks in this region are primarily volcanic and sedimentary rocks that underwent low-grade metamorphism giving them a slaty cleavage. Coarse-grained intrusive granites comprise the rest of the Slate Belt rocks (Rogers, 2006). The geology of this area has important effects on Site hydrology, hydraulics, geomorphology, and sediment transport. Streams in the Carolina Slate Belt tend to go dry during late summer and early fall as a result of geologic, topographic, and climatic factors. A study by Giese and Mason states that the "Carolina slate belt has among the lowest potential for sustaining baseflow in streams" throughout the year as compared to other regions of North Carolina. Median low flows in the Carolina Slate Belt, defined by the study as the 7Q10 (7-day consecutive low flow with a 10-year return frequency, or the lowest stream flow for seven consecutive days that would be expected to occur once in ten years), can be as low as 0.005 $ft^3/s/mi^2$ of drainage area (Giese and Mason, 1993).

2.6 Vegetation

The actively grazed fields on the Site are dominated by pasture grasses such as fescue (*Festuca* spp.) with scattered trees along top of bank. Mature canopy species within forested areas along Perry Branch Reach 1 and 2, UT2, and UT3 primarily include shagbark hickory (*Carya ovata*), sugarberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), eastern red cedar (*Juniperus virginiana*), and sweetgum (*Liquidambar styraciflua*). Shrub species are sparse and primarily consist of American hornbeam (*Carpinus caroliniana*), multiflora rose (*Rosa multiflora*), and Chinese privet (*Ligustrum sinense*). In addition to pasture grasses, the herbaceous layer in these areas include New York ironweed (*Vernonia noveboracensis*), false nettle

(*Boehmeria cylindrica*), pokeweed (*Phytolacca americana*), dog fennel (*Eupatorium capillifolium*), pigweed (*Amaranthus spp.*), jimsonweed (*Datura stramonium*), knotweed (*Persicaria spp.)*, and Japanese stilt grass (*Microstegium spp*.). Herbaceous species in wetter areas include common rush (*Juncus effusus*) and sedges (*Carex* spp.).

2.7 Site Constraints and Access

The Site is accessible via two existing farm roads from Frank Perry Road. An overhead transmission line is located at the downstream extent of Perry Branch (Figure 2). The proposed easement abuts the existing overhead utility easement. Two internal easement culvert crossings are proposed to support on-going farming activities. Streams and buffered areas are excluded from credit computations within these internal crossings (Figure 6). Larry F Warren Field, a small private turf airport is located approximately 2 miles southwest of the project site (Figure 1). There are no other known constraints on or adjacent to the proposed Site.

2.8 Current Site Resources

On February 25, 2019, DWR conducted on-site determinations to review features and land use within the project boundary. The resulting DWR stream determination and site viability letters confirming the Site as suitable for riparian buffer mitigation are enclosed in Appendix 1b. Email correspondence with Katie Merritt and a letter from David McKee, the farmer that leases land within the proposed project, attesting to livestock access prior to the effective date of the rule (1997) are enclosed in Appendix 1b.

2.9 Historic Site Resources

Silviculture and agriculture activities are the predominate historic (and current) activities at the Site. Historic aerial photos, which are included in Appendix 3 of the Perry Hill Stream Mitigation Plan, date back to 1938 and show the Site in various stages of timber succession and harvesting, row crop production, and open pasture. In general, this area has maintained its rural, farming character over the last 81 years with only minor changes in land cover.

3.0 Site Protection Instrument

3.1 Site Protection Instruments Summary Information

The land required for riparian buffer planting, management, and stewardship of the mitigation project includes portions of the parcel listed in Table 5. An option agreement for the project area has been signed by the property owners and a Memorandum of Option has been recorded at the Orange County Register of Deeds. The proposed conservation easement on this property has not yet been recorded.

Table 5: Site Protection Instrument

Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage to be Protected
Evelyn J. Perry, Judy Kadlac, Gene Kadlac, Mary C.P. Bishop and Hubert Bishop	9865081397	Orange	Conservation Easement	DB: 6513 PG: 42	26.877

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.

4.0 Regulatory Considerations

Table 6, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 4.1-4.3. A copy of the signed Categorical Exclusion Form for the project is enclosed with the Perry Hill Stream Mitigation Plan, Appendix 6.

Table 6: Project Attribute Table

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States	Yes	No	Section 404 Permit
	Yes	No	Section 401 Permit
Endangered Species Act	Yes	Yes	Perry Hill Stream Mitigation Plan Appendix 6 (Categorical Exclusion)
Historic Preservation Act	Yes	Yes	Perry Hill Stream Mitigation Plan Appendix (Categorical Exclusion)
Coastal Zone Management Act	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

1. PCN to be provided to DMS with the Final Mitigation Plan.

4.1 Threatened and Endangered Species

The NC Natural Heritage Program (NHP) database and the US Fish and Wildlife Service (USFWS) database were searched for federally listed threatened and endangered plant and animal species in Orange County, NC. The Orange County listed endangered species includes the dwarf wedgemussel (A*lasmidonta heterodon*), Michaux's sumac (*Rhus michauxii*), and smooth coneflower (*Echinacea laevigata*), all which are endangered, and the Atlantic pigtoe (*Fusconaia masoni*), which is listed as proposed threatened.

A pedestrian survey conducted on August 14, 2018, indicated that the Site did not provide suitable habitat for the dwarf wedgemussel. The pedestrian survey did indicate that the site provides suitable habitat for the Atlantic pigtoe, smooth coneflower and Michaux's sumac but no species were identified on the site. Therefore, due to the absence of the listed species on the site, the project has been determined by Wildlands to have "no effect" on the smooth coneflower and Michaux's sumac. Perry Hill Mitigation Site is an active livestock farm leading to poor water quality, due to this and the absence of the Atlantic pigtoe on the site, the project has been determined to "may affect, but not likely to adversely affect" the Atlantic pigtoe. The project will have "no effect" on the dwarf wedgemussel due to the absence of suitable habitat.

Per the United States Fish and Wildlife Service (USFWS) Raleigh Field Office standard, Wildlands submitted the Perry Hill Mitigation Site Self-Certification Letter. The Self-Certification Letter states, the USFWS does "concur with the "no effect" or "not likely to adversely affect" determinations for proposed and listed species and proposed and designated critical habitat; additional coordination with this office is not needed. USFWS had no additional comment during the thirty-day review period. All documents and correspondence submitted to the USFWS are included in the Appendix 6 of the Perry Hill Stream Mitigation Plan.

4.2 Cultural Resources and Significant Natural Heritage Areas

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

There are no existing structures in the project area. The Site is not located near any sites listed on the National Register with the State Historic Preservation Office (SHPO). SHPO was contacted in a letter dated February 18, 2019 and subsequently responded in a letter dated April 2, 2019 which stated there were no concerns or comments on the project site. The approved Categorical Exclusion for the project is located in Appendix 6 of the Perry Hill Stream Mitigation Plan.

4.3 FEMA Floodplain Compliance

The project is illustrated on FEMA FIRM panel 3710986500J, effective February 2, 2007. The streams within the project limits are not located in a Special Flood Hazard Area or floodway. The Site is in a Zone X or 'other flood area' that is designated for streams with a drainage area of less than 1 square mile. No modeling or map revisions will be required. Wildlands will coordinate with Orange County to obtain a floodplain development permit, if necessary.

4.4 Other Environmental Issues

An EDR Radius Map Report with Geocheck was ordered for the Site through Environmental Data Resources, Inc. on August 13, 2018. The target property and the adjacent properties are not listed in any of the Federal, State, or Tribal environmental databases searched by EDR. The EDR report identified a Lillie Warren's parcel, 0.471 miles away, in a listing of leaking aboveground storage tank site locations (LAST) and Incident Management Database (IMD). On March 23, 1991 roughly 100 gallons of heating oil was spilled at 2412 NC Highway 86, Hillsborough, NC 27278. The incident was reported and cleaned up on April 10, 1991, by excavating 30-40 cubic yards of contaminated soil. Based on its location outside of the Site, it was determined that there is no evidence of any "recognized environmental conditions" in connection with the target property. The Executive Summary of the EDR report and the specific Site Summary for Lillie Warren are included in Appendix 6 of the Perry Hill Stream Mitigation Plan.

5.0 Determination of Credits

The Site is a riparian restoration and enhancement site that will generate 878,894.828 square feet of riparian buffer credits (Tables 7a and 7b and Figure 6) that can serve Neuse 03020201, including the Falls Lake Watershed (Figure 10). DMS reserves the right to convert the riparian buffer credits to nutrient offset credits to service the Falls Lake Watershed. The mitigation credit calculation was derived based on Wildlands' conceptual design for maximum ecological uplift. The buffer zones and subject and non-subject stream designations are shown on Figure 7. The management objectives, mitigation type, and amount of buffer mitigation are presented below.

Table 7a: Buffer Project Areas and Assets

Neuse – Upper Falls Lake (03020201)				**Service Area**											19.16394[A]	297.54099[B]
Credit Type	**Location**	**Subject**	**Feature Type**	**Mitigation Activity**	**Min-Max Buffer Width (ft)**	**Feature Name**	**Total Area (sf)**	**Total (Creditable) Area of Buffer Mitigation (sf)**	**Initial Credit Ratio (x:1)**	**% Full Credit**	**Final Credit Ratio (x:1)**	**Convertible to Riparian Buffer?**	**Riparian Buffer Credits**	**Convertible to Nutrient Offset?**	**Delivered Nutrient Offset: N (lbs) ***	**Delivered Nutrient Offset: P (lbs) ***
Buffer	Rural	Yes	I / P	Restoration	0-100	Perry Branch	406,900	406,900	1	100%	1.00000	Yes	406,900.000	Yes	21,232.586	1,367.543
Buffer	Rural	Yes	I / P	Restoration	101-200	Perry Branch	26,502	26,502	1	33%	3.03030	Yes	8,745.669	Yes	1,382.910	89.070
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	Perry Branch	158,681	158,681	2	100%	2.00000	Yes	79,340.50	No	—	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	101-200	Perry Branch	1,867	1,867	2	33%	6.06061	Yes	308.055	No	—	—
Buffer	Rural	Yes	I / P	Restoration	0-100	UT1	94,359	94,359	1	100%	1.00000	Yes	94,359.000	Yes	4,923.779	317.129
Buffer	Rural	Yes	I / P	Restoration	101-200	UT1	2,204	2,204	1	33%	3.03030	Yes	727.321	Yes	115.008	7.407
Buffer	Rural	No	I / P	Restoration	0-100	UT2	58,504	58,504	1	100%	1.00000	Yes	58,504.000	Yes	3,052.817	196.625
Buffer	Rural	No	I / P	Restoration	101-200	UT2	1,039	1,039	1	33%	3.03030	Yes	342.870	Yes	54.216	3.492
Buffer	Rural	No	I / P	Enhancement via Cattle Exclusion	0-100	UT2	125,169	125,169	2	100%	2.00000	Yes	62,584.500	No	—	—
Buffer	Rural	No	I / P	Enhancement via Cattle Exclusion	101-200	UT2	24,819	24,819	2	33%	6.06061	Yes	4,095.132	No	—	—
Buffer	Rural	No	I / P	Enhancement via Cattle Exclusion	0-100	UT3	37,209	37,209	2	100%	2.00000	Yes	18,604.500	No	—	—
Buffer	Rural	No	I / P	Enhancement via Cattle Exclusion	101-200	UT3	26	26	2	33%	6.06061	Yes	4.290	No	—	—
Buffer	Rural	No	Ephemeral	Restoration	0-100	EC1	17,280	17,280	1	100%	1.00000	Yes	17,280.000	Yes	901.693	58.076
Buffer	Rural	No	Ephemeral	Restoration	101-200	EC1	299	299	1	33%	3.03030	Yes	98.670	Yes	15.602	1.005
Buffer	Rural	No	Ephemeral	Restoration	0-100	EC3	125,712	125,712	1	100%	1.00000	Yes	125,712.000	Yes	6,559.820	422.503
Buffer	Rural	No	Ephemeral	Restoration	101-200	EC3	3,904	3,904	1	33%	3.03030	Yes	1,288.321	Yes	203.716	13.121

Table 7b: Buffer Project Areas and Assets (Summary)

TOTAL AREA OF BUFFER MITIGATION (TABM)**		
Mitigation Totals	**Square Feet**	**Credits**
Restoration:	736,703	713,957.851
Enhancement:	347,771	164,936.977
Preservation:	0	0.000
Total Riparian Buffer:	1,084,474	878,894.828
TOTAL NUTRIENT OFFSET MITIGATION		
Mitigation Totals	**Square Feet**	**Credits**
Nutrient Offset: **Nitrogen:**	0	0.000
Nutrient Offset: **Phosphorus:**		0.000

Note A: Nitrogen Nutrient Offset Credit Ratio (sf/credit); Note B: Phosphorus Nutrient Offset Credit Ratio (sf/credit).
*Per the Site Viability for Buffer Mitigation and Nutrient Offset Letter, certain project reaches were deemed viable by DWR for nutrient offset credit. The nutrient offset viable areas are depicted in Figure 9 and their associated potential nutrient offset credits are listed in Table 7a. These areas have a minimum easement width of 50 feet from the top of bank and these areas will be restored. While nutrient offset credits are not being requested at this time, these areas may be converted to nutrient offset credits by DMS at a later date.

**15A NCAC 02B 0295 (o)(7) - Ephemeral Reaches are 14% of the Total Buffer Mitigation Area

6.0 Mitigation Work Plan

Wildlands proposes to restore high quality ecological function to Perry Branch and three unnamed tributaries, and two ephemeral channels. Plan Sheets illustrating the stream mitigation activities at the Site are enclosed with the Perry Hill Stream Mitigation Plan, Appendix 8. The ecological uplift can be summarized as transforming agriculturally impacted areas to a protected forested riparian corridor. All riparian mitigation activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where riparian restoration and enhancement via livestock exclusion is being performed may be altered slightly depending on the implementation of the Perry Hill Stream Mitigation Plan. Planting and fencing will happen in conjunction with the Perry Hill II Nutrient Offset and Buffer Mitigation Bank. Figure 6 depicts the conceptual approach for the riparian areas. More detailed descriptions of the proposed riparian buffer mitigation activities follow in Sections 6.1 through 6.3.

6.1 Parcel Preparation

No additional permits are necessary besides 401/404 authorization for the stream mitigation work. The current land use is agricultural adjacent to the streams proposed for riparian restoration. Undesirable growth and invasive species within the areas that will not be graded, but are slated for riparian restoration, will be subject to select chemical or mechanical treatment. The remaining area within the proposed easement will be graded in accordance with the Interagency Review Team (IRT) approved stream mitigation plan. The restoration and enhancement areas will be planted via hand labor with dibble bars or other acceptable forestry practices. Prior to planting, invasive species will be chemically and mechanically treated within the proposed easement area.

Wildlands collected and analyzed soils samples to develop a site preparation plan. Wildlands noted compacted soils at the site and will implement ripping or disking prior to planting to reduce soil compaction in the planted areas. Soil compaction will be disrupted (disked or ripped) to a depth of 18" or more along haul roads and to a depth of at least 12" for wetland and other planted areas.

Wildlands will apply soil amendments (i.e., an organic plant food and root growth promoter, phosphate, and soil microbes to promote soil health) to planted areas based on soil testing results. Wildlands will also implement topsoil harvesting (harvesting the top 8" of soil) and re-use practices. Topsoil harvesting will be limited to disturbed areas and will not extend into undisturbed riparian areas. Undisturbed areas within the existing pasture and proposed easement will be chemically treated with glyphosate to reduce competition on planted stems. Treated areas will be seeded with temporary and permanent seed mixes. Fescue treatment is introduced in subsequent sections of this report.

6.2 Riparian Area Restoration Activities

The revegetation plan for the riparian buffer restoration area will include permanent seeding, planting bare root trees, live stakes, and herbaceous plugs. These revegetation efforts will be coupled with ongoing maintenance and treatment of invasive species. The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the parcel, and best professional judgement on species establishment and anticipated site conditions in the early years following project implementation. Additionally, pollinator species were included within the permanent seed mixes. Tree species planted across the riparian areas of the Site will include a mixture of the following species: American sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), willow oak (*Quercus phellos*), eastern cottonwood (*Populus deltoids*), black willow (*Salix nigra*), silky willow (*Salix sericea*), elderberry (*Sambucus canadensis*), buttonbush (*Cephalanthus occidentalis*), silky dogwood (*Cornus amomum*), overcup oak (*Quercus lyrata*), swamp chestnut oak (*Quercus michauxii),* southern red oak (*Quercus falcata*), northern red oak (*Quercus rubra*), white oak (*Quercus alba*), winged elm (*Ulmus*

alata), sourwood (*Oxydendrum arboreum*), southern sugar maple (*Acer floridanum*), American elm (*Ulmus americana*), pawpaw (*Asimina triloba*), persimmon (*Diospyros virginiana*), arrowwood viburnum (*Viburnum dentatum*), boxelder (*Acer negundo*), black gum (*Nyssa sylvatica*), flowering dogwood (*Cornus floridus*), sugarberry (*Celtis laegivata*), American beech (*Fagus grandifolia*), ironwood (*Carpinus caroliniana*), possumhaw viburnum (*Viburnum nudum*), blackhaw viburnum (*Viburnum prunifolium*), and strawberry bush (*Euonymus americanus*). Section 4 of the Plan Sheets illustrate the planting activities at the Site and are enclosed with the Perry Hill Stream Mitigation Plan, Appendix 8.

Trees will be planted at a density to meet the performance standards of 260 trees per acre at the completion of monitoring. No one tree species will be greater than 50% of the established stems. An appropriate seed mix will also be applied as necessary to provide temporary ground cover for soil stabilization and reduction of sediment loss during rain events in disturbed areas. This will be followed by an appropriate permanent seed mixture. Planting is proposed for January 2021.

Vegetation planting and replanting should be conducted between November 15 and March 15, unless otherwise noted in the approved Mitigation Plan or remedial action plan.

Vegetation management and herbicide applications may be needed during tree establishment in the restoration areas to prevent establishment of invasive species that could compete with the planted native species. Wildlands will implement two approaches to manage fescue at the Site. Both approaches are designed to mitigate the adverse effects of fescue (i.e., direct competition and allelopathic impacts) on planted vegetation. The first approach consists of chemically treating select areas immediately adjacent to planted trees. A second treatment may be required at the beginning of year two based on fescue re-establishment and tree growth. The second approach entails a chemical application over a broader area that is designed to eradicate fescue in those areas not graded during construction. Following the chemical treatment, temporary and permanent vegetation will be established. Wildlands will develop necessary adaptive measures or implement appropriate remedial actions in the event that other invasive species are preventing the establishment of the targeted vegetative communities.

6.3 Riparian Area Enhancement via Livestock Exclusion Activities

Permanent boundary fencing will exclude livestock from the riparian buffer enhancement areas as outlined in Rule 15A NCAC 02B .0295(o)(6) (Figure 6 and 8). The enhancement via livestock exclusion area will be protected in perpetuity under a conservation easement. Planting within the enhancement areas will be limited to severely degraded forested areas that currently exhibit low woody vegetation (stem) densities. A seed mix will be applied where livestock have created bare soil and sufficient sunlight is available to support the species in the seed mix. Planting and fencing will happen in conjunction with the Perry Hill II Nutrient Offset and Buffer Mitigation Bank. Section 5 of the Plan Sheets illustrate the fencing plans at the Site and are enclosed with the Perry Hill Stream Mitigation Plan, Appendix 8.

7.0 Performance Standards

The performance criteria for the Site follows approved performance criteria presented in the guidance documents outlined in RFP 16-007576 and the Consolidated Buffer Rule (15A NCAC 02B .0295). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the constructed and planted project. This riparian buffer project has been assigned specific performance criteria components for vegetation. Performance criteria will be evaluated throughout the five-year post-construction monitoring period. An outline of the performance criteria components follows.

7.1 Vegetation

The final vegetative success criteria will be the health, survival, and density of at least 260 stems per acre at the end of the fifth year of monitoring, with a minimum of four native hardwood tree or shrub species

composition and no one species comprises more than 50 percent of stems. Vigor, species composition, height, and density will all be assessed. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period. Wildlands plans to control fescue during the construction and planting activities. Wildlands will continue to monitor impacts of fescue on the targeted plant communities at the Site during the monitoring period. In the event fescue is preventing the establishment of the targeted plant community, Wildlands will prescribe a specific remedial plan of action.

7.2 Visual Assessments

Visual assessments, which will include reference photos, should support the specific performance standards for each metric as described above. Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species or encroachment). Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas with be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

To ensure compliance with 0295 (0) (6): A visual assessment of the livestock exclusion areas within the conservation easement will also be performed each year to confirm:

- Fencing is in good condition throughout the Site; no livestock access within the conservation easement area; no encroachment has occurred; diffuse flow is being maintained in the conservation easement area; and there has not been any cutting, clearing, filling, grading, or similar activities that would negatively affect the functioning of the riparian buffer.
- Any issues identified during the visual assessments will be photographed and mapped as part of the annual monitoring report with remedial efforts proposed or documented.

7.3 Reporting Performance Criteria

Using the DMS Riparian Buffer and Nutrient Offset Buffer Baseline and Annual Monitoring Report Template Version 2.0 (May 2017), a baseline monitoring document and as-built record drawings of the project will be developed for the constructed Site. Complete monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS. Annual monitoring reports will be based on the above referenced DMS Template (May 2017). The monitoring period will extend five years beyond completion of construction or until performance criteria have been met.

7.4 Maintenance and Contingency Plans

Wildlands will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

8.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met and project goals and objectives are achieved. The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes and assist in close-out decision making.

8.1 Monitoring Components

Project monitoring components are listed in Table 8 and illustrated in Figure 8.

8.2 Vegetation

Vegetation monitoring quadrants will be installed across the Site to measure the survival of the planted trees (Figure 8). The first annual monitoring activities will commence at the end of the first growing season, at least five months after planting has been completed, and will be reassessed annually no earlier than the Fall of each year. Species composition, density, height, and survival rates will be evaluated on an annual basis by plot and for the entire site. The number of monitoring quadrants required and frequency of monitoring will be based on the DMS monitoring guidance documents. Vegetation monitoring will follow the CVS-EEP Protocol for Recording Vegetation (2008) or another DMS approved protocol. Planted stems will be flagged. Reference photographs of the vegetation plots and Site will be taken during the annual vegetation assessments.

8.3 Visual Assessment and Photo Documentation

Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species or encroachment). Visual assessments will include documenting the condition of livestock exclusion fencing and that no livestock are accessing the conservation easement area. Additionally, Unmanned Aerial Vehicle (UAV) photographs will be taken within the project area once a year to visually document vegetation growth for five years following construction.

Table 8: Monitoring Components

Parameter	Monitoring Feature	Quantity	Frequency
Vegetation	CVS Level 2	14	Annual
Visual Assessment		Yes	Semi-Annual
Exotic and Nuisance Vegetation		Yes	Semi-Annual
Project Boundary		Yes	Semi-Annual
Reference Photos	UAV Photographs	Yes	Annual

9.0 Long-Term Management Plan

The Site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct inspection of the Site at least twice per year (semi-annual basis) to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

The Stewardship Program will periodically install signage, to identify boundary markings, as needed. No livestock, fencing, or internal crossing changes are currently present or planned by the landowner for the project area. Any future livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

10.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Section 8. Project maintenance will be performed during the monitoring years to address issues if necessary. If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the DMS/NCDWR to develop contingency plans and remedial actions.

Wildlands will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

11.0 References

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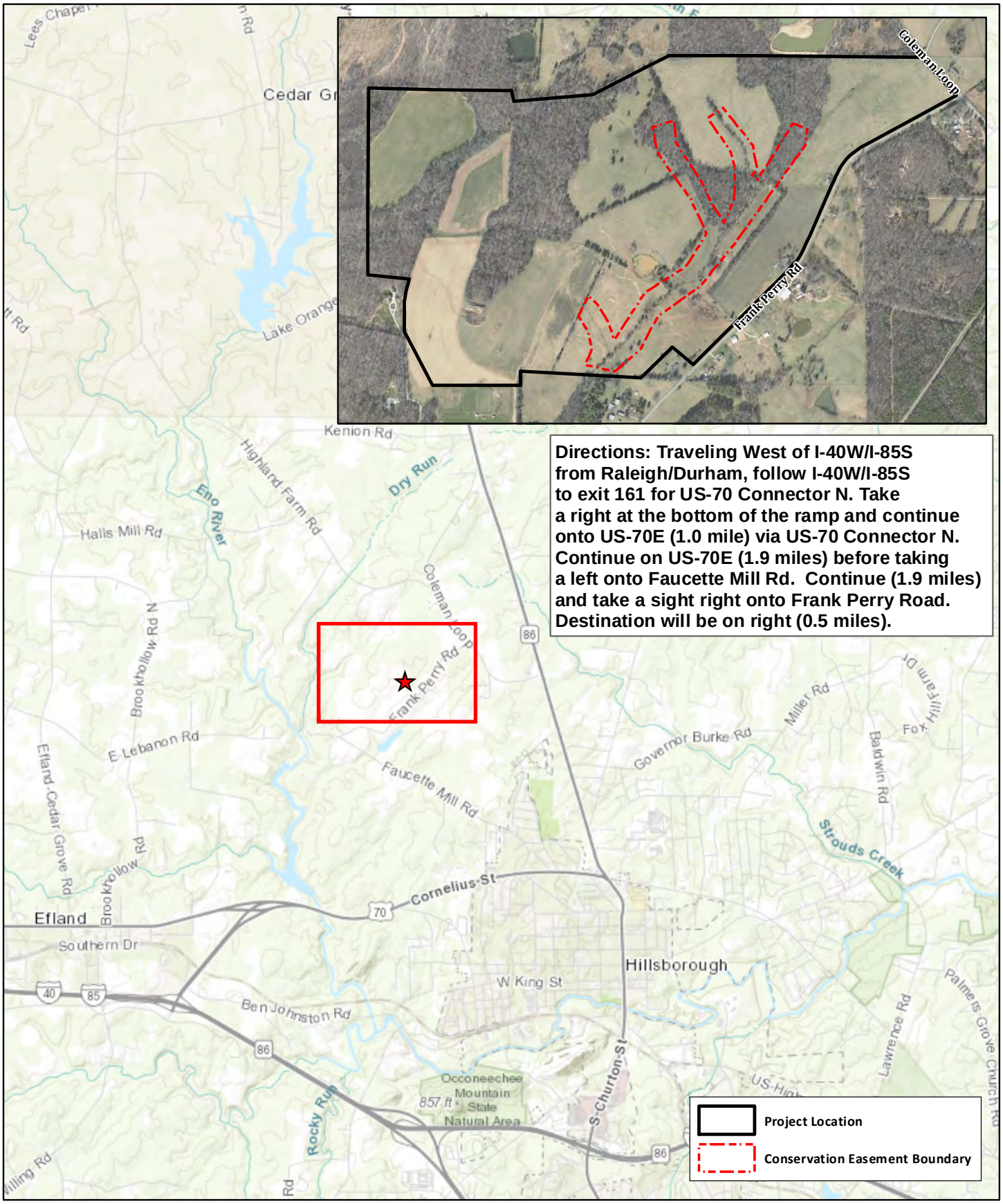

WILDLANDS ENGINEERING

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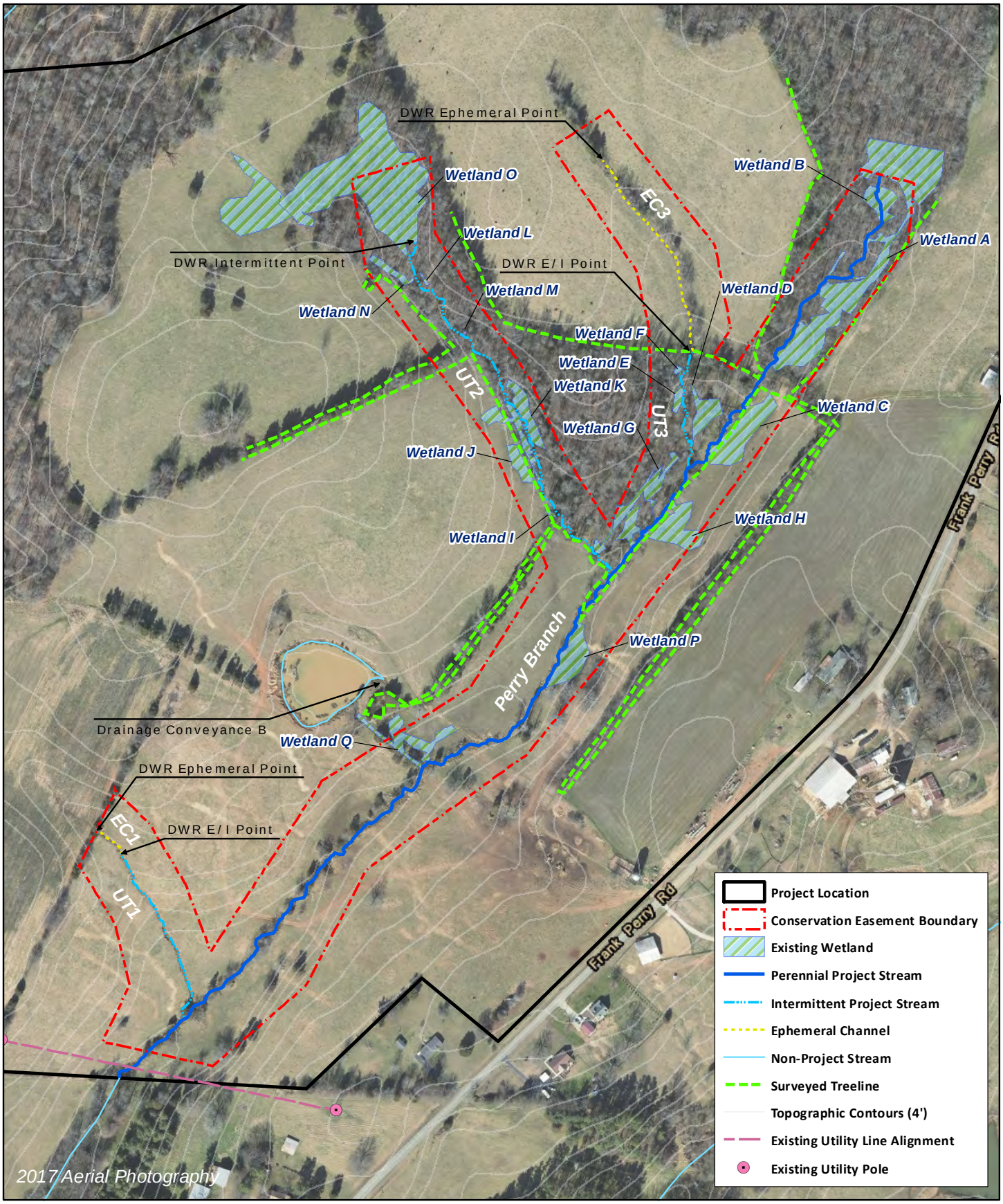
Figure 1 Vicinity Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 175 350 700 Feet

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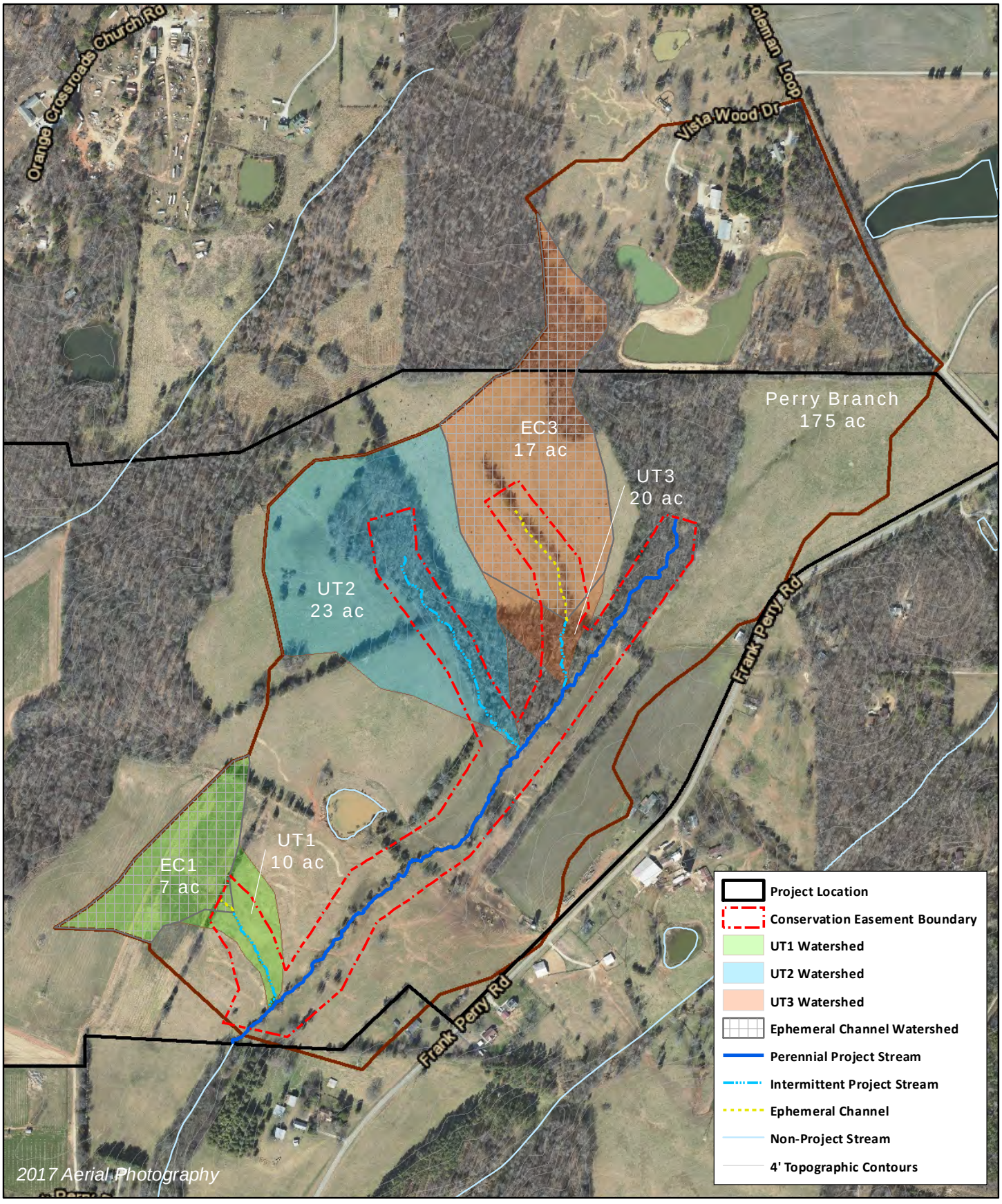
Figure 2 Site Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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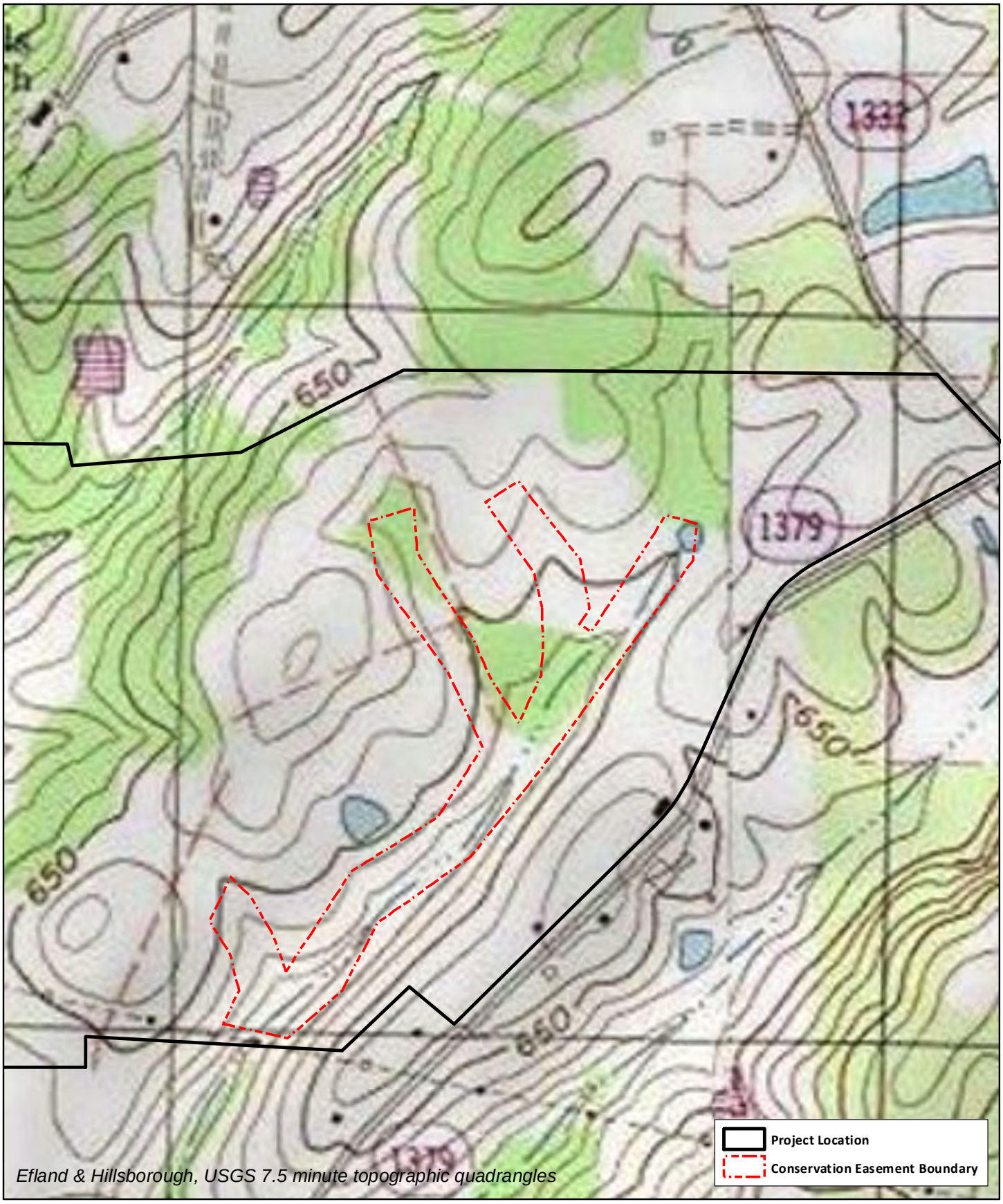
Figure 3 Watershed Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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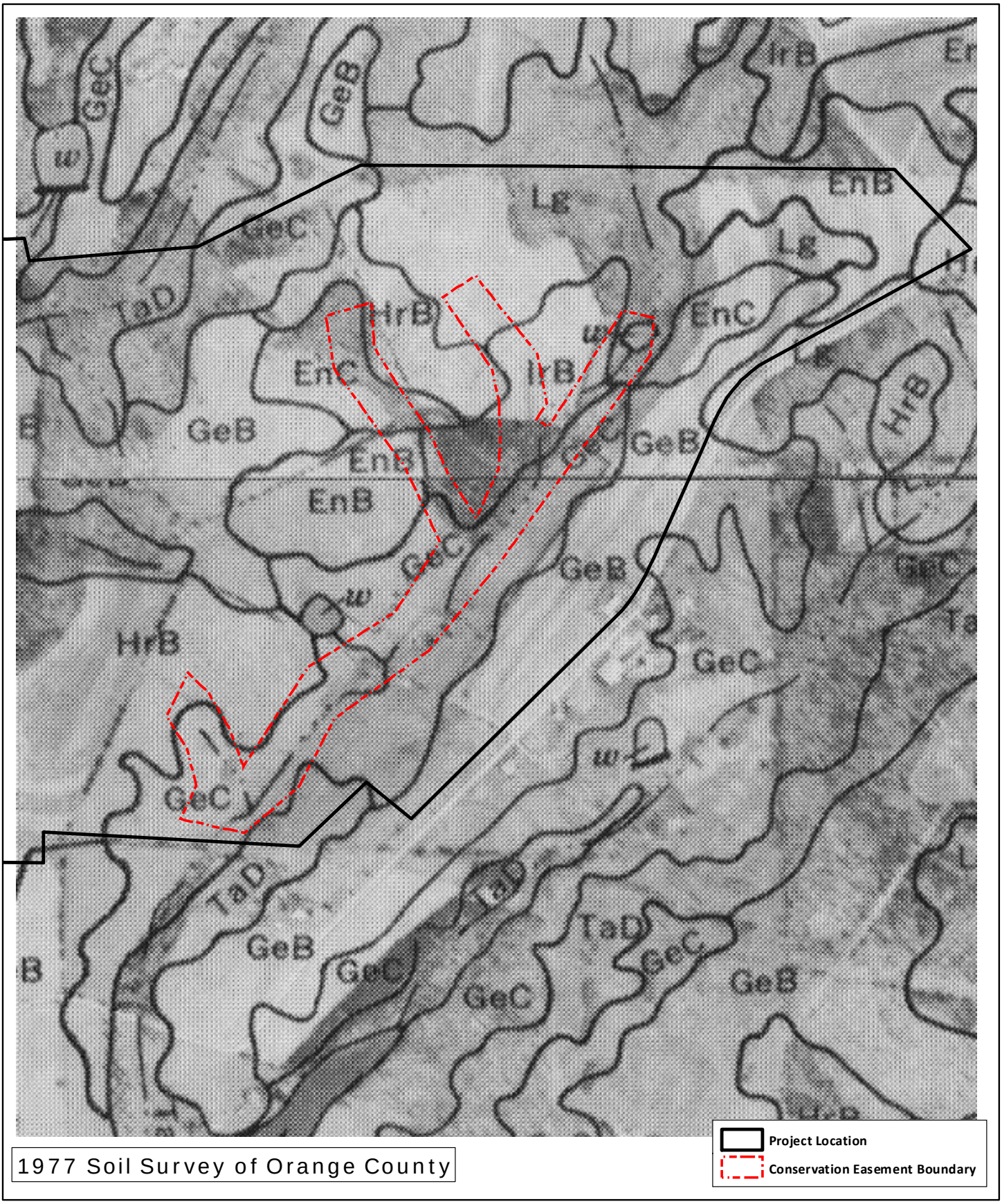
Figure 4 USGS Topographic Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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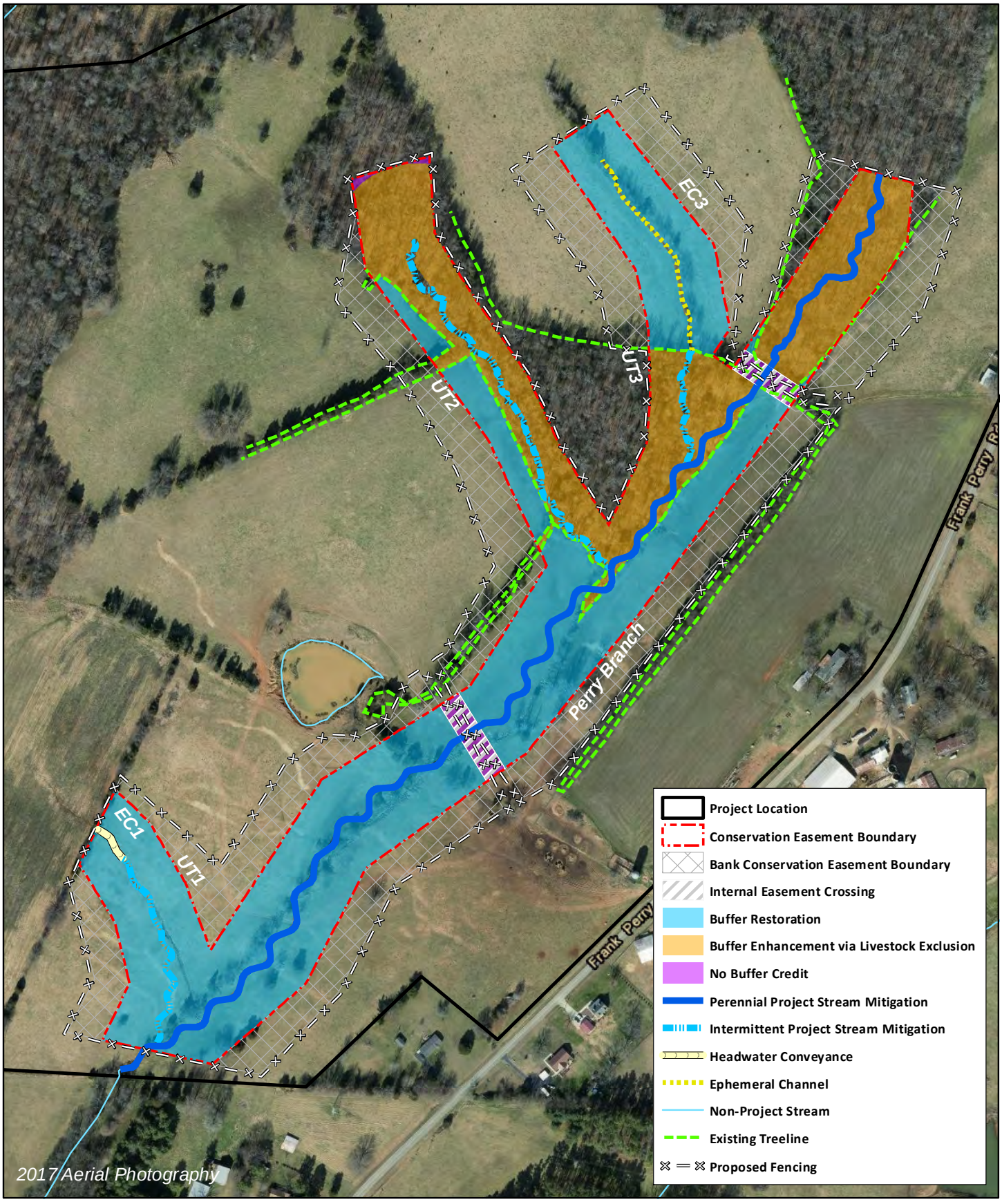
Figure 5 NRCS 1977 Soils Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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Figure 6 Credit Calculations Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

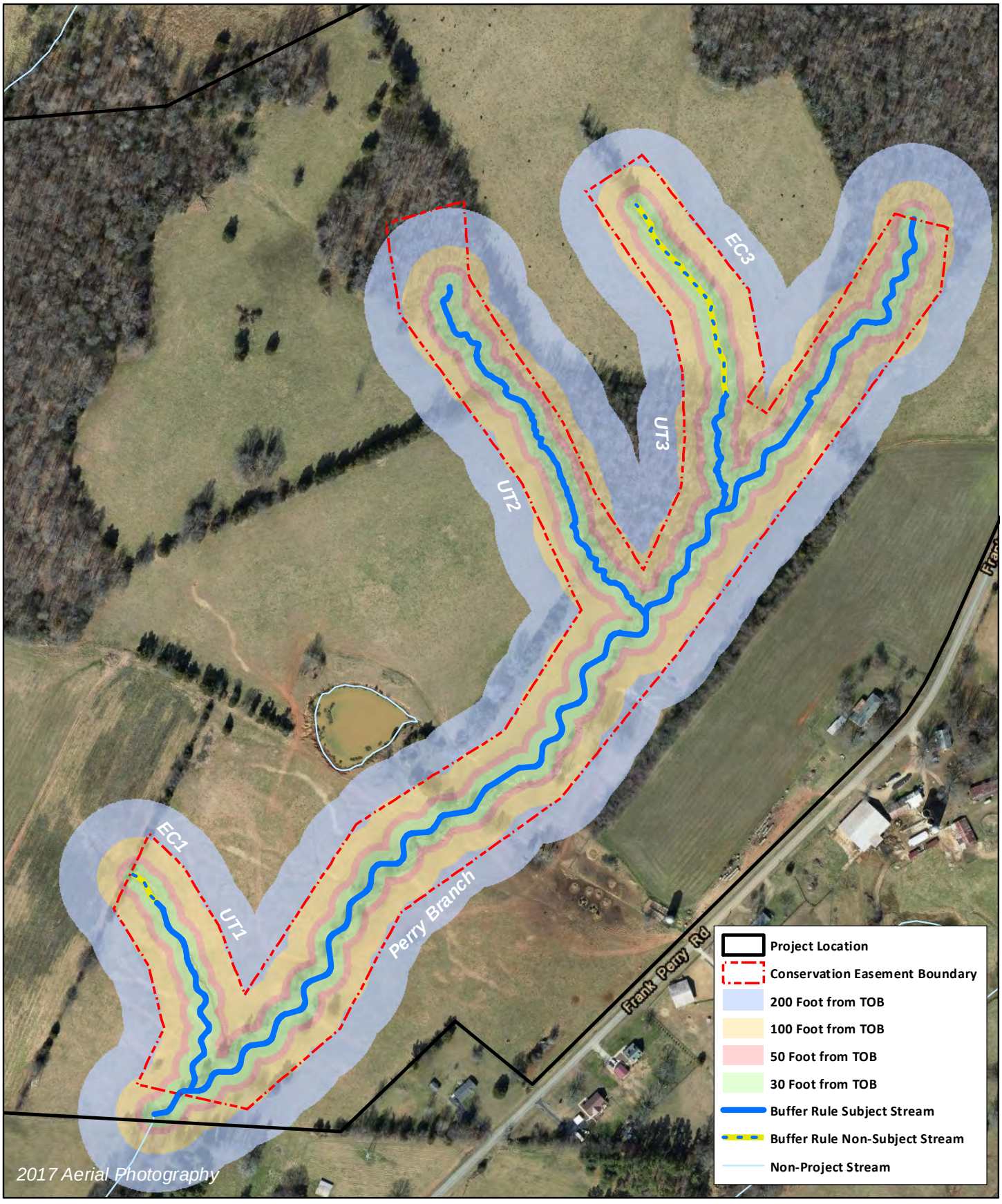

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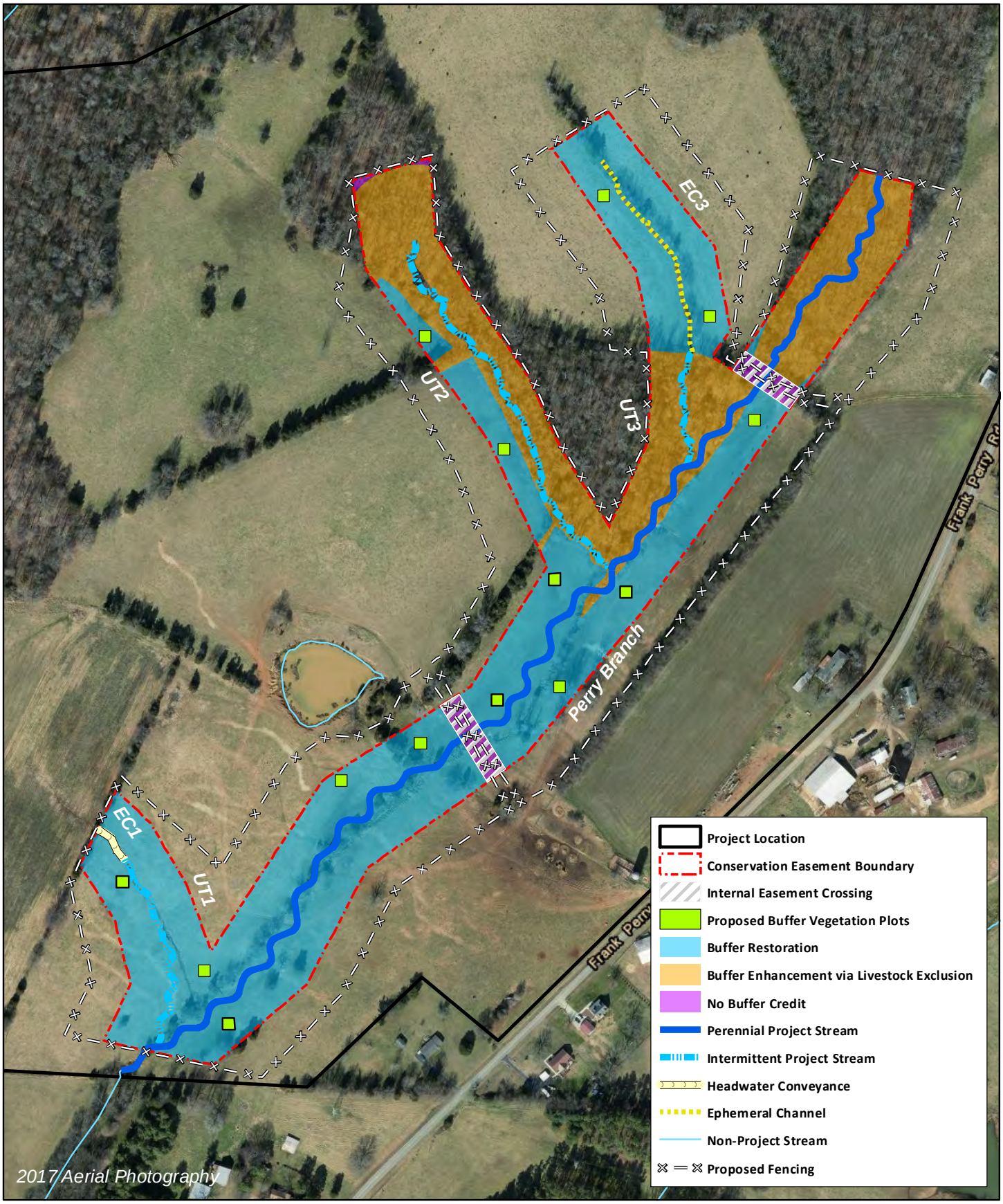
Figure 7 Riparian Buffer Zones Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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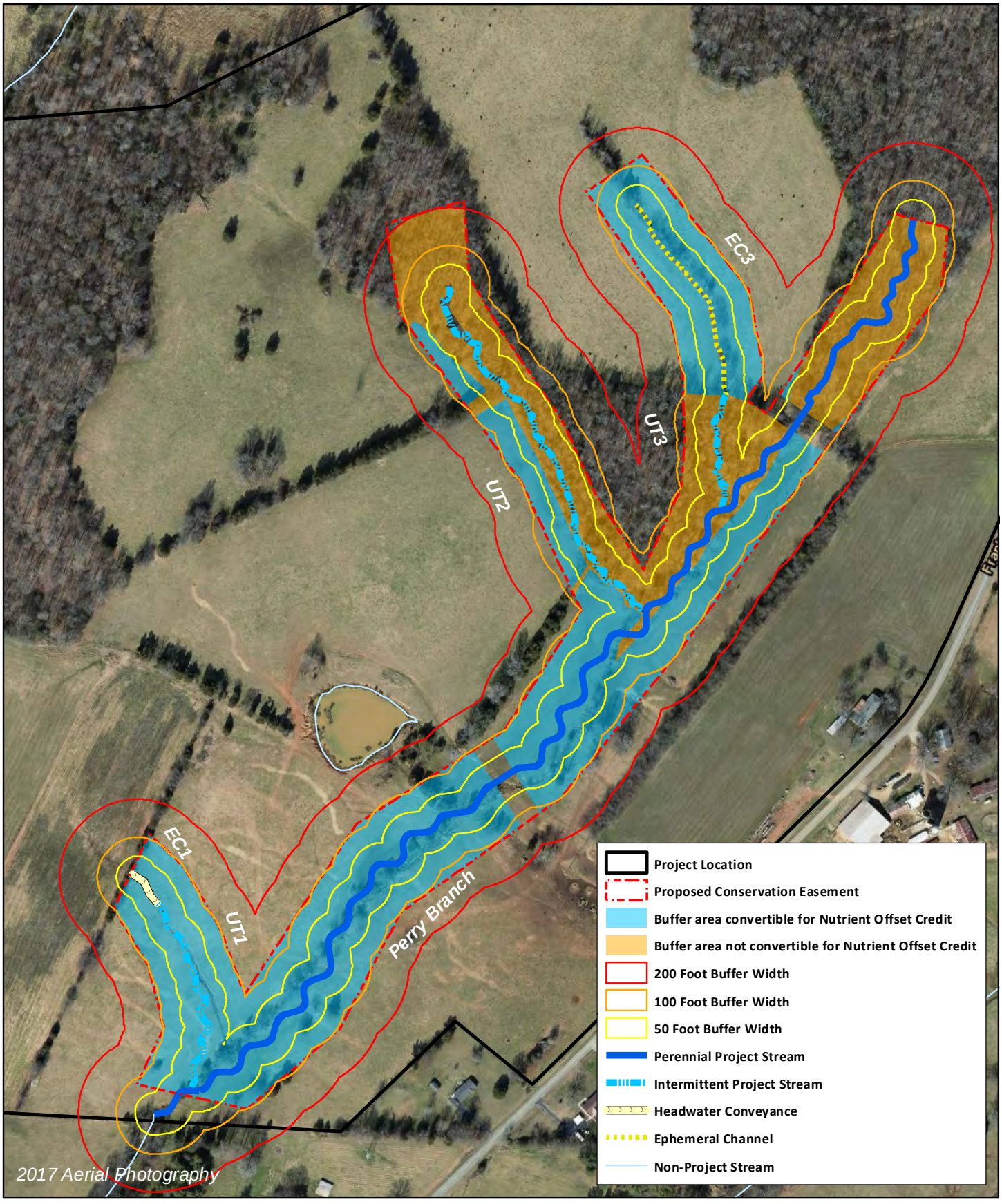
Figure 8 Buffer Monitoring Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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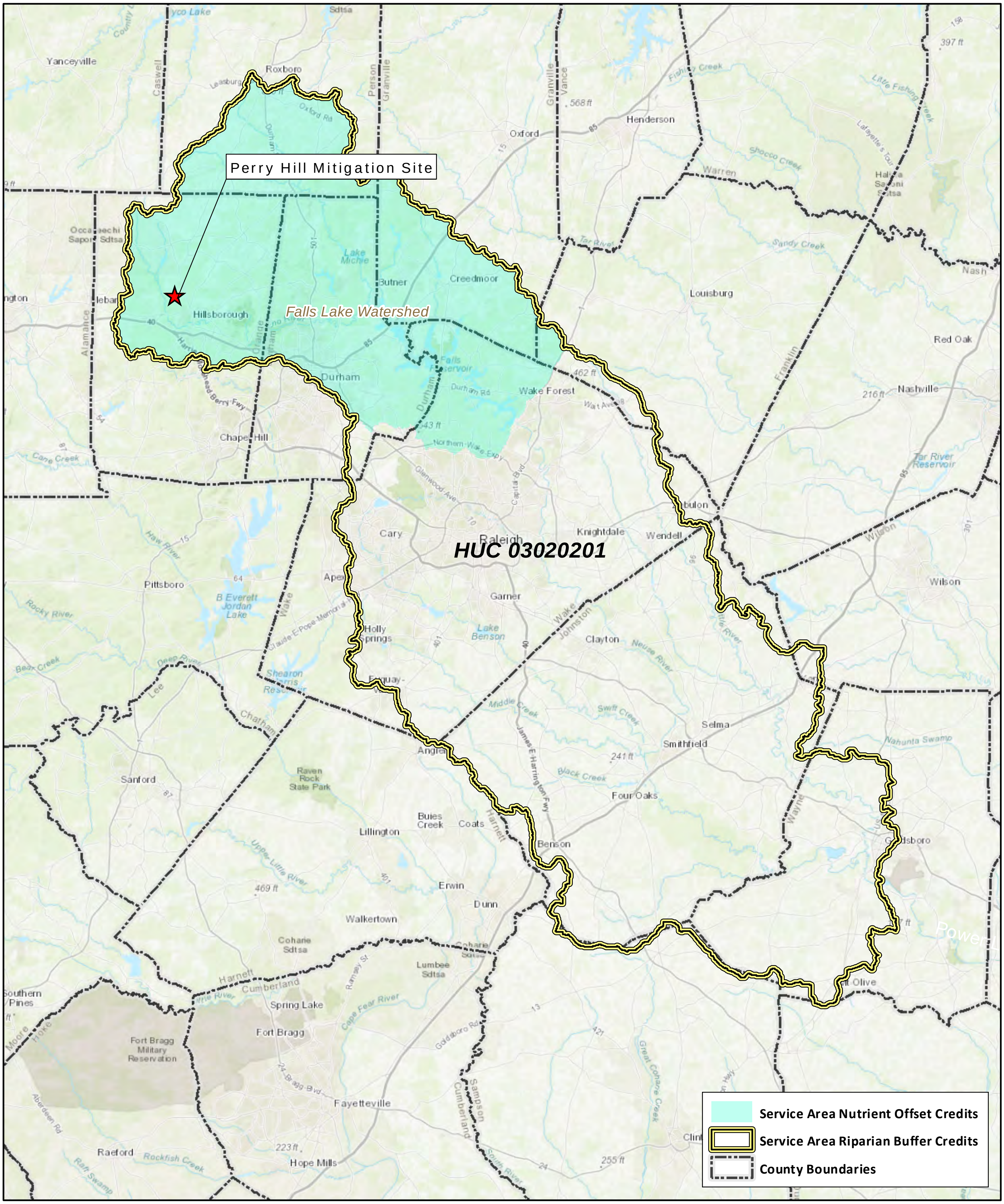
Figure 9 Nutrient Offset Zones Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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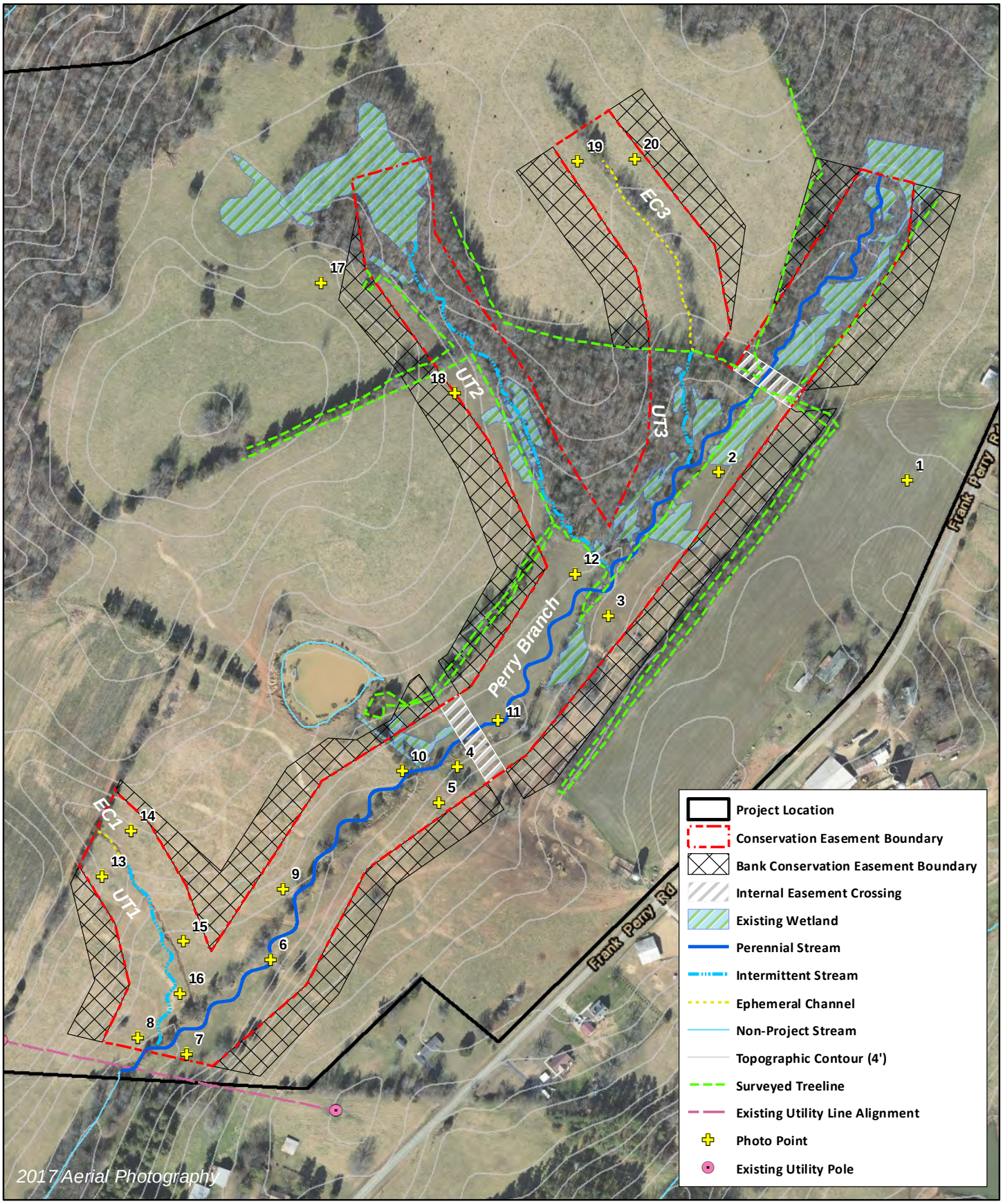
Figure 10 Service Area Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

APPENDIX 1a



WILDLANDS ENGINEERING

0 175 350 700 Feet

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Photo Log Site Map
Perry Hill Mitigation Site
Riparian Buffer Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

Photo Point 1 – Northwest View *(03/03/2020)*

Photo Point 2 – Northeast View *(03/03/2020)*

Photo Point 3 – Northeast View *(03/03/2020)*

Photo Point 4 – Northeast View *(03/03/2020)*

Photo Point 5 – Southwest View *(03/03/2020)*

Photo Point 6 – Northeast View *(03/03/2020)*

Photo Point 7 – Northeast View *(03/03/2020)*

Photo Point 8 – Northeast View *(03/03/2020)*

Photo Point 9 – South View *(03/03/2020)*

Photo Point 10 – Southwest View *(03/03/2020)*

Photo Point 11 – Southwest View *(03/03/2020)*

Photo Point 12 – South View *(03/03/2020)*

Photo Point 13 – Southeast View *(03/03/2020)*

Photo Point 14 – Downward View *(03/03/2020)*

Photo Point 15 – Northwest View *(03/03/2020)*

Photo Point 16 – Northwest View *(03/03/2020)*

	
Photo Point 17 Southeast View *(03/03/2020)*	**Photo Point 18 – Southeast View *(03/03/2020)***
	
Photo Point 19 – Southeast View *(03/03/2020)*	**Photo Point 20 – South View *(03/03/2020)***

APPENDIX 1b

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

April 15, 2019

John Hutton
Wildlands Engineering, Inc
1430 S. Mint St., Suite 104
Charlotte, NC 28203

DWR Project # 2019-0157v2
Orange County

Subject: On-Site Stream Evaluation and Determination for Applicability to the Neuse Riparian Buffer Rules (15A NCAC 02B .0233) and Water Quality Standards

Project Name: Perry Hill Site

Address/Location: 2623 Frank Perry Rd

Parcel ID's: N/A

Streams Evaluated: UTs to Eno River

Field Date: February 26, 2019

DWR Staff: Katie Merritt

Determination Type:	
Buffer:	Stream:
☒ Neuse (15A NCAC 02B .0233) ☐ Tar-Pamlico (15A NCAC 02B .0259) ☐ Catawba (15A NCAC 02B .0243) ☐ Jordan (15A NCAC 02B .0267) (governmental and/or interjurisdictional projects) ☐ Randleman (15A NCAC 02B .0250) ☐ Goose Creek (15A NCAC 02B .0605-.0608)	☒ Ephemeral/Intermittent/Perennial Determination (where local buffer ordinances apply)

See the following table and written explanation regarding the stream determinations.

Feature ID[1]	Feature Type[2]	Not Subject	Subject	Start@	Stop @	Soil Survey	USGS Topo
Perry Branch	P		X	Easement Boundary	Throughout	X	X
EC1	E	X		Culvert	UT1	X	
UT1	I		X	DWR Flag	Perry Branch	X	
UT2	I	X		DWR Flag (headcut below wetland)	Perry Branch		
EC3	E	X		DWR flag	UT3		
UT3	I	X		Woodline @ crossing	Perry Branch		
A	Off-line pond	X		See map			
B	Drainage conveyance	N/A	N/A	See map			

[1] See maps provided showing labeled features
[2] Ephemeral (E), Intermittent (I), Perennial (P), Ditch (D)

The Division of Water Resources (DWR) received a Request from Wildlands Engineering, Inc. (Wildlands) for a Stream Buffer Applicability Determination for a potential mitigation site at the location described above. A Landowner Authorization Form was provided by Wildlands for the subject site. On February 26, 2019, DWR staff, along with staff from Wildlands and Division of Mitigation Services conducted a site visit.

DWR determined that two (2) features on the site, Perry Branch and one Unnamed Tributary to Perry Branch (UT1) are both streams and are subject to the Neuse River Riparian Buffer Rules and are both located on the most recently published NRCS Soil Survey of Guilford County, North Carolina. There are two (2) other Unnamed Tributaries to Perry Branch, UT2 and UT3, that were determined to be at least intermittent but not subject to the Neuse River Riparian Buffer Rules.

There may be other streams or features located on the properties and on the included maps that may be subject to the buffer rules or may be considered jurisdictional according to the US Army Corps of Engineers and subject to the Clean Water Act.

This on-site determination shall expire five (5) years from the date of this letter. Landowners or affected parties that dispute a determination made by the DWR may request a determination by the Director. An appeal request must be made within sixty (60) calendar days of the date of this letter to the Director in writing.

If sending via US Postal Service: *If sending via delivery service (UPS, FedEx, etc.):*

c/o Karen Higgins
DWR – 401 & Buffer Permitting Branch
1617 Mail Service Center
Raleigh, NC 27699-1617

c/o Karen Higgins
DWR – 401 & Buffer Permitting Branch
512 N. Salisbury Street
Raleigh, NC 27604

This determination is final and binding as detailed above, unless an appeal is requested within sixty (60) days.

This determination only addresses the applicability to the buffer rules and does not approve any activity within the buffers. The project may require a Section 404/401 Permit for the proposed activity. Any inquiries regarding applicability to the Clean Water Act should be directed to the US Army Corps of Engineers Raleigh Regulatory Field Office at (919)-554-4884.

If you have questions regarding this determination, please feel free to contact Katie Merritt at (919) 707-3637.

Sincerely,

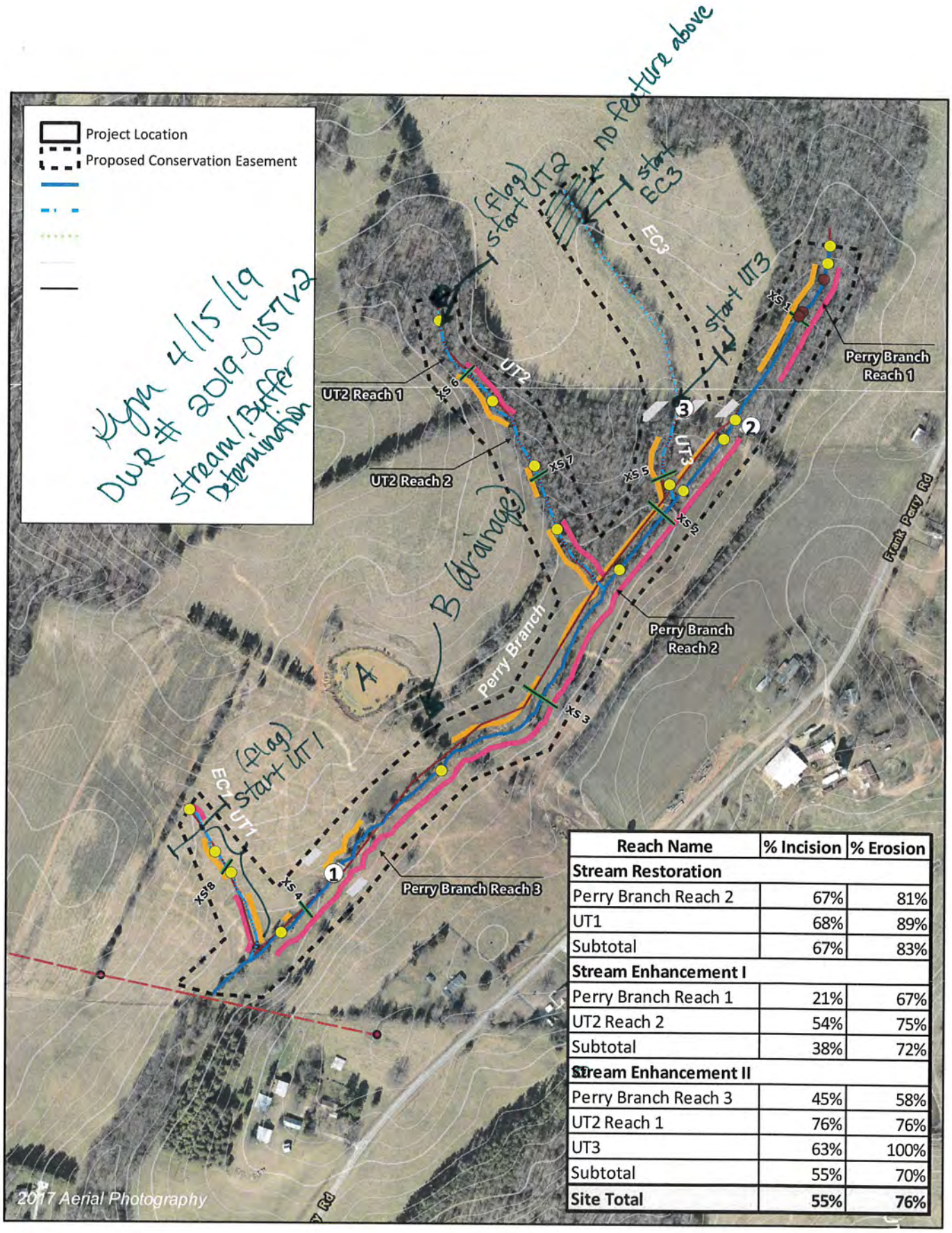
Karen Higgins

Karen Higgins, Supervisor
401 & Buffer Permitting Branch

Attachments: Site Map, Topo, Orange County Soil Survey

cc: 401 & Buffer Permitting Branch file copy
RRO via email- Stephanie Goss
Evelyn Perry, Judy Kadlac, Mary Bishop – PO Box 178, Hillsborough, NC 27278

Filename: 2019-0157v2PerryHillStreamCall(Orange)



Reach Name	% Incision	% Erosion
Stream Restoration		
Perry Branch Reach 2	67%	81%
UT1	68%	89%
Subtotal	67%	83%
Stream Enhancement I		
Perry Branch Reach 1	21%	67%
UT2 Reach 2	54%	75%
Subtotal	38%	72%
Stream Enhancement II		
Perry Branch Reach 3	45%	58%
UT2 Reach 1	76%	76%
UT3	63%	100%
Subtotal	55%	70%
Site Total	**55%**	**76%**

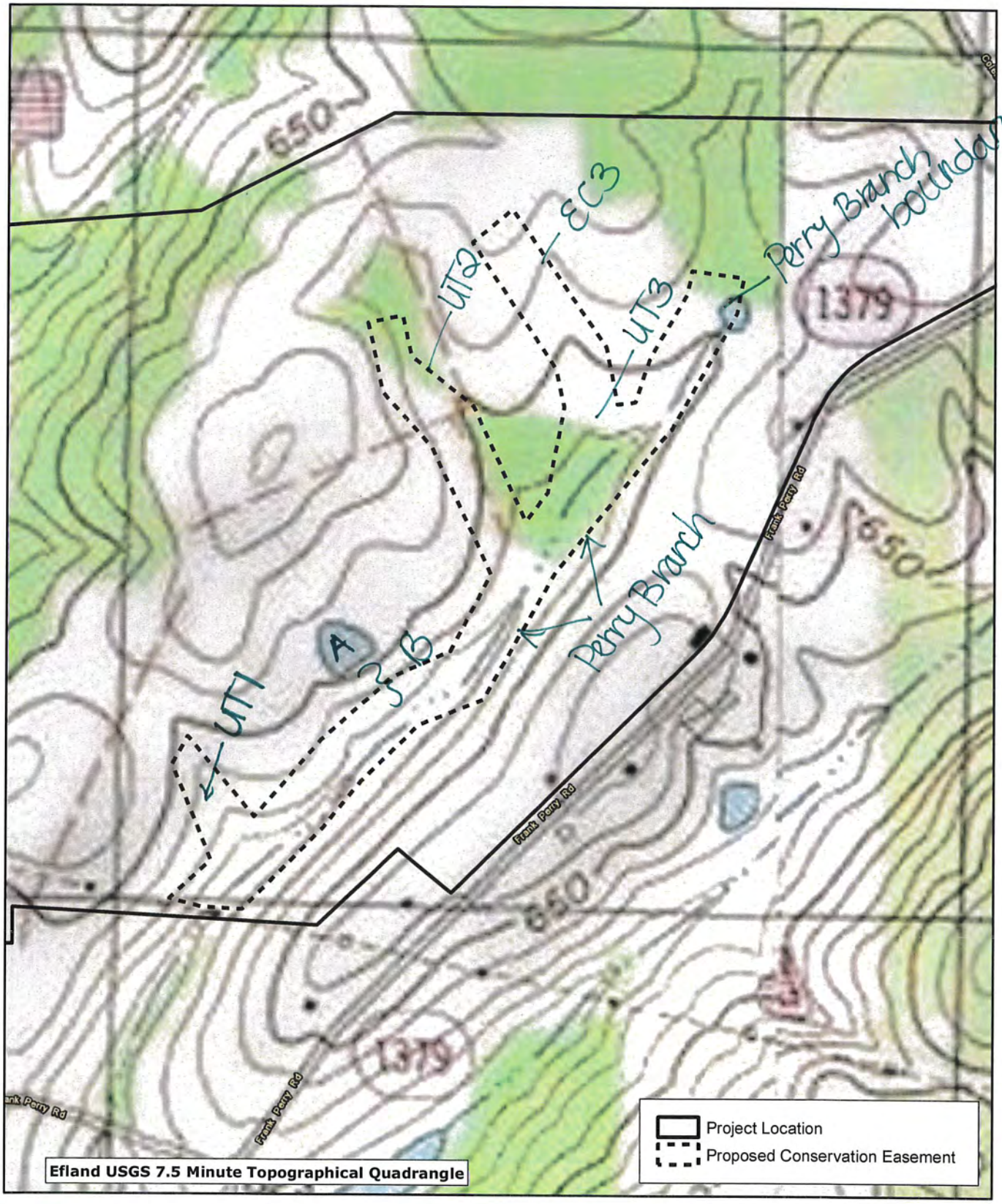
WILDLANDS ENGINEERING

0 250 500 Feet

N

Site Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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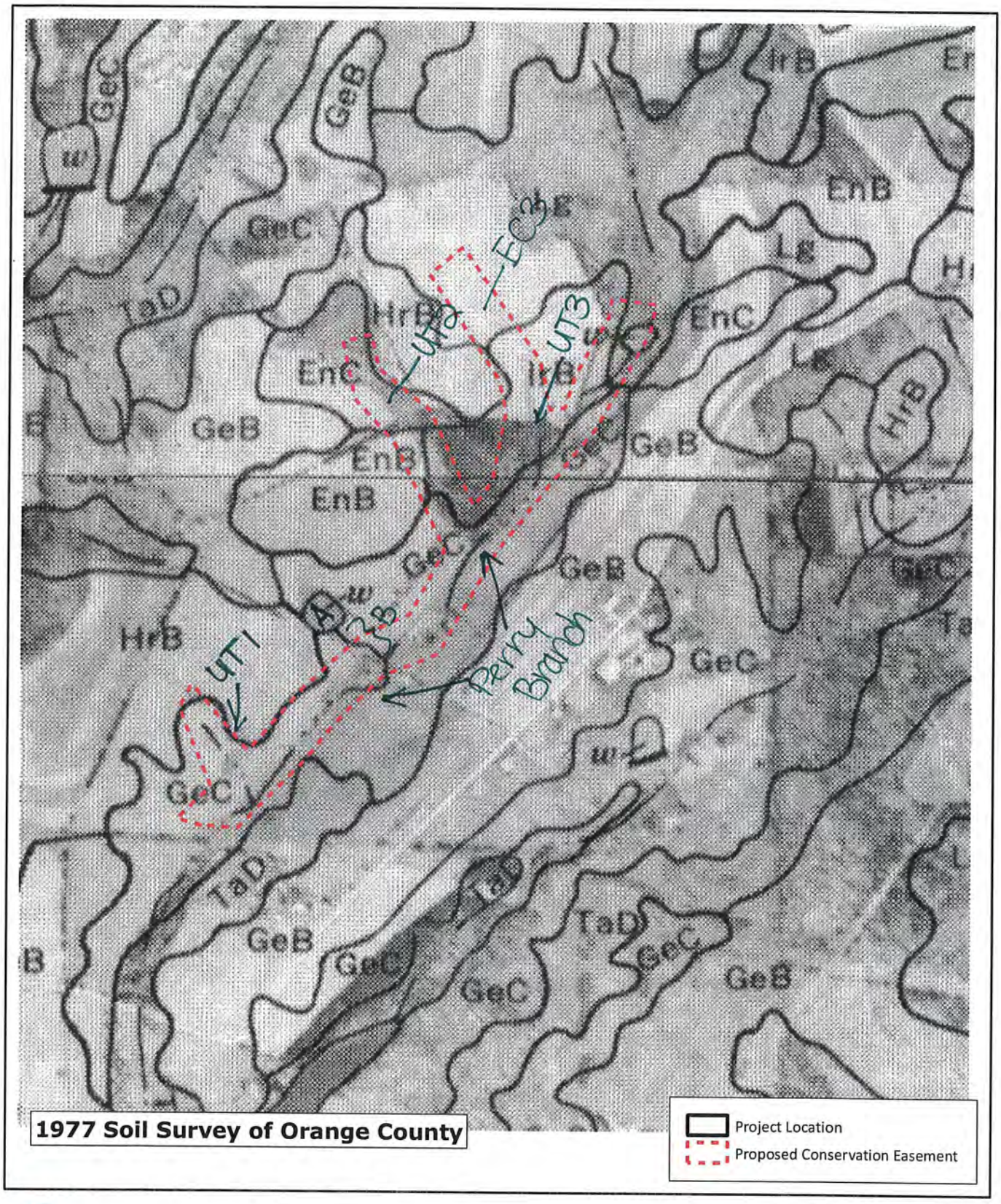
USGS Site Topographic Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC

Kym 4/15/19
DWR#2019-0157v2



WILDLANDS ENGINEERING

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NRCS 1977 Soils Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC

Kyan 4/15/19
DWR# 2019-0157 v2

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

April 16, 2019

John Hutton
Wildlands Engineering, Inc
1430 S. Mint St., Suite 104
Charlotte, NC 28203
(via electronic mail: jhutton@wildlandseng.com)

DWR# 2019-0157
Orange County

Re: Site Viability for Buffer Mitigation & Nutrient Offset – Perry Hill Site
Located near 2623 Frank Perry Rd, Hillsborough
Neuse 03020201

Dear Mr. Hutton,

On February 25, 2019, Katie Merritt, with the Division of Water Resources (DWR), received a request from Wildlands Engineering, Inc. (Wildlands) for an onsite mitigation determination near the above-referenced site (Site). The Site is located within the Upper Falls Lake Watershed of the Neuse River Basin in the 8-digit Hydrologic Unit Code. The Site is being proposed as part of a full-delivery nutrient offset, stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007576). Members of the Interagency Review Team (IRT) and Division of Mitigation Services were also present onsite. At your request, on February 26, 2019, Ms. Merritt performed an onsite assessment of riparian land uses adjacent to streams onsite, which are shown on the attached map labeled "Concept Map".

Ms. Merritt's evaluation of the features onsite and their associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) and landward 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
EC1	Ephemeral (see map)	No	Non-forested pasture grazed by cattle	[5]Yes	Yes	**Restoration Site** per 15A NCAC 02B .0295 (o)(7) *Must submit supporting documentation of additional requirements under .0295 (o)(7) to be viable for buffer mitigation.*

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
UT1	Stream	Yes	Non-forested pasture grazed by cattle	Yes	Yes	**Restoration Site** per 15A NCAC 02B .0295 (n)
Perry Branch	Stream	Yes	Combination of forested & non-forested pasture grazed by cattle	[3,4]Yes	Yes *(non-forested areas only)*	Non-forested areas – **Restoration Site** per 15A NCAC 02B .0295 (n) Forested areas - **Enhancement Site** per 15A NCAC 02B .0295 (o)(6) if fence is installed **or Preservation Site** per 15A NCAC 02B .0295 (o)(5) if fence isn't installed.
UT2	Intermittent @ DWR flag	No	Combination of forested & non-forested pasture grazed by cattle	[3,4]Yes	Yes *(non-forested areas only)*	Non-forested areas – **Restoration Site** per 15A NCAC 02B .0295 (o)(3) Forested areas - **Enhancement Site** per 15A NCAC 02B .0295 (o)(6) if fence is installed **or Preservation Site** per 15A NCAC 02B .0295 (o)(4) if fence isn't installed.
EC3	Ephemeral (see map)	No	Non-forested pasture grazed by cattle	[5]Yes	Yes	**Restoration Site** per 15A NCAC 02B .0295 (o)(7) *Must submit supporting documentation of additional requirements under .0295 (o)(7) to be viable for buffer mitigation.*
UT3	Intermittent @ crossing & woodline	No	forested pasture grazed by cattle	[3,4]Yes	No	Forested areas - **Enhancement Site** per 15A NCAC 02B .0295 (o)(6) if fence is installed **or Preservation Site** per 15A NCAC 02B .0295 (o)(4) if fence isn't installed.
A	Off-line pond	No	Non-forested pasture	No	No	N/A

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
B	Drainage conveyance	No	Non-forested pasture	No	Yes	**Restoration Site** per 15A NCAC 02B .0295 (n)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated April 15, 2019 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS .
[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*
[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation Only site to comply with this rule.
[4]The area described as an Enhancement Site was assessed and determined to comply with all 15A NCAC 02B .0295(o)(6). Cattle exclusion fencing is required to be installed around the mitigation area to get buffer credit under this part of the rule.
[5]The area of the mitigation site on ephemeral channels shall comprise no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 02B .0295 (o)(7).

The maps attached to this letter were prepared by Wildlands and were initialed by Ms. Merritt on April 15, 2019 and April 16, 2019. **This letter should be provided in all stream and wetland, buffer and/or nutrient offset mitigation plans for this Site.**

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on April 16, 2021 or upon the submittal of an As-Built Report to the DWR, whichever comes first. This letter should be provided in all stream, wetland or buffer mitigation plans for this Site.

Please contact Katie Merritt at (919) 707-3637 if you have any questions regarding this correspondence.

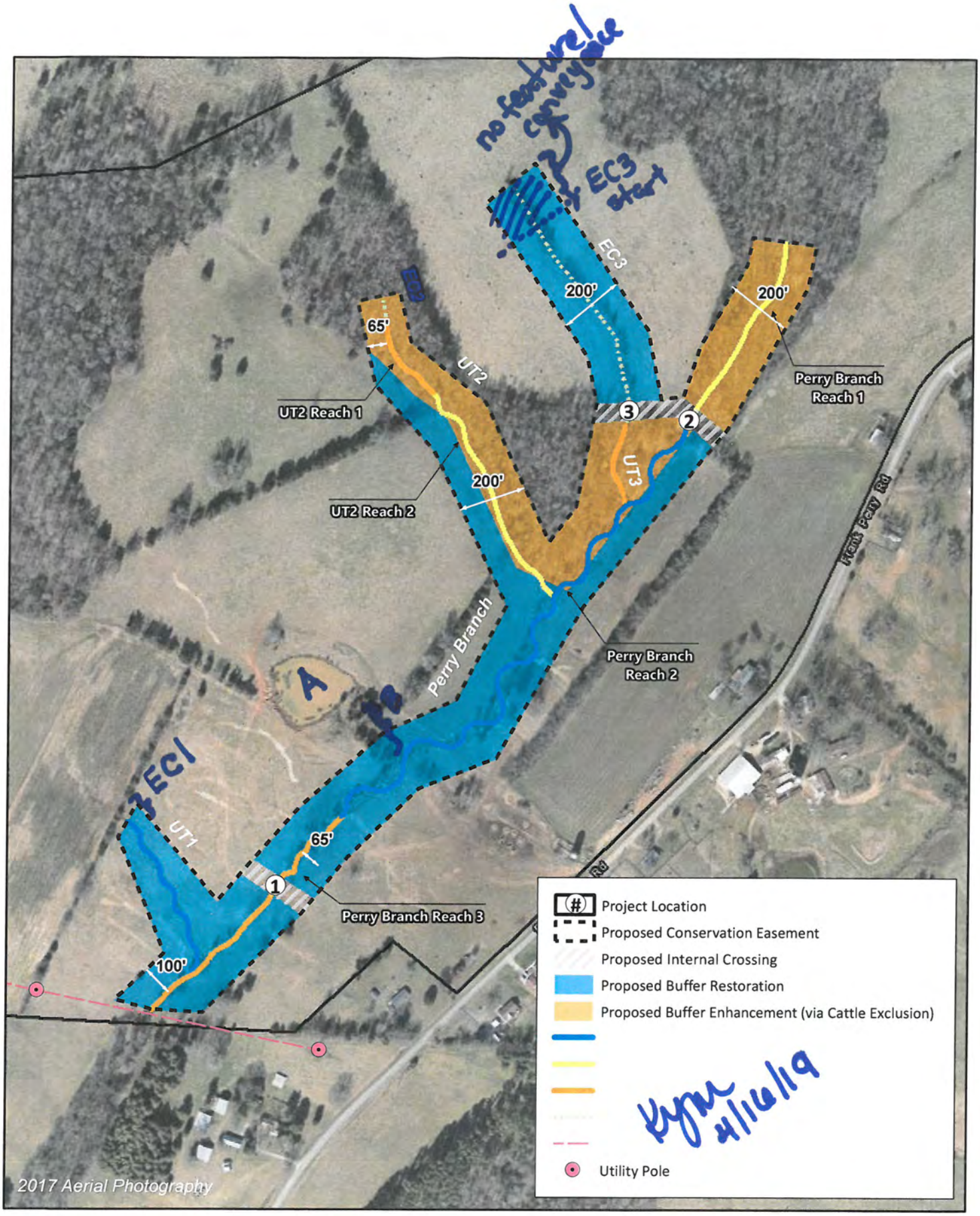
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Concept Map, Site map

cc: File Copy (Katie Merritt)



WILDLANDS ENGINEERING

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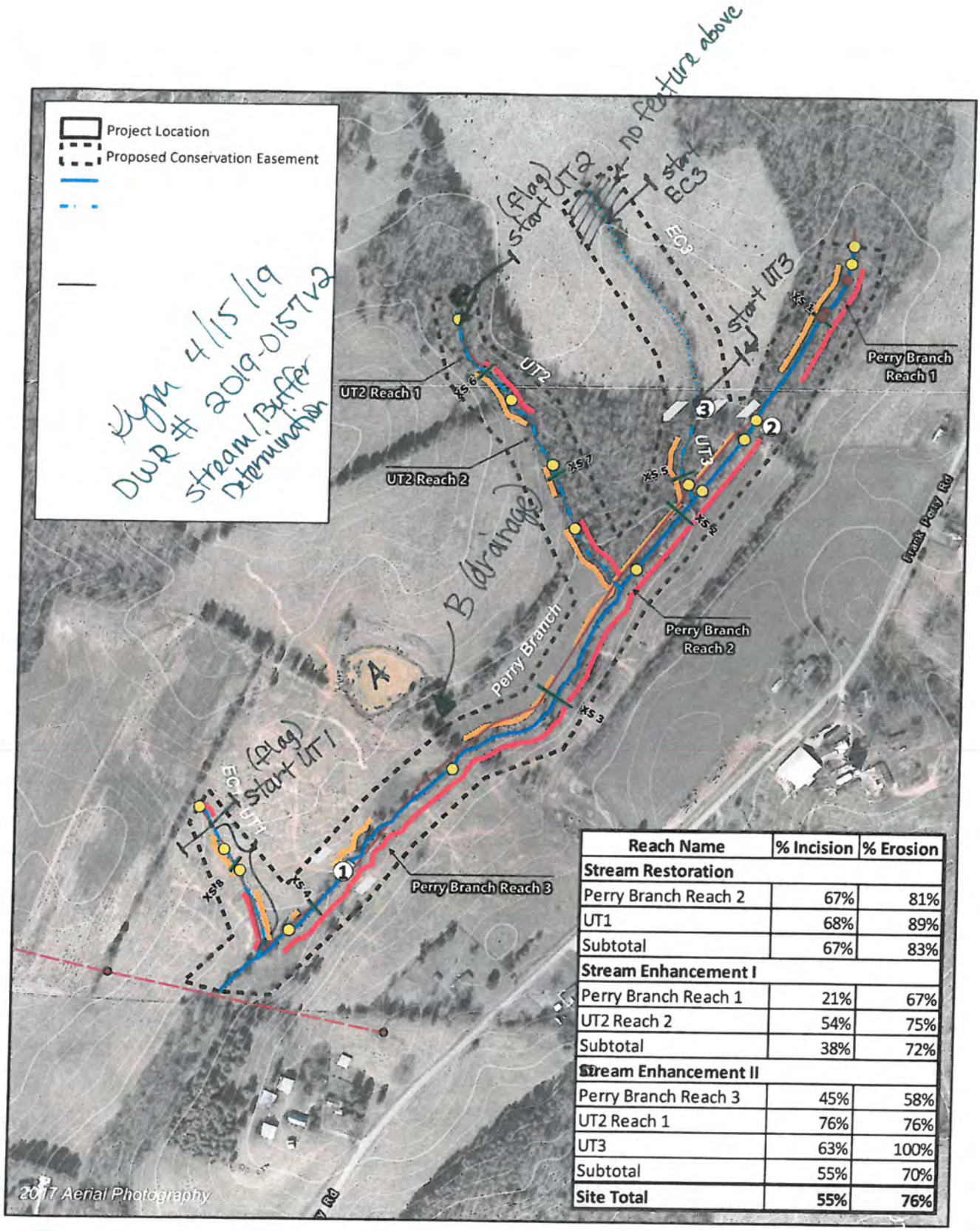
Riparian Buffer Concept Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC

DWR # 2019-0157



Reach Name	% Incision	% Erosion
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Subtotal	38%	72%
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Site Total	**55%**	**76%**

WILDLANDS ENGINEERING

0 250 500 Feet

N

Site Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

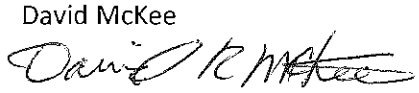
Orange County, NC

Attestation from David McKee, the farmer who leases land that is part of Perry Hill Mitigation Project

I attest that cattle had access to the land shown on Katie Merritt's email in July, 1997.

Sincerely,

David McKee



Signed 3/15/19

Daniel Johnson

From: Chris Roessler
Sent: Thursday, April 2, 2020 1:35 PM
To: Daniel Johnson
Cc: Andrea Eckardt
Subject: FW: [External] FW: Cattle Exclusion assessment-Perry Hill-need more info
Attachments: attestation_DavidMcKee_15March2019.pdf

How bout this?

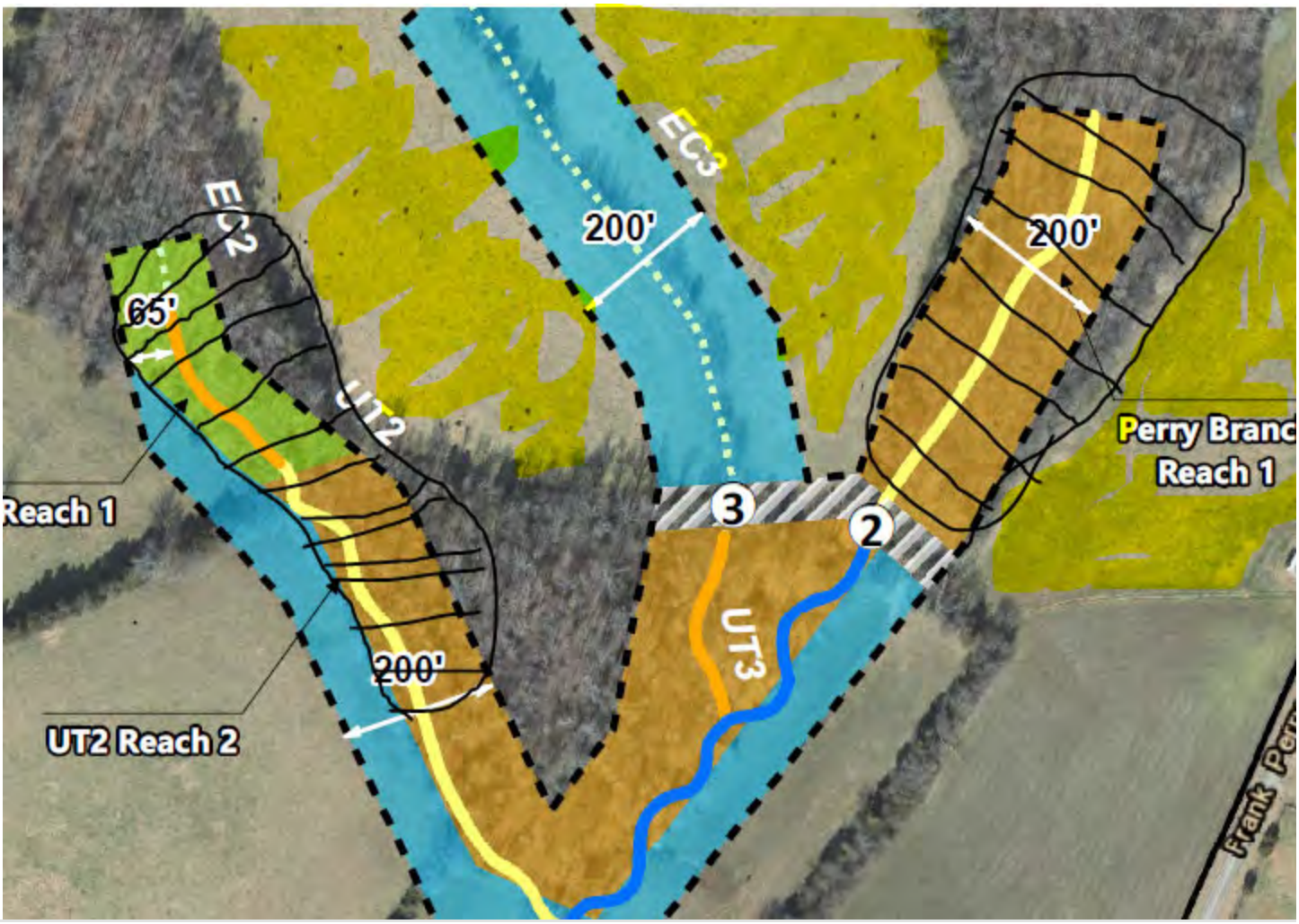
. . . . . .

Chris Roessler | *Senior Scientist/Project Manager*
O: 919.851.9986, x 111 **M**: 919.624.0905

Wildlands Engineering, Inc.
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609

From: Merritt, Katie <katie.merritt@ncdenr.gov>
Sent: Monday, April 15, 2019 1:50 PM
To: Chris Roessler <croessler@wildlandseng.com>
Cc: John Hutton <jhutton@wildlandseng.com>
Subject: FW: [External] FW: Cattle Exclusion assessment-Perry Hill-need more info

Hey Chris,
Based on Mr. Mckee's letter and other site factors I observed during my site visit on February 26, 2019, I will support that cattle had access to the areas circled in the picture below. Therefore, based on this assessment, would you like to provide a revised map for me to use for the Site Viability letter? Thus, showing the Preservation area (green) as cattle exclusion for Enhancement? If so, let me know.



From: Chris Roessler <croessler@wildlandseng.com>
Sent: Monday, March 18, 2019 7:32 AM
To: Merritt, Katie <katie.merritt@ncdenr.gov>
Cc: John Hutton <jhutton@wildlandseng.com>
Subject: [External] FW: Cattle Exclusion assessment-Perry Hill-need more info

Hi Katie-> I showed David McKee your email and the map below and he was sure there were cows in those areas in July 1997.
He signed the attached to attest to this. Let me know if you need anything else. Thanks, Chris

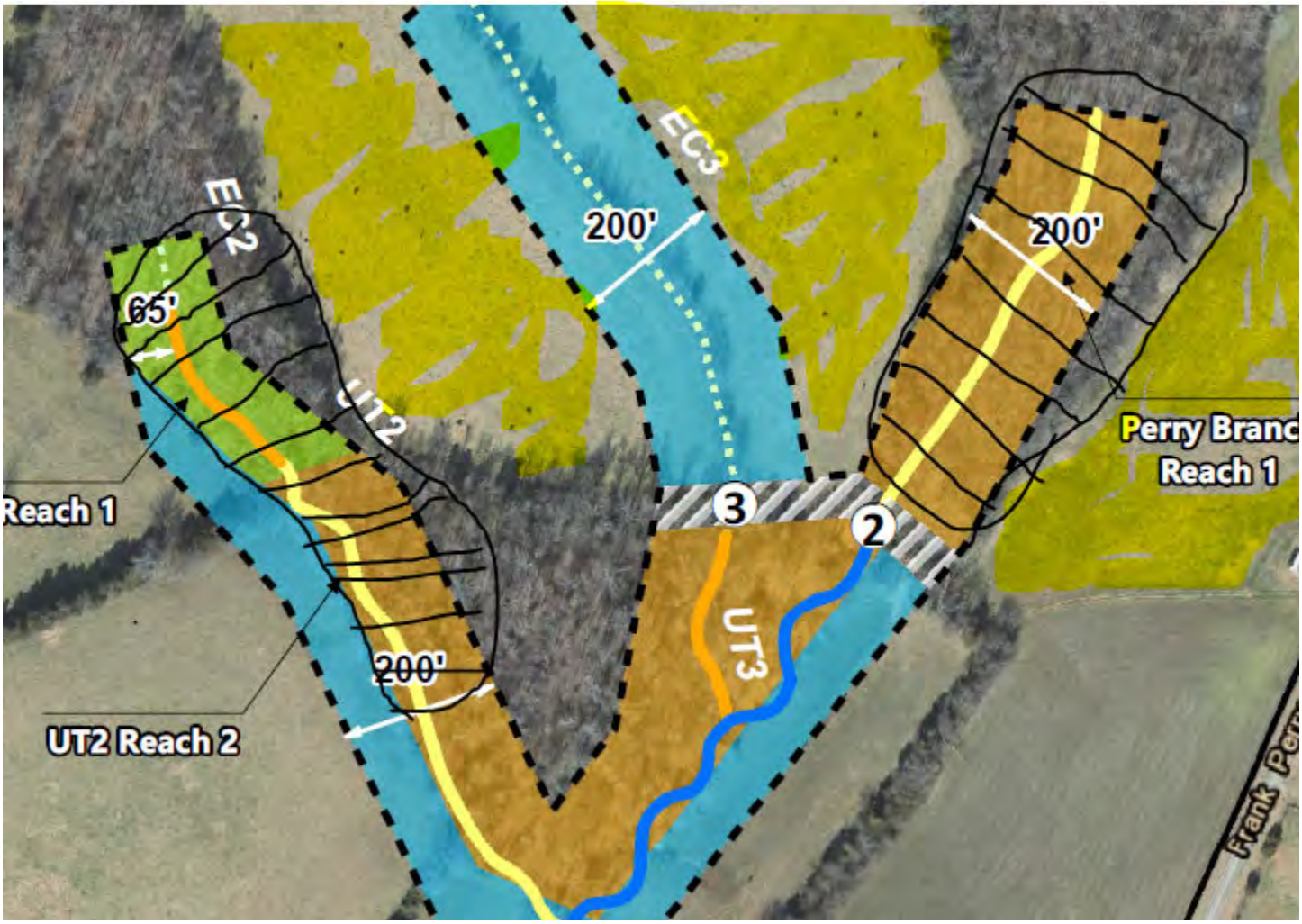
. . . . . .

Chris Roessler | *Senior Scientist/Project Manager*
O: 919.851.9986, x 111 **M**: 919.624.0905

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

From: Merritt, Katie <katie.merritt@ncdenr.gov>
Sent: Wednesday, March 6, 2019 2:37 PM
To: John Hutton <jhutton@wildlandseng.com>; Daniel Taylor <dtaylor@wildlandseng.com>
Cc: Schaffer, Jeff <jeff.schaffer@ncdenr.gov>
Subject: Cattle Exclusion assessment-Perry Hill-need more info

Hey John,
Below is a picture showing two forested areas hatched in black. Based on my onsite observations of these areas and my review of the historical photos I was able to dig up, I am not certain that these areas qualify under 15A NCAC 02B .0295 (o)(6) to receive Enhancement buffer credit at a 2:1 ratio. These areas did have cattle access during the time of our site visit. However, when looking at both historical aerials of these areas prior to the buffer protection rule as well as the presence of relic pasture fencing in and around the areas, it would appear the cattle were excluded from having access at some point and possibly prior to the effective date of the rule (1997). It isn't until approximately 2008 that cows are observed in the fields adjacent to EC3 and Reach 1 of Perry Branch shown highlighted in Yellow below. Unless Wildlands has anything more they can provide me to assist in this assessment to confirm w/o a doubt there were cows present in the forested areas prior to the effective buffer rule date, I'm going to issue the viability letter based on my Best Professional Judgement and show these areas as viable for Preservation buffer credit under 15A NCAC 02B .0295 (o)(4) which would yield a ratio of 5:1. I'd like to issue this letter by the 15th if at all possible, so please send me anything you have prior to then. If Wildlands agrees with the assessment of Preservation, then no information is required and the letter will be issued.



Thank you,
Katie

please note my phone number has changed

Katie Merritt
Nutrient Offset & Buffer Banking Coordinator
401 & Buffer Permitting Unit
North Carolina Department of Environmental Quality
Office: 919-707-3637
Work Cell: 919-500-0683
Website: http://portal.ncdenr.org/web/wq/401bufferpermitting

512 N. Salisbury Street, Raleigh, NC 27620
1617 Mail Service Center, Raleigh, NC 27699-1617

Appendix 2

Site Protection Instrument

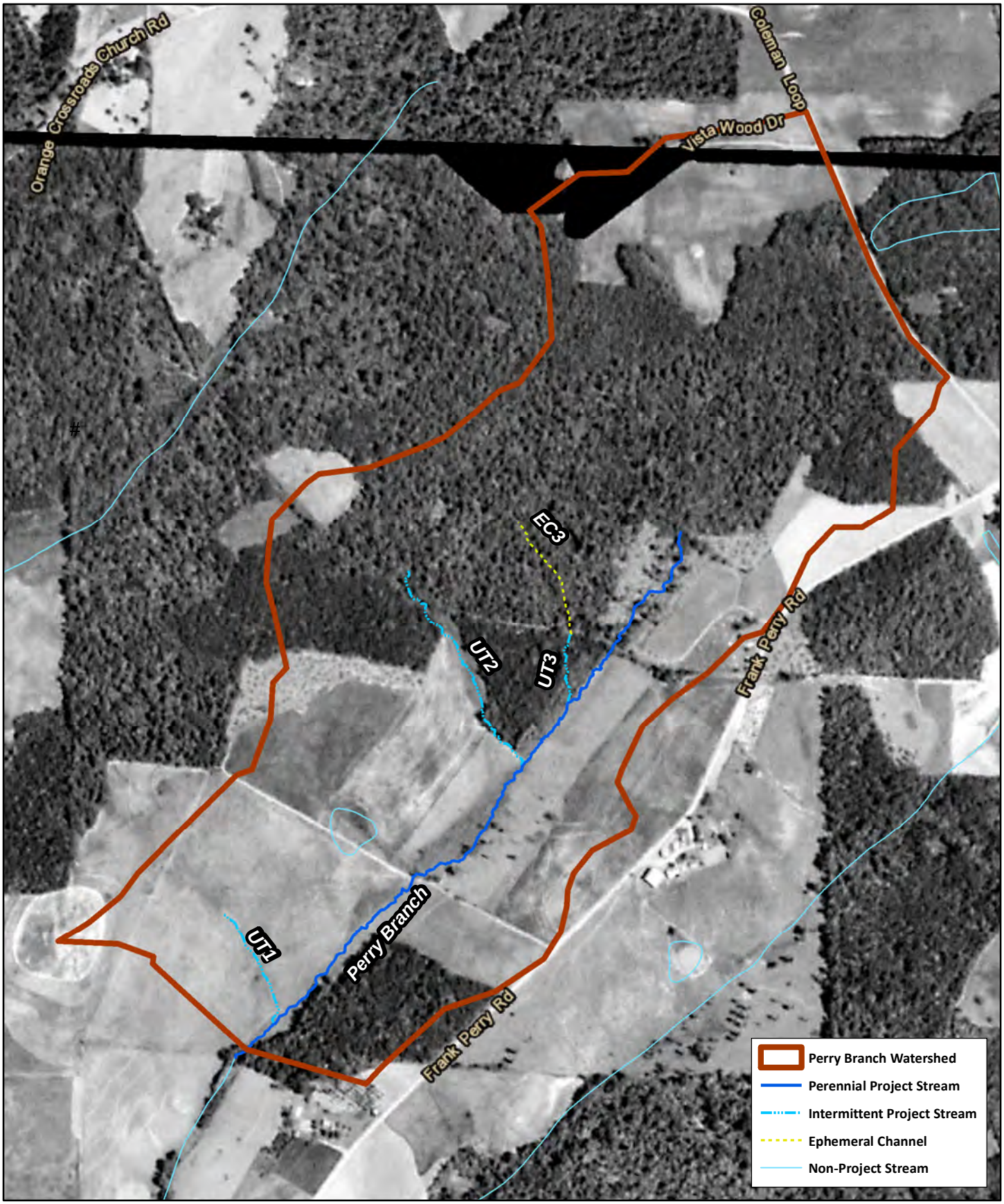
The land required for construction, management, and stewardship of this mitigation project includes portions of the parcel listed in the table below. An option to purchase a conservation easement on a portion of Evelyn J. Perry; Judy and Gene Kadlac; and Mary C. P. and Hubert Bishop property as identified below has been executed. Upon issuance of the nationwide permit for this project and prior to construction, a conservation easement will be established to encompass the restored and enhanced streams and their corresponding riparian buffers associated with this project.

Table 1: Site Protection Instrument

Landowner	PIN	County	Site Protection Instrument	Memorandum of Option/Temporary Access and Conservation Easement Deed Book (DB) and Page Number (PG)	Acreage to be Protected
Evelyn J. Perry, Judy Kadlac, Gene Kadlac, Mary C.P. Bishop and Hubert Bishop	9865081397	Orange	Conservation Easement	DB: 6513 PG: 42	26.88

The site protection instrument requires 60-day advance notification to the USACE and or DMS before any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

Appendix 3



WILDLANDS ENGINEERING

0 300 600 1,200 Feet

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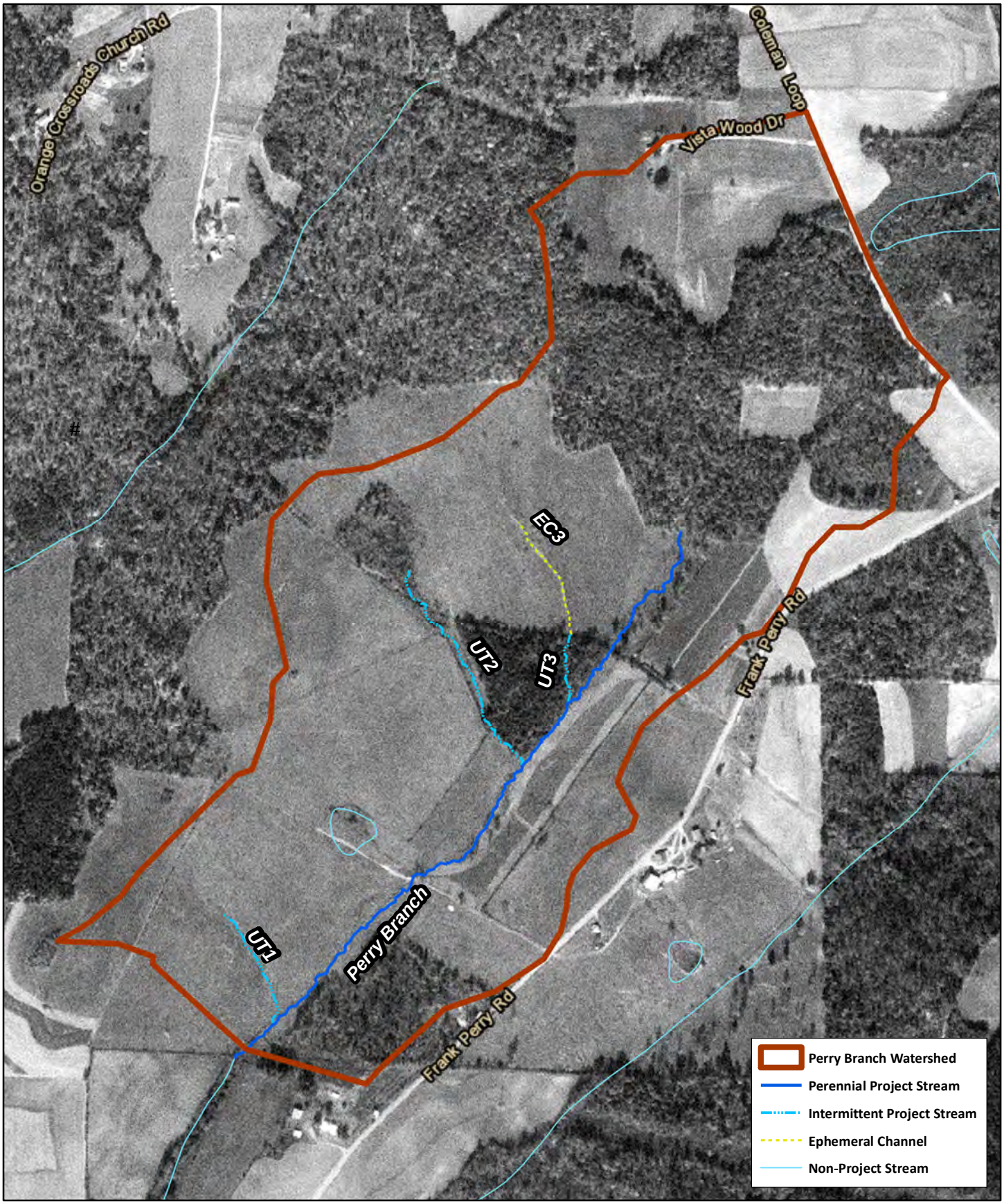
1938 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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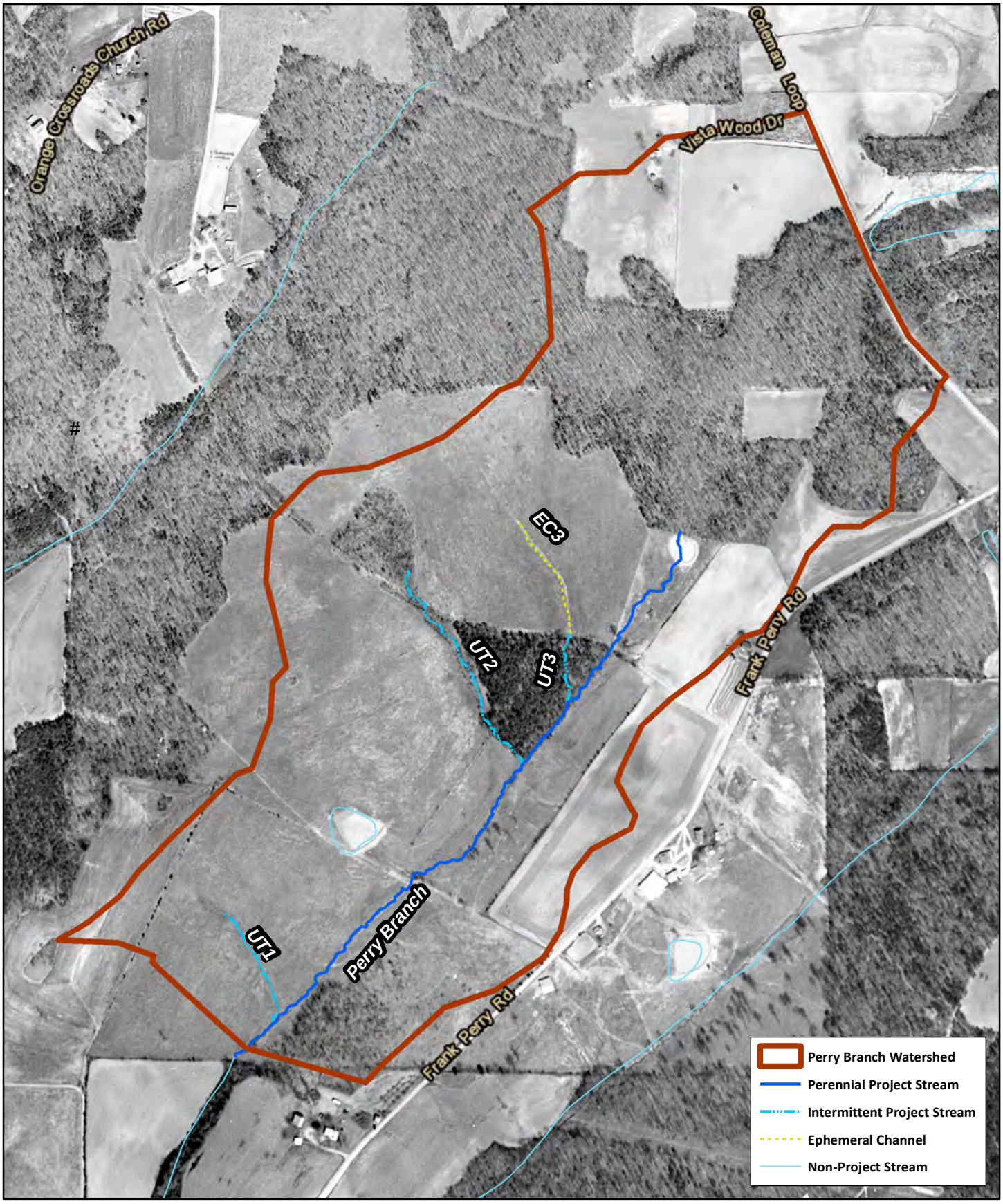
1950 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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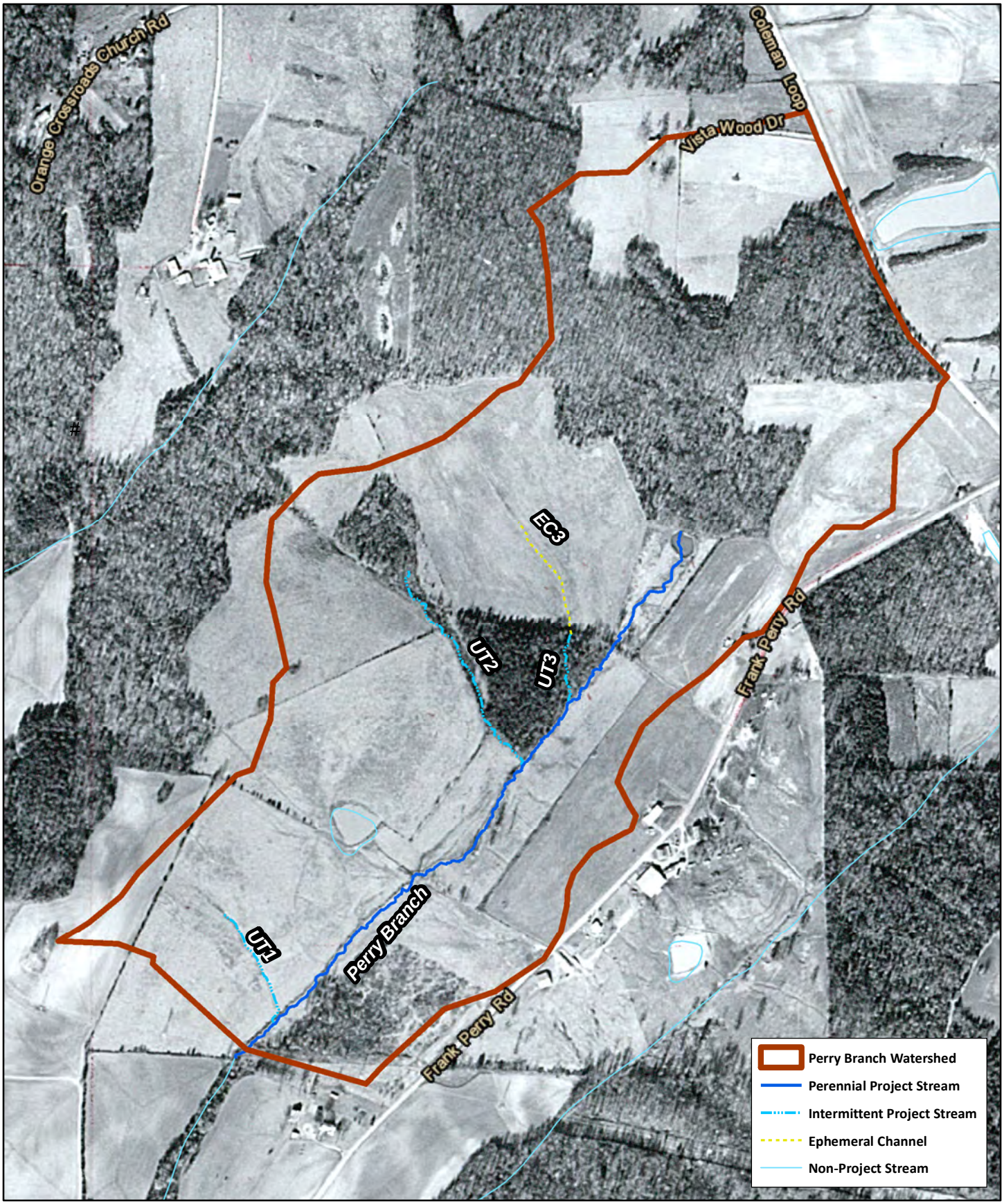
1955 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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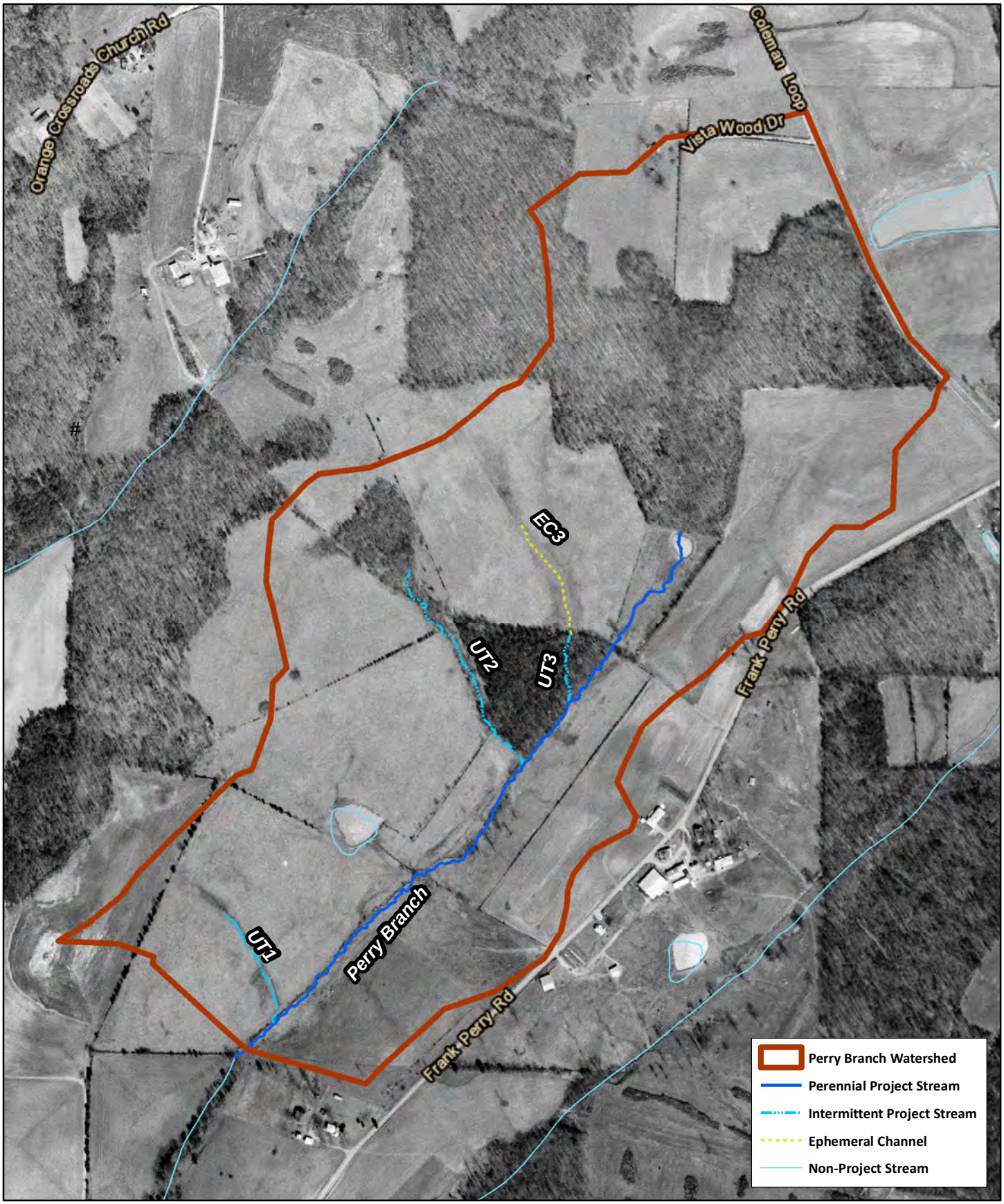
1960 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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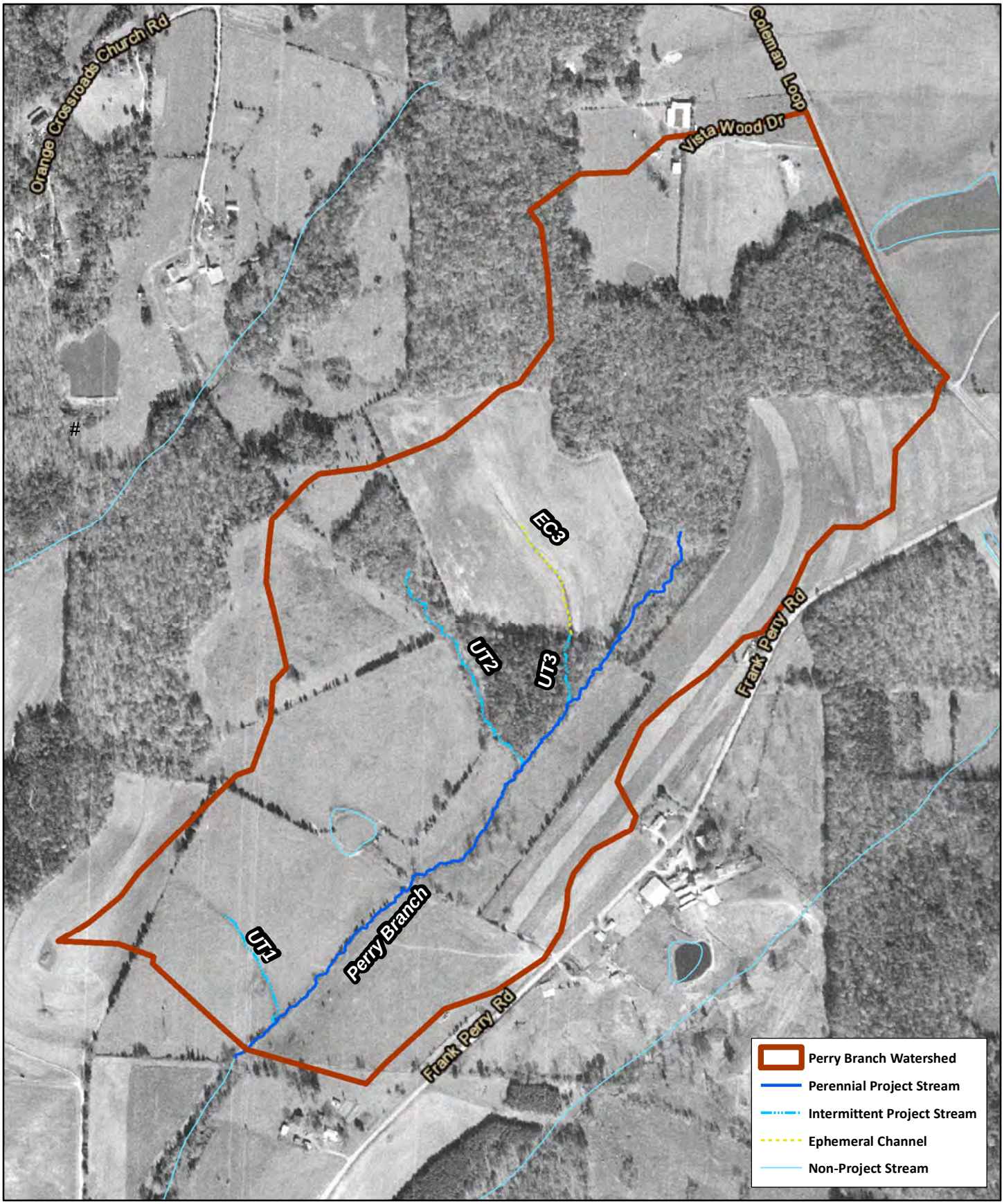
1964 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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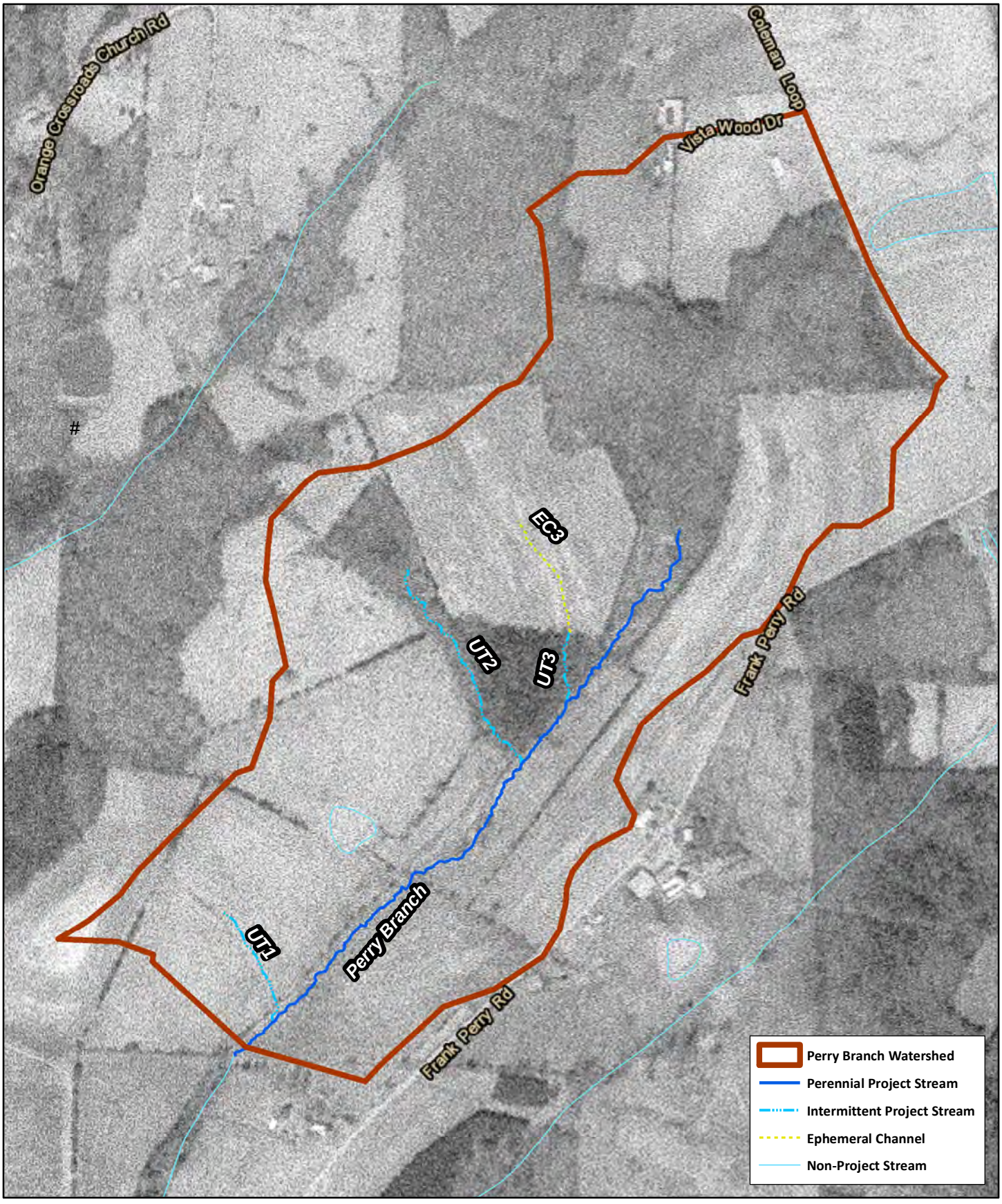
1975 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 300 600 1,200 Feet

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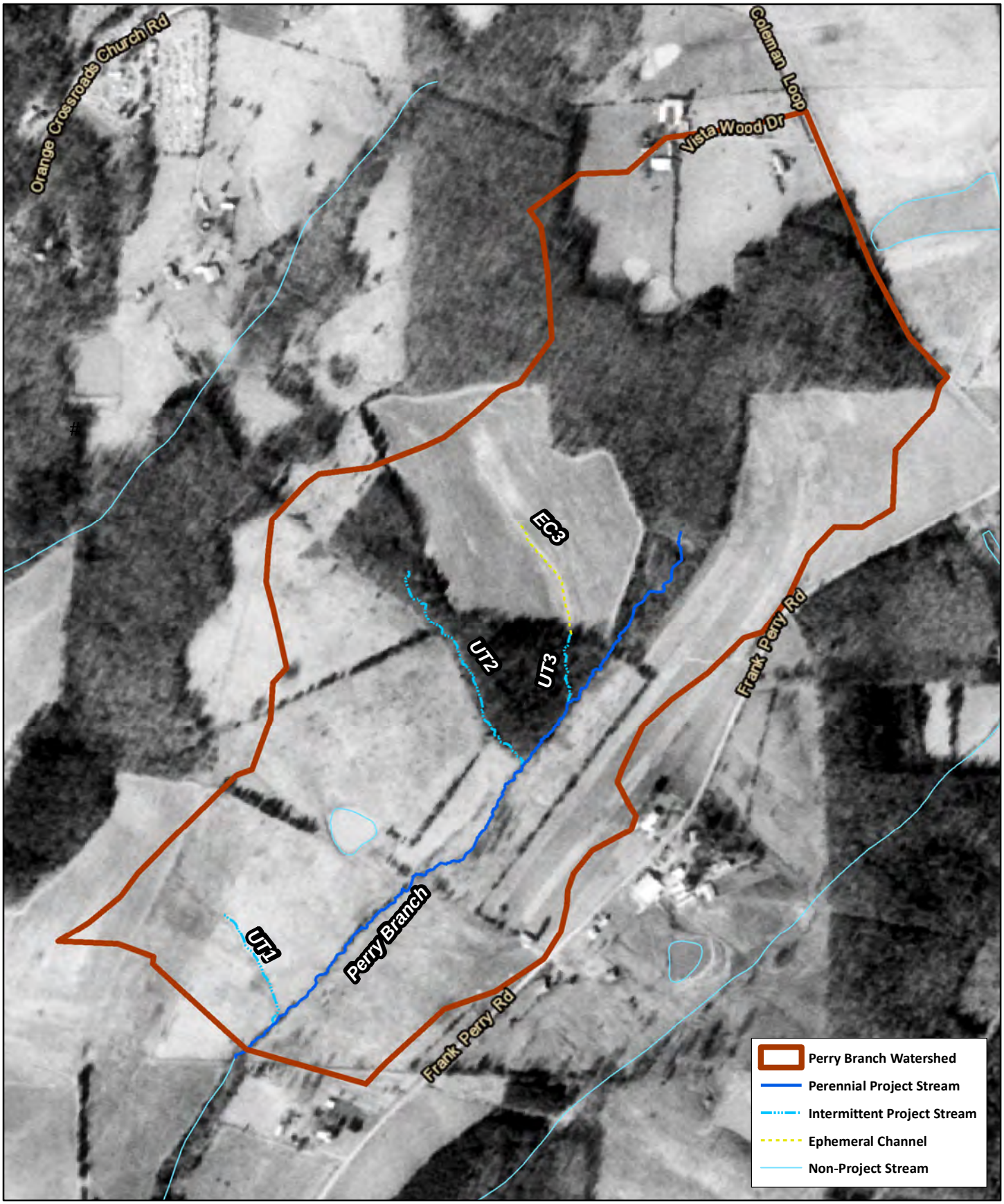
1977 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 300 600 1,200 Feet

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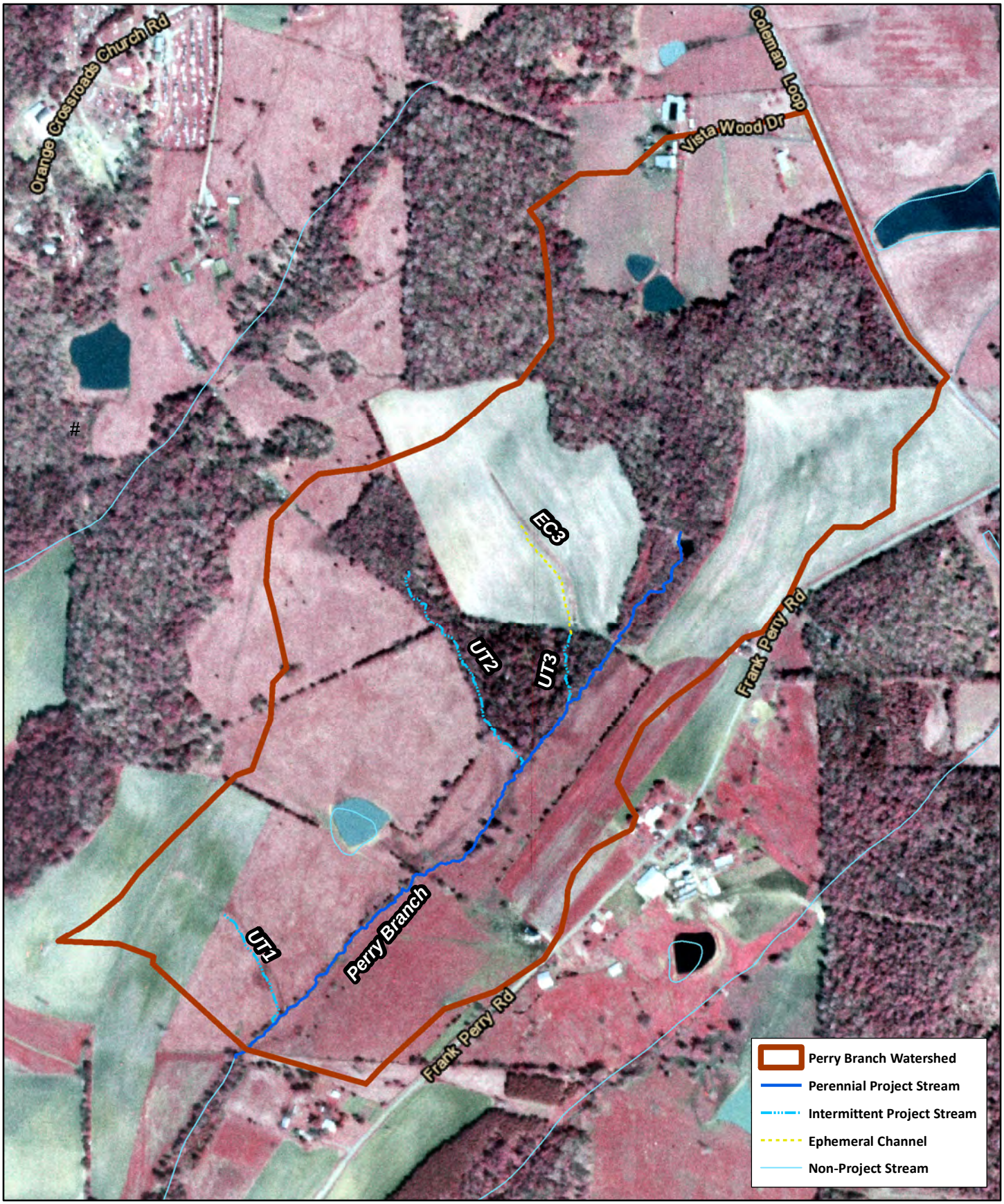
1980 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

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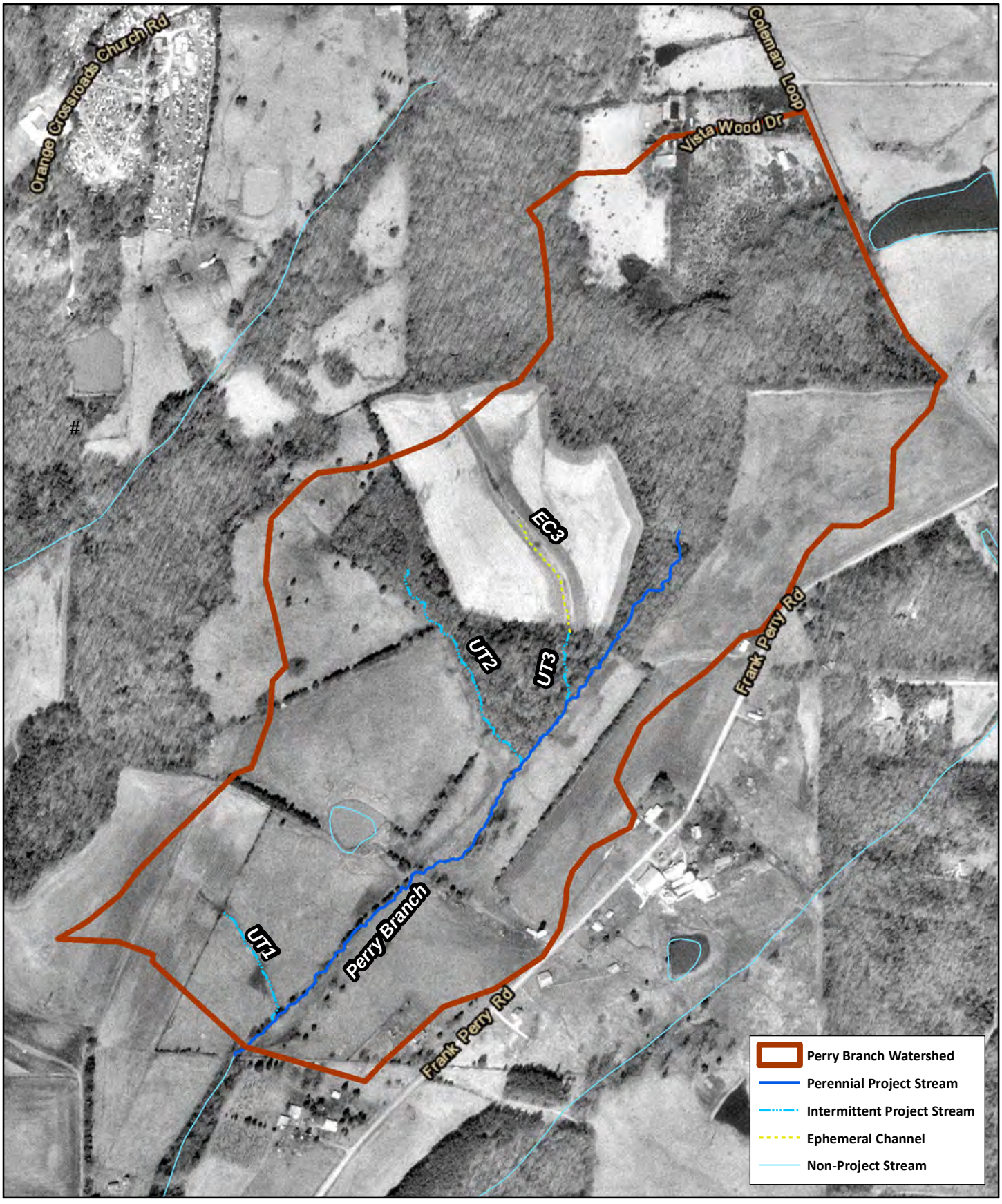
1982 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 300 600 1,200 Feet

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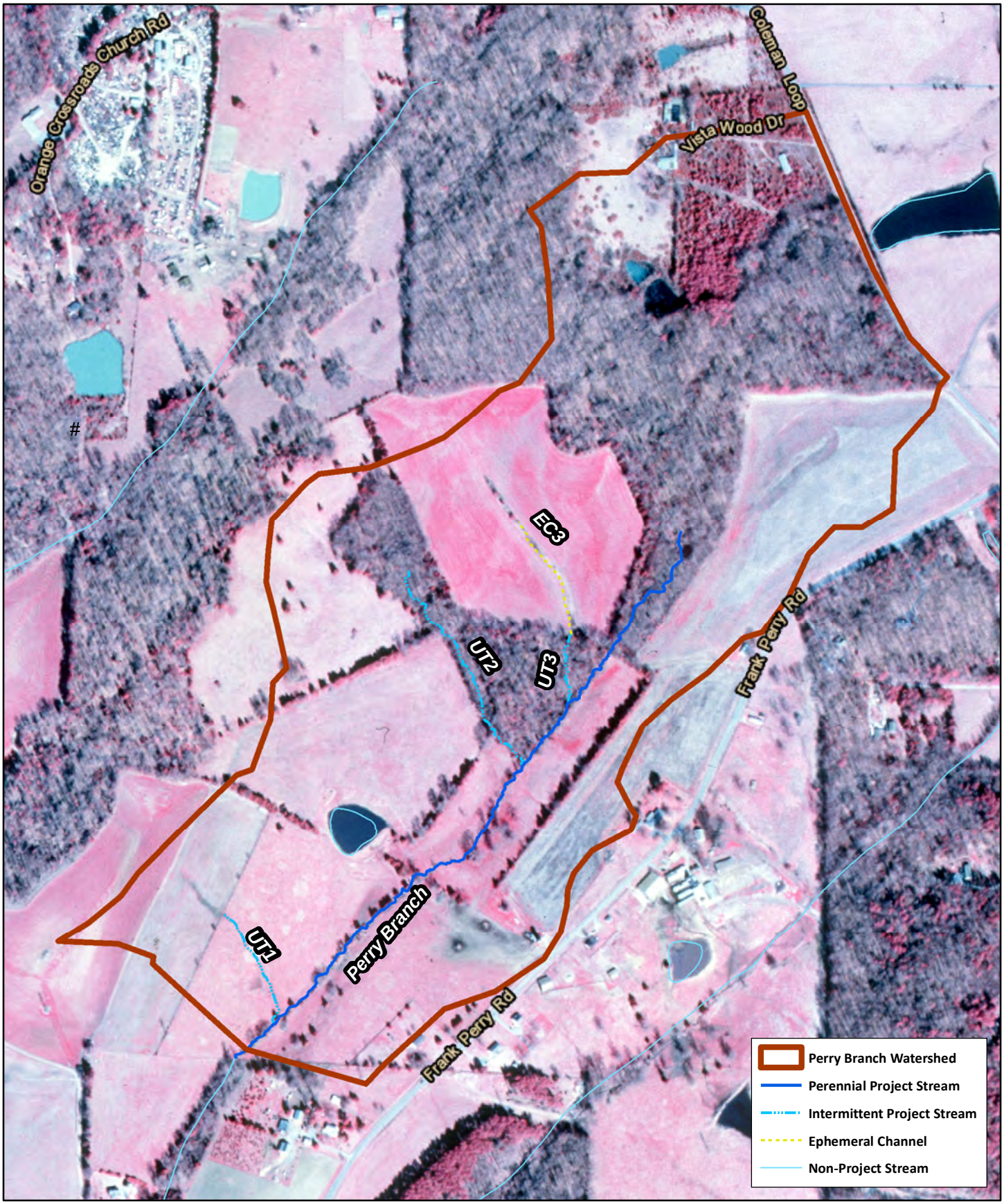
1993 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



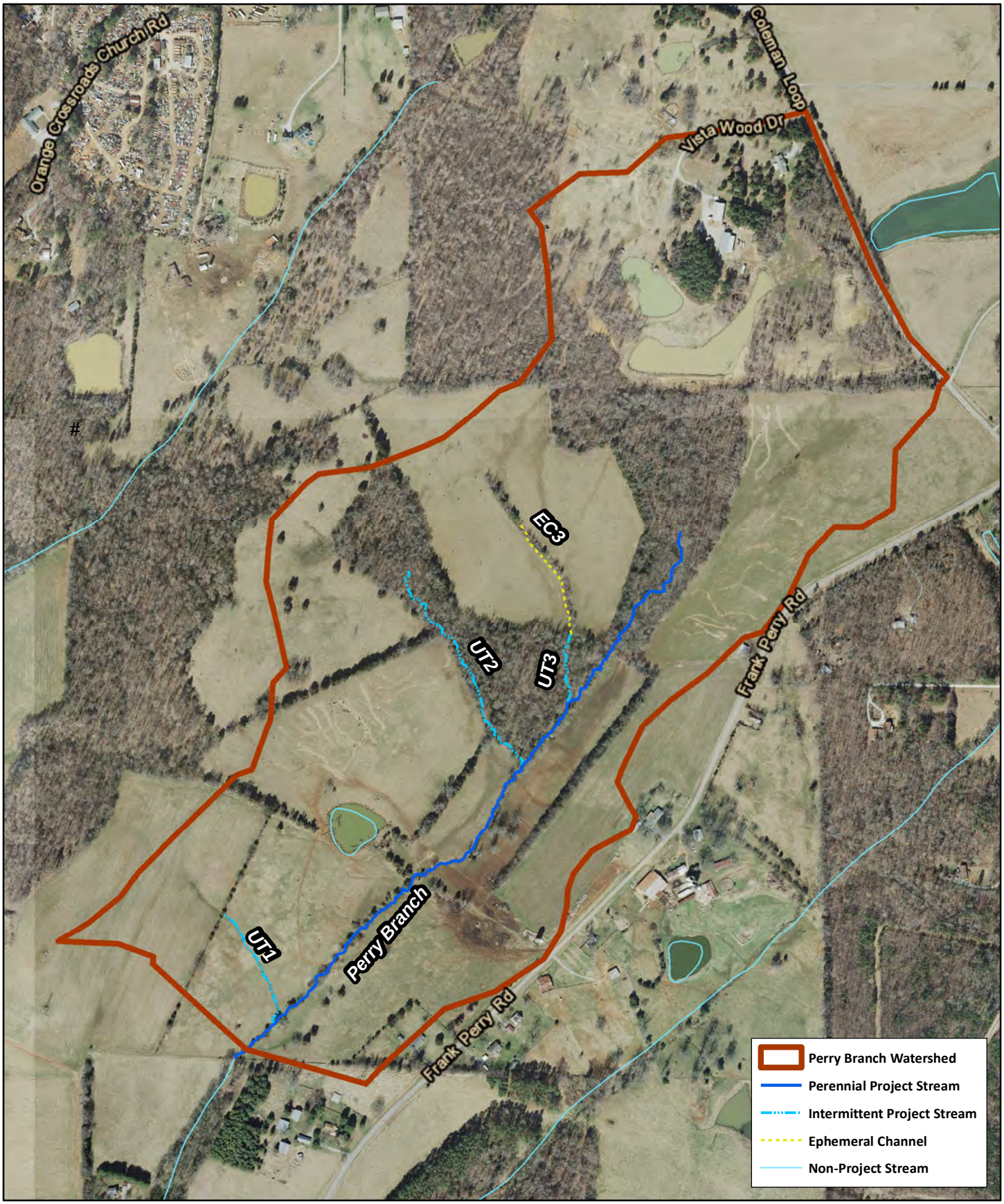
WILDLANDS ENGINEERING

0 300 600 1,200 Feet

N

1999 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 300 600 1,200 Feet

N

2013 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

WILDLANDS ENGINEERING

0 300 600 1,200 Feet

N

2017 Aerial Photo
Perry Hill Mitigation Site
Mitigation Plan
Neuse River Basin (03020201)

Orange County, NC

Appendix 4

From: Dailey, Samantha J CIV USARMY CESAW (USA)
To: Win Taylor
Subject: RE: Perry Hill PJD Revisions
Date: Wednesday, December 11, 2019 11:32:30 AM
Attachments: Perry Hill Fig3 Site Map.pdf
PreliminaryJDworksheet Table Perry Hill_12.11.2019.pdf

Good morning Win,

This office concurs with your Figure 3 Site Map dated 12/11/2019 and Table 1. Summary of On-Site Jurisdictional Waters dated 12.11.2019 (enclosed). The Corps Action ID for the project is: SAW-2019-00125. Please reference this on all future correspondence. This email serves as JD concurrence for the above referenced project and may be used for planning purposes and avoidance and minimization. Please let me know if you have any additional questions.

Sincerely,
Sam

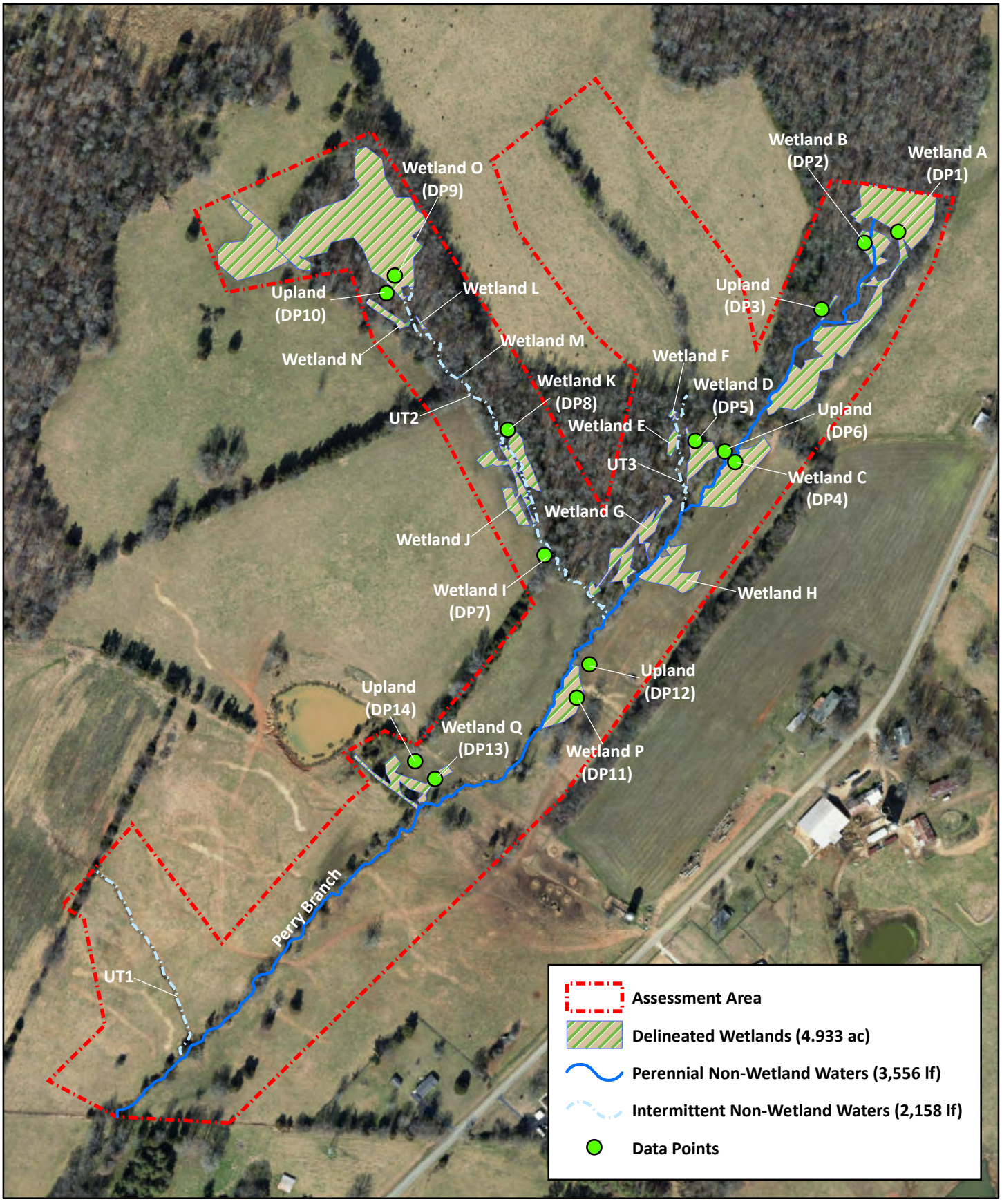
Samantha Dailey
Regulatory Project Manager
U.S. Army Corps of Engineers
Regulatory Division
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587
(919) 554-4884, Ext. 22
Samantha.j.dailey@usace.army.mil

-----Original Message-----
From: Win Taylor [mailto:wtaylor@wildlandseng.com]
Sent: Wednesday, December 11, 2019 8:26 AM
To: Dailey, Samantha J CIV USARMY CESAW (USA) <Samantha.J.Dailey@usace.army.mil>
Subject: [Non-DoD Source] Perry Hill PJD Revisions

Sam,

Good to see you yesterday. Attached is the revised figure illustrating the change to Wetland A as well as the revised table reflecting Wetland A revisions. Please let me know if you need anything else.

Thanks, Win



WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 3 Site Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)
12/11/2019

Orange County, NC

Table 1. Summary of On-Site Jurisdictional Waters

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Perry Branch	36.107343	-79.129073	Riverine-Upper Perennial Streambed	3,556	Perennial Non-Wetland Waters of the US
UT1	36.105982	-79.131928	Riverine Intermittent-Streambed	601	Intermittent Non-Wetland Waters of the US
UT2	36.109312	-79.128536	Riverine Intermittent-Streambed	1,200	Intermittent Non-Wetland Waters of the US
UT3	36.109974	-79.127209	Riverine Intermittent-Streambed	357	Intermittent Non-Wetland Waters of the US
Wetland A	36.111392	-79.125334	Palustrine Forested	1.153	Non-Section 10 – Wetland
Wetland B	36.111318	-79.125639	Palustrine-Emergent	0.113	Non-Section 10 – Wetland
Wetland C	36.109701	-79.126795	Palustrine-Emergent	0.310	Non-Section 10 – Wetland
Wetland D	36.109859	-79.127161	Palustrine Forested	0.121	Non-Section 10 – Wetland
Wetland E	36.109820	-79.127381	Palustrine Forested	0.030	Non-Section 10 – Wetland
Wetland F	36.110049	-79.127357	Palustrine Forested	0.009	Non-Section 10 – Wetland
Wetland G	36.109223	-79.127557	Palustrine Forested	0.235	Non-Section 10 – Wetland
Wetland H	36.108959	-79.127429	Palustrine-Emergent	0.240	Non-Section 10 – Wetland
Wetland I	36.109011	-79.128496	Palustrine Forested	0.007	Non-Section 10 – Wetland

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Wetland J	36.109373	-79.128756	Palustrine Forested / Emergent	0.192	Non-Section 10 – Wetland
Wetland K	36.109948	-79.128845	Palustrine Forested	0.121	Non-Section 10 – Wetland
Wetland L	36.110318	-79.129260	Palustrine Forested	0.001	Non-Section 10 – Wetland
Wetland M	36.110668	-79.129597	Palustrine Forested	0.006	Non-Section 10 – Wetland
Wetland N	36.110701	-79.129807	Palustrine Forested	0.049	Non-Section 10 – Wetland
Wetland O	36.111073	-79.129862	Palustrine Forested / Emergent	1.961	Non-Section 10 – Wetland
Wetland P	36.107987	-79.128213	Palustrine Emergent	0.196	Non-Section 10 – Wetland
Wetland Q	36.107390	-79.129483	Palustrine-Emergent	0.189	Non-Section 10 – Wetland

Preliminary ORM Data Entry Fields for New Actions

ACTION ID #: SAW- Begin Date (Date Received):

Prepare file folder ☐ Assign Action ID Number in ORM ☐

1. Project Name [PCN Form A2a]: Perry Hill Mitigation Site
2. Work Type: ☑ Private ☐ Institutional ☑ Government ☐ Commercial
3. Project Description / Purpose [PCN Form B3d and B3e]:
   Stream and buffer mitigation site for NC Division of Mitigation Services.
4. Property Owner / Applicant [PCN Form A3 or A4]: Evelyn J Perry Etal Mary C P Bishop
5. Agent / Consultant [PNC Form A5 – or ORM Consultant ID Number]:
   Win Taylor Wildlands Engineering
6. Related Action ID Number(s) [PCN Form B5b]:
7. Project Location – Coordinates, Street Address, and/or Location Description [PCN Form B1b]:
   36.108078 / -79.128361 2623 Frank Perry Road Hillsborough, NC
8. Project Location – Tax Parcel ID [PCN Form B1a]: 9865081397
9. Project Location – County [PCN Form A2b]: Orange
10. Project Location – Nearest Municipality or Town [PCN Form A2c]: Hillsborough
11. Project Information – Nearest Waterbody [PCN Form B2a]: Eno River
12. Watershed / 8-Digit Hydrologic Unit Code [PCN Form B2c]: Neuse 03020201

Authorization: Section 10 ☐ Section 404 ☑ Section 10 and 404 ☐

Regulatory Action Type:

- ☐ Standard Permit
- ☐ Nationwide Permit #
- ☐ Regional General Permit #
- ☑ Jurisdictional Determination Request
- ☐ Pre-Application Request
- ☐ Unauthorized Activity
- ☐ Compliance
- ☐ No Permit Required

Corps Submittal Cover Sheet

Please provide the following info:

1. Project Name Perry Hill Mitigation Site
2. Name of Property Owner/Applicant: Wildlands Engineering
3. Name of Consultant/Agent: Win Taylor, Wildlands Engineering, Inc

   *Agent authorization needs to be attached.
4. Related/Previous Action ID number(s): _____
5. Site Address: 2623 Frank Perry Road Hillsborough, NC
6. Subdivision Name: N/A
7. City: Hillsborough
8. County: Orange
9. Lat: 36.108078 Long: -79.128361 (Decimal Degrees *Please*)
10. Quadrangle Name: Efland
11. Waterway: Unnamed Tributaries Eno River
12. Watershed: Neuse River 03020201
13. Requested Action:

    ___ Nationwide Permit # ____

    ___ General Permit # _____

    _X_ Jurisdictional Determination Request

    ___ Pre-Application Request

The following information will be completed by Corps office:

AID: _____

_____ Prepare File Folder _____ Assign number in ORM _____ Begin Date

Authorization: ____ Section 10 ____ Section 404

Project Description/ Nature of Activity/ Project Purpose:

_____

Site/Waters Name: _____

Keywords: _____

September 4, 2019

Ms. Samantha Dailey
US Army Corps of Engineers
Raleigh Regulatory Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587

Subject: **Preliminary Jurisdictional Delineation and Request for Verification**
Perry Hill Mitigation Site
Orange County, North Carolina

Dear Mr. Elliot:

Wildlands Engineering, Inc. (Wildlands) is requesting written verification from the U.S. Army Corps of Engineers (USACE) regarding the extent of potential waters of the United States within the subject project area. The Perry Hill Mitigation Site (Site) is located off of Frank Perry Road approximately 2 miles northwest of Hillsborough, NC (Figures 1 and 2). The Site has been accepted as full delivery stream mitigation project for the North Carolina Department of Environment and Natural Resources Division of Mitigation Services. To date, a draft mitigation plan is being developed and Wildlands is currently in the process of finalizing easement boundaries.

Methodology

Wildlands delineated potential waters of the United States within the proposed project area in March 2019. These areas were delineated using the USACE Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and subsequent Eastern Mountain and Piedmont Regional Supplement. Wetland Determination Data Forms representative of on-site wetland areas as well as upland areas have been enclosed.

Stream channels were classified according to USACE and NCDWR guidance. NCDWR Stream Classification Forms representative of on-site stream channels are enclosed.

Potential Waters of the United States

The results of the on-site field investigation indicate that there are four non-wetland waters within the proposed project area which are unnamed tributaries to the Eno River; hereafter referred to as Perry Branch, UT1, UT2, and UT3. Seventeen wetland areas were identified within the proposed project area and are located within the headwaters and floodplain areas associated with the onsite streams (Figure 3).

Approximate linear footage and acreage of on-site waters are summarized in Table 1.

Table 1. Summary of On-Site Potential Waters of the United States

Feature	Classification	Length (LF)	Acreage	Watershed (ac)	NCDWR Stream Scores
Perry Branch	Perennial Non-Wetland Water	3,556	-	175	34
UT1	Intermittent Non-Wetland Water	601	-	10	27.25
UT2	Intermittent Non-Wetland Water	1,200	-	23	26.5
UT3	Intermittent Non-Wetland Water	357	-	20	22
Wetland A	Headwater Forest	-	1.415	-	-
Wetland B	Headwater Forest	-	0.113	-	-
Wetland C	Headwater Forest / Seep	-	0.310	-	-
Wetland D	Headwater Forest	-	0.121	-	-
Wetland E	Headwater Forest	-	0.030	-	-
Wetland F	Headwater Forest	-	0.009		
Wetland G	Headwater Forest	-	0.235		
Wetland H	Headwater Forest / Seep	-	0.240		
Wetland I	Headwater Forest	-	0.007		
Wetland J	Headwater Forest / Seep	-	0.192		
Wetland K	Headwater Forest	-	0.121		
Wetland L	Headwater Forest	-	0.001		
Wetland M	Headwater Forest	-	0.006		
Wetland N	Headwater Forest	-	0.049		
Wetland O	Headwater Forest / Seep	-	1.961		
Wetland P	Headwater Forest / Seep	-	0.196		
Wetland Q	Headwater Forest / Seep	-	0.189		

Streams

Perry Branch is a perennial non-wetland water located within the project easement area. Additionally, there are three intermittent non-wetland waters including UT1, UT2 and UT3 (Figure 3). The scores on the NCDWR Stream Classification Form ranged from 22 to 34 out of 61.5 possible points. Throughout the project area, the stream channels and riparian corridors have been affected by active livestock grazing and hoof shear. As a result, degraded channel beds and banks as well as riparian communities are persistent along these reaches.

Wetlands

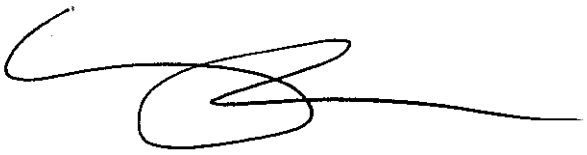
There are 17 wetlands located within the project area. These wetland features were classified as seeps and headwater forest using the North Carolina Wetland Assessment Method (NCWAM) classification key and the evaluator's best professional judgment. The wetlands occur in the side slopes and floodplains that drain to the on-site stream channels. These features exhibited a saturation within the upper 12 inches of the soil profile, wetland plant communities, and a low chroma matrix. Wetland Determination Data Forms representative of the wetlands and the associated upland points are enclosed.

Table 1 shows the acreage of on-site wetland areas.

Soils
Soil types within the study area include Georgeville silt loam (GeC), Iredell gravelly loam (IrB), Lignum silt (Lg), Enon loam (EnB & EnC), and Herndon silt (HrB). Georgeville silt loam (GeC) soils are well drained and are located within the floodplains of the majority of Perry Branch, UT1, and the downstream extent of UT2. Iredell gravelly loam (IrB) and Lignum silt (Lg) soils are moderately well drained soils located along within the floodplains of UT3 and the upper portion of Perry Branch. Enon loam (EnB & EnC) and Herndon silt (HrB) soils are well drained soils associated with the upper UT2 floodplain. On-site soils are mapped in Figure 4.

Please do not hesitate to contact me at 843-277-6221 or at wtaylor@wildlandseng.com should you have any questions regarding this request for preliminary jurisdictional verification.

Sincerely,



Win Taylor, PWS
Senior Environmental Scientist

Jurisdictional Determination Request

US Army Corps of Engineers
Wilmington District

This form is intended for use by anyone requesting a jurisdictional determination (JD) from the U.S. Army Corps of Engineers, Wilmington District (Corps). Please include all supporting information, as described within each category, with your request. You may submit your request via mail, electronic mail, or facsimile. Requests should be sent to the appropriate project manager of the county in which the property is located. A current list of project managers by assigned counties can be found on-line at: http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/Contact/CountyLocator.aspx, by calling 910-251-4633, or by contacting any of the field offices listed below. Once your request is received you will be contacted by a Corps project manager.

ASHEVILLE & CHARLOTTE REGULATORY FIELD OFFICES
US Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006
General Number: (828) 271-7980
Fax Number: (828) 281-8120

RALEIGH REGULATORY FIELD OFFICE
US Army Corps of Engineers
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
General Number: (919) 554-4884
Fax Number: (919) 562-0421

WASHINGTON REGULATORY FIELD OFFICE
US Army Corps of Engineers
2407 West Fifth Street
Washington, North Carolina 27889
General Number: (910) 251-4610
Fax Number: (252) 975-1399

WILMINGTON REGULATORY FIELD OFFICE
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403
General Number: 910-251-4633
Fax Number: (910) 251-4025

INSTRUCTIONS:

All requestors must complete Parts A, B, C, D, E, F and G.

NOTE TO CONSULTANTS AND AGENCIES: If you are requesting a JD on behalf of a paying client or your agency, please note the specific submittal requirements in **Part H**.

NOTE ON PART D – PROPERTY OWNER AUTHORIZATION: Please be aware that all JD requests must include the current property owner authorization for the Corps to proceed with the determination, which may include inspection of the property when necessary. This form must be signed by the current property owner(s) or the owner(s) authorized agent to be considered a complete request.

NOTE ON PART D - NCDOT REQUESTS: Property owner authorization/notification for JD requests associated with North Carolina Department of Transportation (NCDOT) projects will be conducted according to the current NCDOT/USACE protocols.

NOTE TO USDA PROGRAM PARTICIPANTS: A Corps approved or preliminary JD may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should also request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

A. PARCEL INFORMATION

Street Address: 2221 Frank Perry Road

City, State: Hillsborough, North Carolina 27278

County: Orange

Parcel Index Number(s) (PIN): 9865081397

B. REQUESTOR INFORMATION

Name: Win Taylor - Wildlands Engineering

Mailing Address: 497 Bramson Court, Suite 104

Mt. Pleasant, SC 29464

Telephone Number: 843-277-6221

Electronic Mail Address: wtaylor@wildlandseng.com

Select one:

- ☐ I am the current property owner.
- ☑ I am an Authorized Agent or Environmental Consultant[1]
- ☐ Interested Buyer or Under Contract to Purchase
- ☐ Other, please explain. _____

_____

C. PROPERTY OWNER INFORMATION[2]

Name: Evelyn J Perry Etal Mary C P Bishop

Mailing Address: 2623 Frank Perry Road

Hillsborough, NC 27278

Telephone Number: 919-732-7074

Electronic Mail Address: _____

[1] Must provide completed Agent Authorization Form/Letter.

[2] Documentation of ownership also needs to be provided with request (copy of Deed, County GIS/Parcel/Tax Record).

D. PROPERTY ACCESS CERTIFICATION[3,4]

By signing below, I authorize representatives of the Wilmington District, U.S. Army Corps of Engineers (Corps) to enter upon the property herein described for the purpose of conducting on-site investigations, if necessary, and issuing a jurisdictional determination pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899. I, the undersigned, am either a duly authorized owner of record of the property identified herein, or acting as the duly authorized agent of the owner of record of the property.

Win Taylor
Print Name

Capacity: ☐ Owner ☑ Authorized Agent[5]

9/3/2019
Date

Signature

E. REASON FOR JD REQUEST: (Check as many as applicable)

☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.

☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.

☑ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.

☐ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.

☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.

☐ A Corps JD is required in order obtain my local/state authorization.

☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.

☐ I believe that the site may be comprised entirely of dry land.

☑ Other: Stream Mitigation Site

[3] For NCDOT requests following the current NCDOT/USACE protocols, skip to Part E.

[4] If there are multiple parcels owned by different parties, please provide the following for each additional parcel on a continuation sheet.

[5] Must provide agent authorization form/letter signed by owner(s).

F. JURISDICTIONAL DETERMINATION (JD) TYPE (Select One)

☑ I am requesting that the Corps provide a preliminary JD for the property identified herein.

A Preliminary Jurisdictional Determination (PJD) provides an indication that there may be "waters of the United States" or "navigable waters of the United States"on a property. PJDs are sufficient as the basis for permit decisions. For the purposes of permitting, all waters and wetlands on the property will be treated as if they are jurisdictional "waters of the United States". PJDs cannot be appealed (33 C.F.R. 331.2); however, a PJD is "preliminary" in the sense that an approved JD can be requested at any time. PJDs do not expire.

☐ I am requesting that the Corps provide an approved JD for the property identified herein.

An Approved Jurisdictional Determination (AJD) is a determination that jurisdictional "waters of the United States" or "navigable waters of the United States" are either present or absent on a site. An approved JD identifies the limits of waters on a site determined to be jurisdictional under the Clean Water Act and/or Rivers and Harbors Act. Approved JDs are sufficient as the basis for permit decisions. AJDs are appealable (33 C.F.R. 331.2). The results of the AJD will be posted on the Corps website. A landowner, permit applicant, or other "affected party" (33 C.F.R. 331.2) who receives an AJD may rely upon the AJD for five years (subject to certain limited exceptions explained in Regulatory Guidance Letter 05-02).

☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

G. ALL REQUESTS

☑ Map of Property or Project Area. This Map must clearly depict the boundaries of the review area.

☑ Size of Property or Review Area ~50 acres.

☐ The property boundary (or review area boundary) is clearly physically marked on the site.

H. REQUESTS FROM CONSULTANTS

☑ Project Coordinates (Decimal Degrees): Latitude: 36.108078
Longitude: -79.128361

☑ A legible delineation map depicting the aquatic resources and the property/review area. Delineation maps must be no larger than 11x17 and should contain the following: (Corps signature of submitted survey plats will occur after the submitted delineation map has been reviewed and approved).[6]

- North Arrow
- Graphical Scale
- Boundary of Review Area
- Date
- Location of data points for each Wetland Determination Data Form or tributary assessment reach.

For Approved Jurisdictional Determinations:

- Jurisdictional wetland features should be labeled as Wetland Waters of the US, 404 wetlands, etc. Please include the acreage of these features.
- Jurisdictional non-wetland features (i.e. tidal/navigable waters, tributaries, impoundments) should be labeled as Non-Wetland Waters of the US, stream, tributary, open water, relatively permanent water, pond, etc. Please include the acreage or linear length of each of these features as appropriate.
- Isolated waters, waters that lack a significant nexus to navigable waters, or non-jurisdictional upland features should be identified as Non-Jurisdictional. Please include a justification in the label regarding why the feature is non-jurisdictional (i.e. "Isolated", "No Significant Nexus", or "Upland Feature"). Please include the acreage or linear length of these features as appropriate.

For Preliminary Jurisdictional Determinations:

- Wetland and non-wetland features should not be identified as Jurisdictional, 404, Waters of the United States, or anything that implies jurisdiction. These features can be identified as Potential Waters of the United States, Potential Non-wetland Waters of the United States, wetland, stream, open water, etc. Please include the acreage and linear length of these features as appropriate.

☑ Completed Wetland Determination Data Forms for appropriate region
(at least one wetland and one upland form needs to be completed for each wetland type)

[6] Please refer to the guidance document titled "Survey Standards for Jurisdictional Determinations" to ensure that the supplied map meets the necessary mapping standards. http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/

- [x] Completed appropriate Jurisdictional Determination form
  - **PJDs,** please complete a Preliminary Jurisdictional Determination Form[7] and include the Aquatic Resource Table
  - **AJDs**, please complete an Approved Jurisdictional Determination Form[8]
- [x] Vicinity Map
- [x] Aerial Photograph
- [x] USGS Topographic Map
- [x] Soil Survey Map
- [ ] Other Maps, as appropriate (e.g. National Wetland Inventory Map, Proposed Site Plan, previous delineation maps, LIDAR maps, FEMA floodplain maps)
- [x] Landscape Photos (if taken)
- [ ] NCSAM and/or NCWAM Assessment Forms and Rating Sheets
- [x] NC Division of Water Resources Stream Identification Forms
- [ ] Other Assessment Forms

[7] www.saw.usace.army.mil/Portals/59/docs/regulatory/regdocs/JD/RGL_08-02_App_A_Prelim_JD_Form_fillable.pdf
[8] Please see http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/

Principal Purpose: The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.
Disclosure: Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: September 4, 2019

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Win Taylor 497 Bramson Ct. Suite 104 Mt. Pleasant, SC 29464

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Raleigh, Perry Hill Mitigation Site, TBD

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: NC County/parish/borough: Orange City: Hillsborough

Center coordinates of site (lat/long in degree decimal format):

Lat.: 36.108078 Long.: -79.128361

Universal Transverse Mercator:

Name of nearest waterbody: Eno River

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:

☐ Field Determination. Date(s):

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
See attached					

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- [■] Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: _____.
- [■] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [ ] Office concurs with data sheets/delineation report.
  - [ ] Office does not concur with data sheets/delineation report. Rationale: _____.
- [ ] Data sheets prepared by the Corps: _____.
- [ ] Corps navigable waters' study: _____.
- [ ] U.S. Geological Survey Hydrologic Atlas: _____.
  - [ ] USGS NHD data.
  - [ ] USGS 8 and 12 digit HUC maps.
- [■] U.S. Geological Survey map(s). Cite scale & quad name: 7.5 Minute Efland Quadrangle.
- [■] Natural Resources Conservation Service Soil Survey. Citation: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.
- [ ] National wetlands inventory map(s). Cite name: _____.
- [ ] State/local wetland inventory map(s): _____.
- [ ] FEMA/FIRM maps: _____.
- [ ] 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- [■] Photographs: [■] Aerial (Name & Date): 2016.
  or [ ] Other (Name & Date): _____.
- [ ] Previous determination(s). File no. and date of response letter: _____.
- [ ] Other information (please specify): _____.

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

_____
Signature and date of
Regulatory staff member
completing PJD

9/4/2019
Signature and date of
person requesting PJD
(REQUIRED, unless obtaining
the signature is impracticable)[1]

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

Table 1. Summary of On-Site Jurisdictional Waters

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Perry Branch	36.107343	-79.129073	Riverine-Upper Perennial Streambed	3,556	Perennial Non-Wetland Waters of the US
UT1	36.105982	-79.131928	Riverine Intermittent-Streambed	601	Intermittent Non-Wetland Waters of the US
UT2	36.109312	-79.128536	Riverine Intermittent-Streambed	1,200	Intermittent Non-Wetland Waters of the US
UT3	36.109974	-79.127209	Riverine Intermittent-Streambed	357	Intermittent Non-Wetland Waters of the US
Wetland A	36.111392	-79.125334	Palustrine Forested	1.415	Non-Section 10 – Wetland
Wetland B	36.111318	-79.125639	Palustrine-Emergent	0.113	Non-Section 10 – Wetland
Wetland C	36.109701	-79.126795	Palustrine-Emergent	0.310	Non-Section 10 – Wetland
Wetland D	36.109859	-79.127161	Palustrine Forested	0.121	Non-Section 10 – Wetland
Wetland E	36.109820	-79.127381	Palustrine Forested	0.030	Non-Section 10 – Wetland
Wetland F	36.110049	-79.127357	Palustrine Forested	0.009	Non-Section 10 – Wetland
Wetland G	36.109223	-79.127557	Palustrine Forested	0.235	Non-Section 10 – Wetland
Wetland H	36.108959	-79.127429	Palustrine-Emergent	0.240	Non-Section 10 – Wetland
Wetland I	36.109011	-79.128496	Palustrine Forested	0.007	Non-Section 10 – Wetland

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Wetland J	36.109373	-79.128756	Palustrine Forested / Emergent	0.192	Non-Section 10 – Wetland
Wetland K	36.109948	-79.128845	Palustrine Forested	0.121	Non-Section 10 – Wetland
Wetland L	36.110318	-79.129260	Palustrine Forested	0.001	Non-Section 10 – Wetland
Wetland M	36.110668	-79.129597	Palustrine Forested	0.006	Non-Section 10 – Wetland
Wetland N	36.110701	-79.129807	Palustrine Forested	0.049	Non-Section 10 – Wetland
Wetland O	36.111073	-79.129862	Palustrine Forested / Emergent	1.961	Non-Section 10 – Wetland
Wetland P	36.107987	-79.128213	Palustrine Emergent	0.196	Non-Section 10 – Wetland
Wetland Q	36.107390	-79.129483	Palustrine-Emergent	0.189	Non-Section 10 – Wetland

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Estate Record: 10-E-102 Page: _____ County: Orange

Parcel ID Number: 986508137~~9~~97

Street Address: 2623 Frank Perry Road
Hillsborough, NC 27278

Property Owners (please print): Evelyn J Perry, Judy Kadlac, Mary C.P. Bishop

The undersigned, registered property owner(s) of the above property, do hereby authorize Wildlands Engineering, Inc. to take all actions necessary for the evaluation of the property as a potential stream, wetland and/or riparian buffer mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owners(s) Address: _____
(if different from above)

Property Owner Telephone Number: 919.732.7074 (Evelyn Perry)

Property Owner Telephone Number: _____

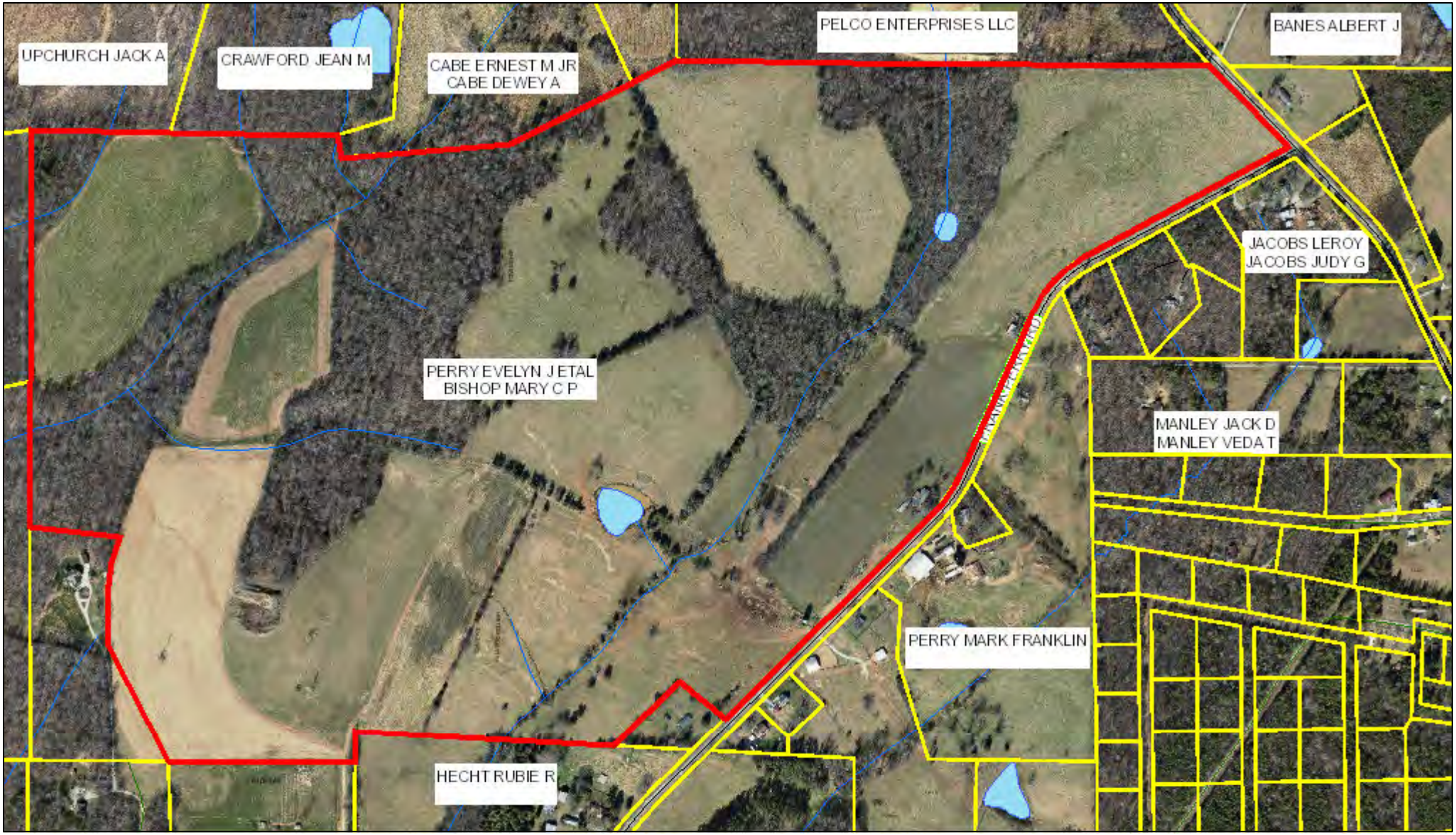
We hereby certify the above information to be true and accurate to the best of our knowledge.

Mary P Bishop 08-12-18
(Property Owner Authorized Signature) (Date)

Evelyn J Perry 08-12-18
(Property Owner Authorized Signature) (Date)

Judith G Kadlac 8-14-18
(Property Owner Authorized Signature) (Date)

Orange County



April 19, 2019

PIN: 9865081397

OWNER 1:	PERRY EVELYN J ETAL
OWNER 2:	BISHOP MARY C P
ADDRESS 1:	PO BOX 178
ADDRESS 2:	
CITY:	HILLSBOROUGH
STATE, ZIP:	NC 272787544
LEGAL DESC:	W/S SR 1306 (AKA 1379)

SIZE:	278.19 A
DEED REF:	
RATECODE:	00
TOWNSHIP	HILLSBOROUGH
BLDG SQFT:	2859
YEAR BUILT:	1958

BUILDING COUNT:	1
LAND VALUE:	$1,955,330
BLDG_VALUE:	$173,200
USE VALUE:	$0
TOTAL VALUE:	$2,128,530
DATE SOLD:	3/14/2013
TAX STAMPS:	

1:7,361

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

ORANGE COUNTY
NORTH CAROLINA

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet A DP1

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.111392 Long: -79.125334 Datum:

Soil Map Unit Name: Lignum silt NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- X Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- X 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)
- X Sparsely Vegetated Concave Surface (B8)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet A DP1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus michauxii*	30	Yes	FACW
2. *Fraxinus pennsylvanica*	30	Yes	FACW
3. *Quercus phellos*	20	Yes	FAC
4. *Nyssa sylvatica*	10	No	FAC
5.			
6.			
7.			
	90	=Total Cover	
50% of total cover: 45		20% of total cover: 18	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fraxinus pennsylvanica*	20	Yes	FACW
2. *Ligustrum sinense*	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	30	=Total Cover	
50% of total cover: 15		20% of total cover: 6	
Herb Stratum (Plot size: 5)			
1. *Caltha palustris*	2	No	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	2	=Total Cover	
50% of total cover: 1		20% of total cover: 1	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	80	x 2 =	160
FAC species	30	x 3 =	90
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	122 (A)		292 (B)

Prevalence Index = B/A = 2.39

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Wet A DP1

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2						Loamy/Clayey	
2-10	2.5Y 5/2	98	10YR 4/6	2	C	PL	Loamy/Clayey	Prominent redox concentrations
10-12	10YR 6/1	90	10YR 3/6	10	C	PL	Loamy/Clayey	Prominent redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet B DP2

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.111318 Long: -79.125639 Datum:

Soil Map Unit Name: Water NWI classification: PBHh

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
Old breached pond bed

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- X Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- X 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)
- X Sparsely Vegetated Concave Surface (B8)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 0.25
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet B DP2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus pennsylvanica*	40	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	40 =Total Cover		
50% of total cover: 20	20% of total cover: 8		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fraxinus pennsylvanica*	10	Yes	FACW
2. *Liquidambar styraciflua*	2	No	FAC
3. *Lindera benzoin*	2	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
	14 =Total Cover		
50% of total cover: 7	20% of total cover: 3		
Herb Stratum (Plot size: 5)			
1. *Juncus effusus*	2	No	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	2 =Total Cover		
50% of total cover: 1	20% of total cover: 1		
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	52	x 2 =	104
FAC species	4	x 3 =	12
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	56 (A)		116 (B)

Prevalence Index = B/A = 2.07

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Wet B DP2

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/1						Mucky Loam/Clay	

[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)
- ___ 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)**
- X Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upl DP3

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.110828 Long: -79.126018 Datum:

Soil Map Unit Name: Iredell gravelly loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	**Is the Sampled Area**		
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	**Yes** ____	**No** X
Wetland Hydrology Present?	Yes ____	No X			

Remarks:

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 X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: Upl DP3

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carya ovata*	60	Yes	FACU
2. *Pinus taeda*	10	No	FAC
3. *Prunus serotina*	5	No	FACU
4. *Oxydendrum arboreum*	5	No	UPL
5. *Fraxinus pennsylvanica*	2	No	FACW
6.			
7.			
	82	=Total Cover	
50% of total cover: 41		20% of total cover: 17	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Juniperus virginiana*	10	Yes	FACU
2. *Liquidambar styraciflua*	3	No	FAC
3. *Fraxinus pennsylvanica*	2	No	FACW
4. *Carya ovata*	2	No	FACU
5.			
6.			
7.			
8.			
9.			
	17	=Total Cover	
50% of total cover: 9		20% of total cover: 4	
Herb Stratum (Plot size: 5)			
1. *Allium allegheniense*	5	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5	=Total Cover	
50% of total cover: 3		20% of total cover: 1	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	4	x 2 =	8
FAC species	13	x 3 =	39
FACU species	77	x 4 =	308
UPL species	10	x 5 =	50
Column Totals:	104 (A)		405 (B)

Prevalence Index = B/A = 3.89

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 or equal to 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** X

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

SOIL

Sampling Point: Upl DP3

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/3						Loamy/Clayey	
2-12	10YR 5/6						Loamy/Clayey	

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ 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** X

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet C & H DP4

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.109701 Long: -79.126795 Datum:

Soil Map Unit Name: Georgeville silt loam NWI classification: NA

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

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

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 X	No	**Is the Sampled Area within a Wetland?** **Yes** X **No**
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:
Heavily grazed pasture.

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X 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)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No	Depth (inches): 0.1
Water Table Present?	Yes X	No	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet C & H DP4

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Caltha palustris*	40	Yes	OBL
2. *Festuca paradoxa*	10	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50 =Total Cover		
50% of total cover: 25	20% of total cover: 10		
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	50 (A)		70 (B)

Prevalence Index = B/A = 1.40

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Vet C & H DP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/1	98	10YR 4/6	2	C	PL	Loamy/Clayey	Prominent redox concentrations
2-12	10YR 3/1	85	10YR 4/4	15	C	PL	Loamy/Clayey	Distinct redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- X Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/20/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: D/E/F/G DP5

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.109859 Long: -79.127161 Datum:

Soil Map Unit Name: Iredell gravelly loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- X Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X 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)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: D/E/F/G DP5

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	30	Yes	FAC
2. *Fraxinus pennsylvanica*	10	No	FACW
3. *Ulmus americana*	15	Yes	FACW
4. *Juniperus virginiana*	10	No	FACU
5.			
6.			
7.			
	65	=Total Cover	
50% of total cover: 33		20% of total cover: 13	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Juniperus virginiana*	1	No	FACU
2. *Ligustrum sinense*	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	6	=Total Cover	
50% of total cover: 3		20% of total cover: 2	
Herb Stratum (Plot size: 5)			
1. *Caltha palustris*	15	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	15	=Total Cover	
50% of total cover: 8		20% of total cover: 3	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	25	x 2 =	50
FAC species	30	x 3 =	90
FACU species	16	x 4 =	64
UPL species	0	x 5 =	0
Column Totals:	86 (A)		219 (B)

Prevalence Index = B/A = 2.55

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: D/E/F/G DP5

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
0-2	10YR 5/2						Loamy/Clayey	
2-12	10YR 5/2	80	10YR 4/6	20	C	PL	Loamy/Clayey	Prominent redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/20/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upl DP6

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.109603 Long: =-79.127040 Datum:

Soil Map Unit Name: Georgeville silt loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	**Is the Sampled Area**		
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	**Yes** ____	**No** X
Wetland Hydrology Present?	Yes ____	No X			

Remarks:

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 X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Upl DP6

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	60	=Total Cover	

50% of total cover: 30 20% of total cover: 12

Sapling/Shrub Stratum (Plot size: 15)			
1. *Juniperus virginiana*	5	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	5	=Total Cover	

50% of total cover: 3 20% of total cover: 1

Herb Stratum (Plot size: 5)			
1. *Allium allegheniense*	60	Yes	UPL
2. *Trifolium repens*	2	No	FACU
3. *Festuca paradoxa*	5	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	67	=Total Cover	

50% of total cover: 34 20% of total cover: 14

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	

50% of total cover: 20% of total cover:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	65	x 3 =	195
FACU species	7	x 4 =	28
UPL species	60	x 5 =	300
Column Totals:	132 (A)		523 (B)

Prevalence Index = B/A = 3.96

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 or equal to 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** X

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

SOIL

Sampling Point: Upl DP6

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3						Loamy/Clayey	
2-12	10YR 5/3	80	10YR 4/6	20	C	PL	Loamy/Clayey	Distinct redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ 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** X

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet I DP7

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.109011 Long: -79.128496 Datum:

Soil Map Unit Name: Enon loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No	**Is the Sampled Area**
Hydric Soil Present?	Yes X	No	**within a Wetland?** **Yes** X **No**
Wetland Hydrology Present?	Yes X	No	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- X 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)
- X Sparsely Vegetated Concave Surface (B8)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No	Depth (inches): 0.5
Water Table Present?	Yes X	No	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet I DP7

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	20	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	

50% of total cover: 10 20% of total cover: 4

Sapling/Shrub Stratum (Plot size: 15)			
1. *Fraxinus pennsylvanica*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	5	=Total Cover	

50% of total cover: 3 20% of total cover: 1

Herb Stratum (Plot size: 5)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
		=Total Cover	

50% of total cover: 20% of total cover:

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	

50% of total cover: 20% of total cover:

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	25 (A)		70 (B)

Prevalence Index = B/A = 2.80

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Wet I DP7

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/1	95	10YR 5/6	5	C	PL	Mucky Loam/Clay	Prominent redox concentrations

[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)
- ___ 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)**
- X Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet J/K/L DP8

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.109948 Long: -79.128845 Datum:

Soil Map Unit Name: Enon loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- X 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)
- X 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)
- X Sparsely Vegetated Concave Surface (B8)
- X 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 X	No ____	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet J/K/L DP8

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	60	Yes	FAC
2. *Ulmus americana*	10	No	FACW
3.			
4.			
5.			
6.			
7.			
	70	=Total Cover	
50% of total cover: 35		20% of total cover: 14	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Ligustrum sinense*	2	No	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	2	=Total Cover	
50% of total cover: 1		20% of total cover: 1	
Herb Stratum (Plot size: 5)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
		=Total Cover	
50% of total cover:		20% of total cover:	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	60	x 3 =	180
FACU species	2	x 4 =	8
UPL species	0	x 5 =	0
Column Totals:	72 (A)		208 (B)

Prevalence Index = B/A = 2.89

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Wet J/K/L DP8

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/1						Loamy/Clayey	
2-6	10YR 5/2	5	10YR 4/6	5	C	PL	Loamy/Clayey	Prominent redox concentrations
6-12	10YR 5/2	80	10YR 5/6	20	C	PL	Loamy/Clayey	Prominent redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

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WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: M/N/O DP9

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): headwater seeps Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.111073 Long: -79.129862 Datum:

Soil Map Unit Name: Enon loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X 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)
- X Sparsely Vegetated Concave Surface (B8)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 0.5
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: M/N/O DP9

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus pennsylvanica*	30	Yes	FACW
2. *Quercus phellos*	20	Yes	FAC
3.			
4.			
5.			
6.			
7.			
	50	=Total Cover	
50% of total cover: 25		20% of total cover: 10	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Ulmus americana*	10	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10	=Total Cover	
50% of total cover: 5		20% of total cover: 2	
Herb Stratum (Plot size: 5)			
1. *Carex alata*	5	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5	=Total Cover	
50% of total cover: 3		20% of total cover: 1	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	40	x 2 =	80
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	65 (A)		145 (B)

Prevalence Index = B/A = 2.23

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: M/N/O DP9

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/1						Loamy/Clayey	
2-4	10YR 3/1	98	10YR 5/6	2	C	PL	Loamy/Clayey	Prominent redox concentrations
4-12	10YR 5/1	90	10YR 5/6	10	C	PL	Loamy/Clayey	Prominent redox concentrations

[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)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/19/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upl DP10

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.110952 Long: -79.129936 Datum:

Soil Map Unit Name: Enon loam NWI classification: NA

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

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	**Is the Sampled Area**		
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	**Yes** ____	**No** X
Wetland Hydrology Present?	Yes ____	No X			

Remarks:

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 X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: Upl DP10

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	60	Yes	FAC
2. *Pinus taeda*	15	No	FAC
3. *Carya glabra*	15	No	FACU
4.			
5.			
6.			
7.			
	90	=Total Cover	
50% of total cover: 45		20% of total cover: 18	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Juniperus virginiana*	10	Yes	FACU
2. *Liquidambar styraciflua*	10	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	20	=Total Cover	
50% of total cover: 10		20% of total cover: 4	
Herb Stratum (Plot size: 5)			
1. *Allium allegheniense*	5	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5	=Total Cover	
50% of total cover: 3		20% of total cover: 1	
Woody Vine Stratum (Plot size: 30)			
1. *Lonicera japonica*	3	No	FACU
2.			
3.			
4.			
5.			
	3	=Total Cover	
50% of total cover: 2		20% of total cover: 1	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	85	x 3 =	255
FACU species	28	x 4 =	112
UPL species	5	x 5 =	25
Column Totals:	118 (A)		392 (B)

Prevalence Index = B/A = 3.32

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 or equal to 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** X

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

SOIL

Sampling Point: Upl DP10

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/3						Loamy/Clayey	
2-12	10YR 4/4						Loamy/Clayey	

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ 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** X

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/20/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet P DP11

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.107987 Long: -79.128213 Datum:

Soil Map Unit Name: Georgeville silt loam NWI classification: NA

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

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

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 X	No	**Is the Sampled Area**
Hydric Soil Present?	Yes X	No	**within a Wetland?** **Yes** X **No**
Wetland Hydrology Present?	Yes X	No	

Remarks:
Heavily grazed pasture.

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No	Depth (inches): 0.1
Water Table Present?	Yes X	No	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet P DP11

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Caltha palustris*	5	No	OBL
2. *Festuca paradoxa*	10	Yes	FAC
3. *Carex alata*	15	Yes	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30 =Total Cover		
50% of total cover: 15	20% of total cover: 6		
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	30 (A)		50 (B)

Prevalence Index = B/A = 1.67

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Wet P DP11

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/1						Loamy/Clayey	
6-12	10YR 5/1	80	10YR 4/4	20	C	PL	Loamy/Clayey	Distinct redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/20/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upl DP12

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.108222 Long: -79.128099 Datum:

Soil Map Unit Name: Georgeville silt loam NWI classification: NA

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

Are Vegetation X, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

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 X	No ____	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
Heavilly grazed pasture

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 X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: Upl DP12

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Festuca paradoxa*	60	Yes	FAC
2. *Trifolium repens*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 =Total Cover		
50% of total cover: 35	20% of total cover: 14		
Woody Vine Stratum (Plot size: 30)			
1. *Lonicera japonica*	3	No	FACU
2.			
3.			
4.			
5.			
	3 =Total Cover		
50% of total cover: 2	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	13	x 4 =	52
UPL species	0	x 5 =	0
Column Totals:	73 (A)		232 (B)

Prevalence Index = B/A = 3.18

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Upl DP12

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/4						Loamy/Clayey	

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ 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** X

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/20/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wet Q DP13

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.107390 Long: -79.129483 Datum:

Soil Map Unit Name: Georgeville silt loam NWI classification: NA

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

Are Vegetation X, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
Heavily grazed pasture.

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X 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)
- X Sparsely Vegetated Concave Surface (B8)
- X 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)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 0.1
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 12

Wetland Hydrology Present? **Yes** X **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: Wet Q DP13

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Caltha palustris*	5	Yes	OBL
2. *Festuca paradoxa*	5	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10 =Total Cover		
50% of total cover: 5	20% of total cover: 2		
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	0	x 2 =	0
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	10 (A)		20 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Wet Q DP13

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/1						Loamy/Clayey	
4-12	10YR 5/1	95	10YR 4/6	5	C	PL	Loamy/Clayey	Prominent redox concentrations

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region

Project/Site: Perry Hill Mitigation Site City/County: Hillsborough / Orange Sampling Date: 3/20/2019

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upl DP14

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillside, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.107518 Long: -79.129667 Datum:

Soil Map Unit Name: Georgeville silt loam NWI classification: NA

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

Are Vegetation X, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

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 X	No ____	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
Heavilly grazed pasture

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 X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: Upl DP14

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	20	Yes	FAC
2. *Juniperus virginiana*	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	30	=Total Cover	
50% of total cover: 15		20% of total cover: 6	

Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 5)			
1. *Festuca paradoxa*	70	Yes	FAC
2. *Trifolium repens*	5	No	FACU
3. *Cynodon dactylon*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	85	=Total Cover	
50% of total cover: 43		20% of total cover: 17	

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of 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: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	90	x 3 =	270
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	115 (A)		370 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 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 or equal to 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** X **No** ___

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

SOIL

Sampling Point: Upl DP14

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3						Loamy/Clayey	
2-12	10YR 5/4						Loamy/Clayey	

[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)
- ___ 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 Mucky Mineral (F1) **(MLRA 136)**
- ___ 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 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 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 (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ 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** X

Remarks:

This data sheet is revised from Eastern Mountains and Piedmont Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 8.0, 2016.

NC DWQ Stream Identification Form Version 4.11

Date: 8/14/18	Project/Site: Perry Mill	Latitude:
Evaluator: Caralyn L.	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Perry Branch R1 *e.g. Quad Name:*

A. Geomorphology (Subtotal =)	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 =)				
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 =)				
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

Date: 8/14/18	Project/Site: Perry Mill	Latitude:
Evaluator: Carolyn	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.25	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other T1 *e.g. Quad Name:*

A. Geomorphology (Subtotal = ____)	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 = ____)				
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 = ____)				
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: Rifle Beetle

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 8/14/18	Project/Site: Perry Hill	Latitude:
Evaluator: Carolyn.	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other T2 R2 *e.g. Quad Name:*

A. Geomorphology (Subtotal =)	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 =)				
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 =)				
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: Frog

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 8/14/18	Project/Site: Perry Hill	Latitude:
Evaluator: Carolyn	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other +3 *e.g. Quad Name:*

A. Geomorphology (Subtotal =)	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

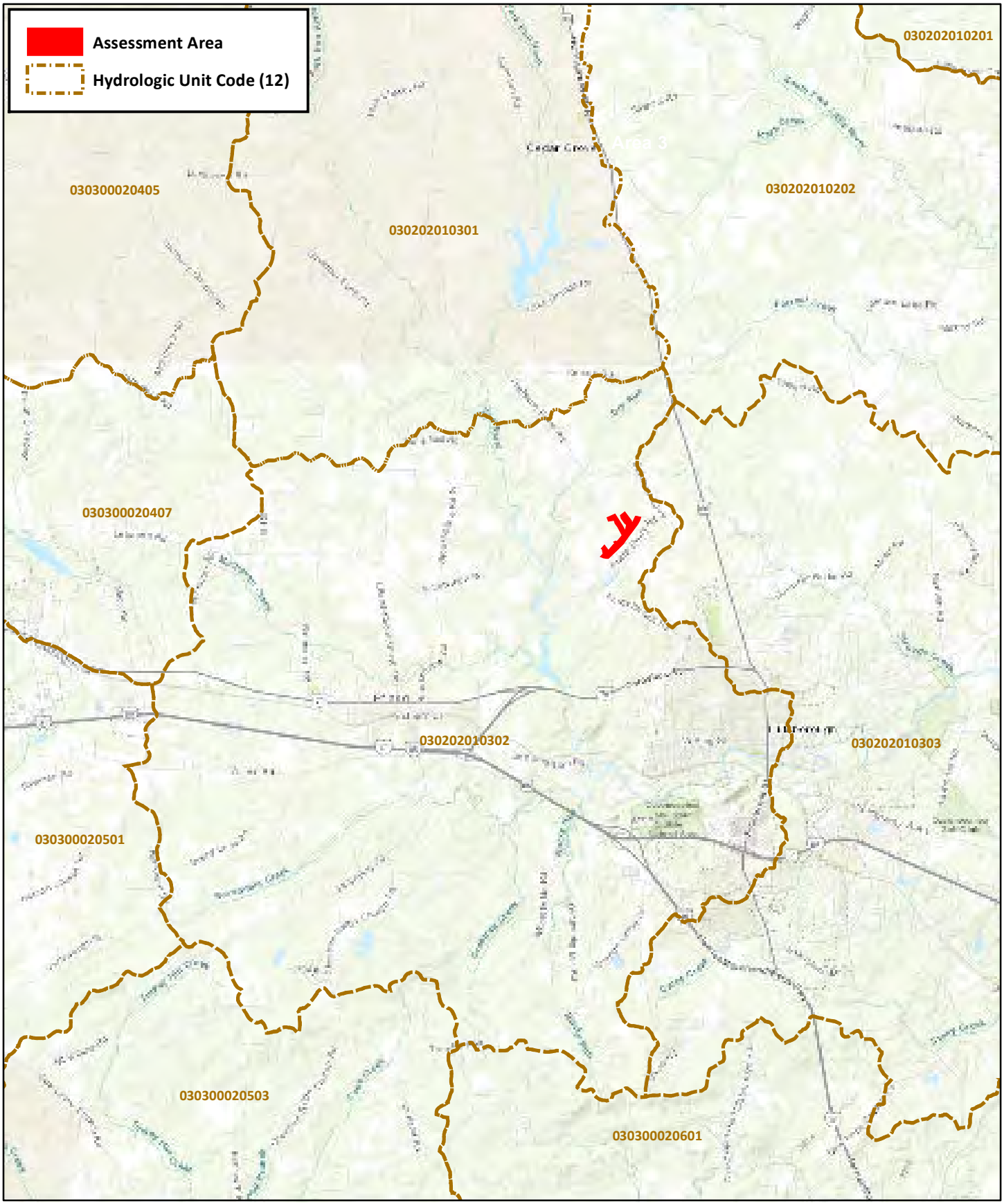
B. Hydrology (Subtotal =)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal =)				
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:



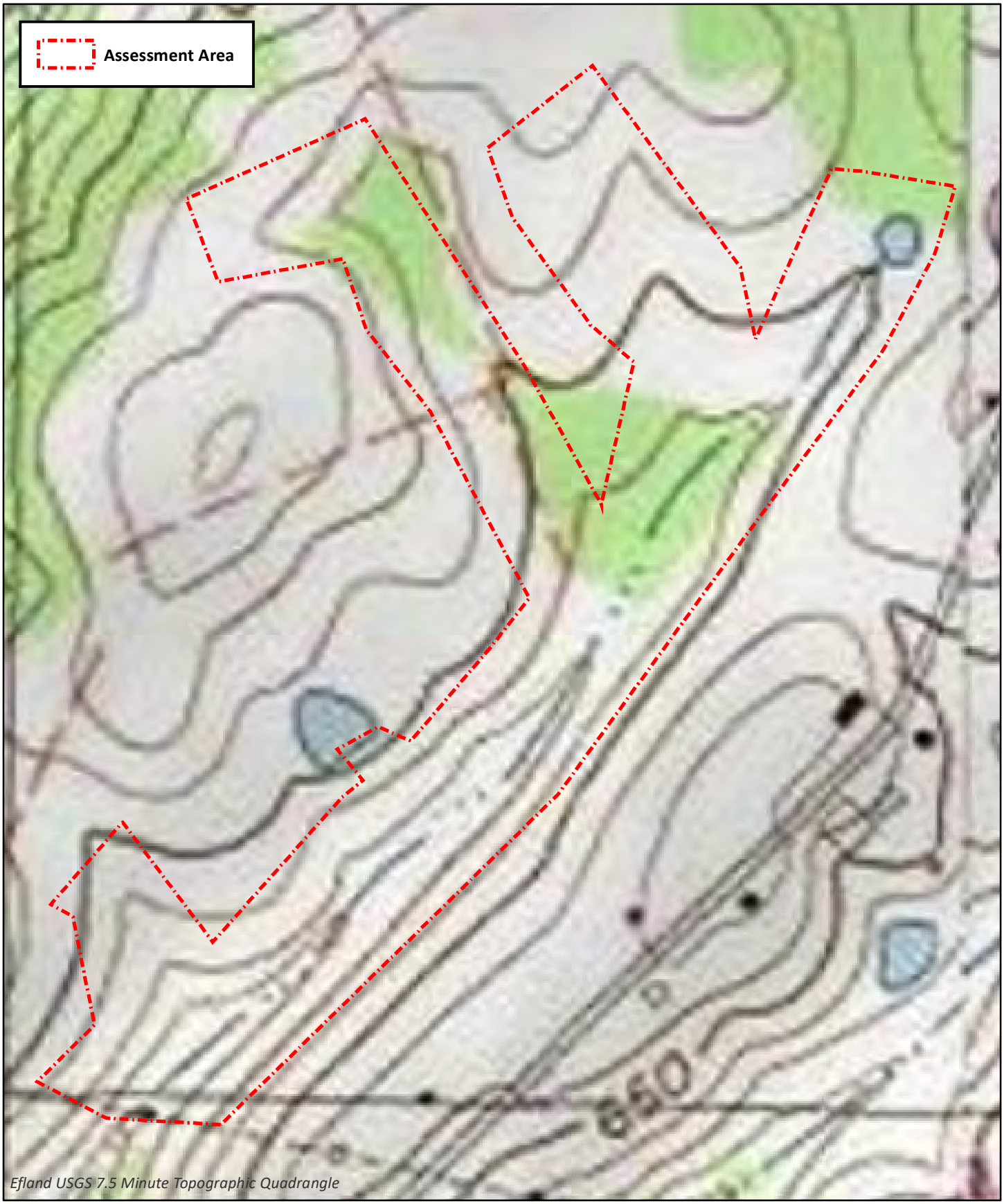
WILDLANDS ENGINEERING

0 2 Miles

N

Figure 1 Vicinity Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC



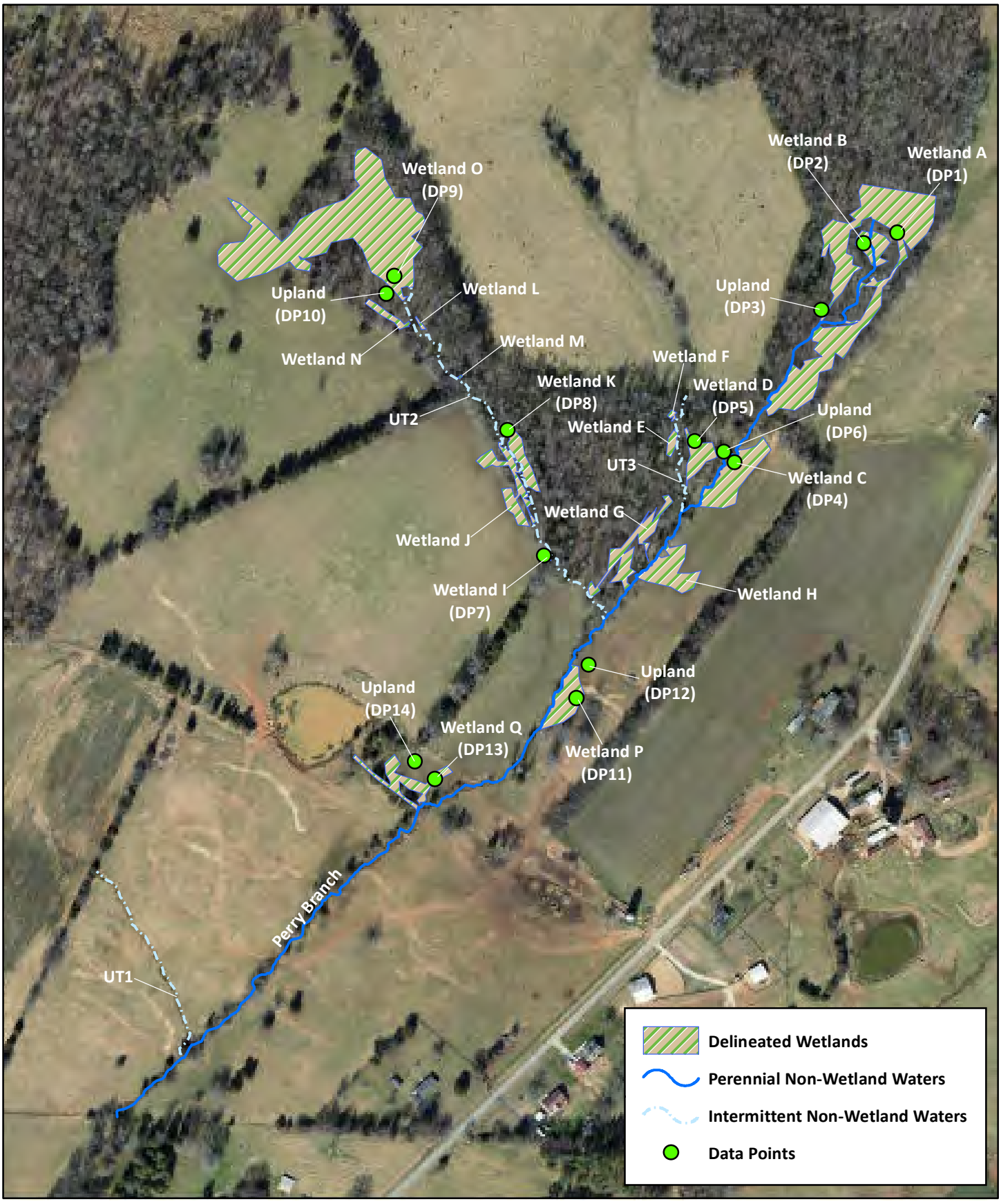
WILDLANDS ENGINEERING

0 500 Feet

N

Figure 2 USGS Topographic Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC



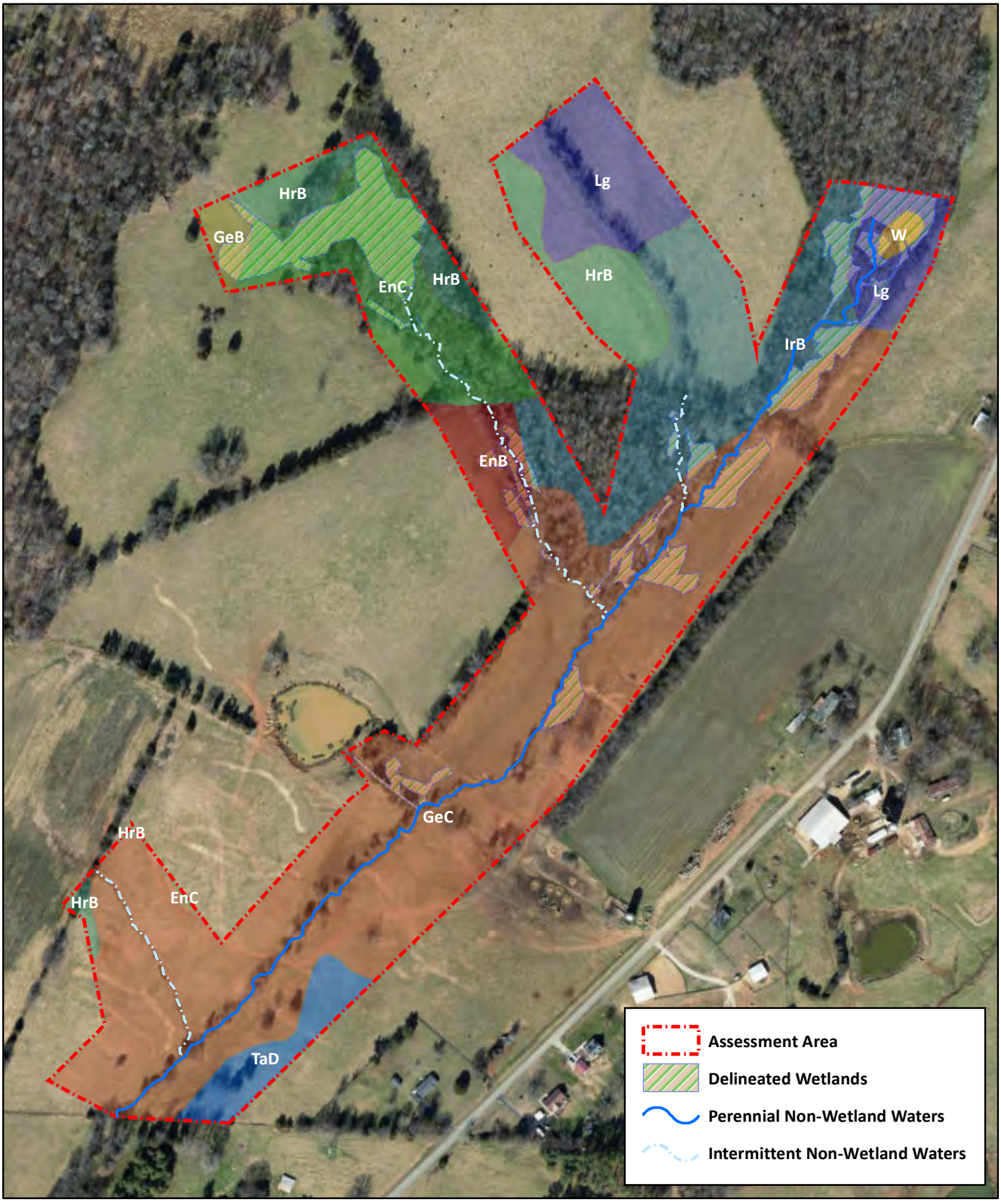
WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 3 Site Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC



WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 4 Soils Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC

Perry Hill Mitigation Site
Site Photographs

	
Perry Branch	UT1
	
UT2	UT3
	
Wetland A – Data Point 1	Wetland B – Data Point 2

	
Upland – Data Point 3	Wetland C – Data Point 4
	
Wetland D – Data Point 5	Upland – Data Point 6
	
Wetland E	Wetland F

	
Wetland G	Wetland H
	
Wetland I – Data Point 7	Wetland J
	
Wetland K – Data Point 8	Wetland L

	
Wetland M	Wetland N
	
Wetland O – Data Point 9	Upland – Data Point 10
	
Wetland P – Data Point 11	Upland – Data Point 12

	
Wetland Q – Data Point 13	Upland – Data Point 14

Appendix 5

Perry Hill Mitigation Site
Existing Condition Photographs

	
Perry Branch Reach 1	**Perry Branch Reach 1 – Breached Impoundment**
	
Perry Branch Reach 2	**Perry Branch Reach 3**
	
Perry Branch Reach 4	**Unnamed Tributary 1 Reach 1**

Unnamed Tributary 1 Reach 2

Unnamed Tributary 2 Reach 1

Unnamed Tributary 2 Reach 2

Unnamed Tributary 3

Ephemeral Channel 3 - Buffer Credit Only

Perry Hill Mitigation Site
DWR Stream Identification Forms

NC DWQ Stream Identification Form Version 4.11

Date: 8/14/18	Project/Site: Perry Mill	Latitude:
Evaluator: Caralyn L.	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Perry Branch R1 *e.g. Quad Name:*

A. Geomorphology (Subtotal =)	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 =)				
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 =)				
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

Date: 8/14/18	Project/Site: Perry Mill	Latitude:
Evaluator: Carolyn	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.25	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other T1 *e.g. Quad Name:*

A. Geomorphology (Subtotal = ____)	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 = ____)				
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 = ____)				
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: Rifle Beetle

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 8/14/18	Project/Site: Perry Hill	Latitude:
Evaluator: Carolyn.	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other T2 R2 *e.g. Quad Name:*

A. Geomorphology (Subtotal =)	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 =)				
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 =)				
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: Frog

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 8/14/18	Project/Site: Perry Hill	Latitude:
Evaluator: Carolyn	County: Orange	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other +3 *e.g. Quad Name:*

A. Geomorphology (Subtotal =)	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 =)				
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 =)				
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:

Perry Hill Mitigation Site
NC SAM Field Assessment Forms

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/21/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Perry Branch Reach 1
10. Length of assessment reach evaluated (feet): ~400
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 4
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☐A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☐	☐	☒	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☐Yes ☒No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☒B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☒F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☒A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/21/2019
Stream Category	Pa1	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**HIGH**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/21/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Perry Branch Reach 2
10. Length of assessment reach evaluated (feet): ~425
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 6
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☐A Water throughout assessment reach.
☒B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☒B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☒A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☐Yes ☒No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☒B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☒F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☒A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☒B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/21/2019
Stream Category	Pa2	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	
(2) Baseflow	**LOW**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**HIGH**	
(4) Floodplain Access	**HIGH**	
(4) Wooded Riparian Buffer	**HIGH**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**HIGH**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**HIGH**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**LOW**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**HIGH**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**LOW**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**MEDIUM**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/21/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Perry Branch Reach 3
10. Length of assessment reach evaluated (feet): ~800
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream)** ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☐A Water throughout assessment reach.
☒B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS************************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☒	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☒	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☐Yes ☒No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☒B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☒F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☒B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☒B	Non-mature woody vegetation or modified vegetation structure
☒C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/21/2019
Stream Category	Pa2	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**LOW**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**HIGH**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**LOW**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**LOW**	
(3) Substrate	**HIGH**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/21/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Perry Branch Reach 4
10. Length of assessment reach evaluated (feet): ~600
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 10
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
☐B Excessive sedimentation (burying of stream features or intertidal zone)
☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
☐D Odor (not including natural sulfide odors)
☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in “Notes/Sketch” section.
☒F Livestock with access to stream or intertidal zone
☐G Excessive algae in stream or intertidal zone
☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
☐I Other: ____________________ (explain in “Notes/Sketch” section)
☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☒B Multiple sticks and/or leaf packs and/or emergent vegetation
☐C Multiple snags and logs (including lap trees)
☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
☐E Little or no habitat

Check for Tidal Marsh Streams Only
☐F 5% oysters or other natural hard bottoms
☐G Submerged aquatic vegetation
☐H Low-tide refugia (pools)
☐I Sand bottom
☐J 5% vertical bank along the marsh
☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
☒A Riffle-run section **(evaluate 11c)**
☒B Pool-glide section **(evaluate 11d)**
☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☒	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☒	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☒	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☒B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☒D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☒B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/21/2019
Stream Category	Pa2	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**MEDIUM**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/22/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT1
10. Length of assessment reach evaluated (feet): ~550
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.8 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☐A (more sinuous stream, flatter valley slope)

☒B (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.

☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☐A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS**************************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☐	☒	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☒	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☒A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/22/2019
Stream Category	Pb1	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**LOW**	**LOW**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**LOW**	**LOW**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**LOW**	**LOW**
(3) Stream Stability	**LOW**	**LOW**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**LOW**	**LOW**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/22/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT2 Reach 1
10. Length of assessment reach evaluated (feet): ~350
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☐A  (more sinuous stream, flatter valley slope)
☒B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☐A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☒	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☐	☐	☒	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☐Yes ☒No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☐B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☒B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☒A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☒B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/22/2019
Stream Category	Pb1	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**MEDIUM**	**MEDIUM**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**HIGH**	**HIGH**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**LOW**	**LOW**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**MEDIUM**	**MEDIUM**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**MEDIUM**	**HIGH**
(2) In-stream Habitat	**LOW**	**MEDIUM**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**LOW**	**LOW**
(3) Stream Stability	**LOW**	**LOW**
(3) In-stream Habitat	**MEDIUM**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**LOW**	**LOW**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Perry Hill Mitigation Site
2. Date of evaluation: 5/22/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT2 Reach 2
10. Length of assessment reach evaluated (feet): ~700
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☐A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☒B 10 to 25% of channel unstable
☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS************************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☒	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☐	☒	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☐B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☒B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☒A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☒B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Perry Hill Mitigation Site	Date of Assessment	5/22/2019
Stream Category	Pa1	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	**MEDIUM**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**MEDIUM**	**MEDIUM**
(3) Streamside Area Attenuation	**HIGH**	**HIGH**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**HIGH**	**HIGH**
(4) Microtopography	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**MEDIUM**	**MEDIUM**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**HIGH**	**HIGH**
(2) In-stream Habitat	**MEDIUM**	**MEDIUM**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**LOW**	**LOW**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**HIGH**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**MEDIUM**	**MEDIUM**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: SAW-2019-00125 NCDWR #: 2019-0157

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): 3
2. Date of evaluation: 5/22/2019
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: W. Taylor
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Eno River
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.108078 / -79.128361

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT3
10. Length of assessment reach evaluated (feet): ~300
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☒Water Supply Watershed (☐I ☒II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☒NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☐A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☒B 10 to 25% of channel unstable
☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS************************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☒	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☒	☐	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☐B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☒B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☒A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☒B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	3	Date of Assessment	5/22/2019
Stream Category	Pa1	Assessor Name/Organization	W. Taylor

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**HIGH**	**HIGH**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**HIGH**	**HIGH**
(3) Streamside Area Attenuation	**HIGH**	**HIGH**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**HIGH**	**HIGH**
(4) Microtopography	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**MEDIUM**	**MEDIUM**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**MEDIUM**	**MEDIUM**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**HIGH**	**HIGH**
(2) In-stream Habitat	**HIGH**	**HIGH**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**HIGH**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**HIGH**	**HIGH**

Appendix 6

Appendix A

Categorical Exclusion Form for Division of Mitigation Services Projects
Version 2

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Perry Hill Mitigation Site
County Name:	Orange County
DMS Number:	100093
Project Sponsor:	Wildlands Engineering, Inc.
Project Contact Name:	Carolyn Lanza
Project Contact Address:	312 W Millbrook Suite 225, Raleigh, NC 27609
Project Contact E-mail:	clanza@wildlandseng.com
DMS Project Manager:	Jeff Schaffer

Project Description

The Perry Hill Mitigation Site is in Orange County approximately 2 miles northwest of Hillsborough. The project includes Perry Branch and three unnamed tributaries, UT1, UT2, and UT3, for a total of 5,634 linear feet of stream and 873,835 riparian buffer credits. Agriculture, specifically livestock, has been the main use of land. The project will provide stream and buffer mitigation units to the Division of Mitigation Services in the Neuse River Basin (03020201).

For Official Use Only

Reviewed By:

6-6-19 — Jeff Schaffer

Date — **DMS Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

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

Final Approval By:

6-6-19 — Donald W. Brew

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

Perry Hill Mitigation Site
Categorical Exclusion

SUMMARY

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

As the Perry Hill Mitigation Site is a full-delivery project; an EDR Radius Map Report with Geocheck was ordered for the site through Environmental Data Resources, Inc on August 13, 2018. The EDR report identified a Lillie Warren's parcel, 0.471 miles away, in a listing of leaking aboveground storage tank site locations (LAST) and Incident Management Database (IMD). On March 23, 1991 roughly 100 gallons of heating oil was spilled at 2412 NC Highway 86, Hillsborough, NC 27278. The incident was reported and cleaned up on April 10, 1991, by excavating 30-40 cubic yards of contaminated soil. Based on its location outside of the Perry Hill Mitigation Site, it was determined that there is no evidence of any "recognized environmental conditions" in connection with the target property. The Executive Summary of the EDR report and the specific Site Summary for Lillie Warren are included in the Appendix. The full report is available if needed.

National Historic Preservation Act (Section 106)

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

Wildlands Engineering, Inc. (Wildlands) requested review and comment from the State Historic Preservation Office (SHPO) with respect to any archeological and architectural resources related to the Perry Hill Mitigation Site on February 28, 2019. SHPO responded on April 2, 2019 and stated they were aware of "no historic resources which would be affected by the project" and would have no further comment. All correspondence related to Section 106 is included in the Appendix.

Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)

These acts, collectively known as the Uniform Act, provide for uniform and equitable treatment of persons displaced from their homes, businesses, non-profit associations, or farms by federal and federally-assisted programs, and establish uniform and equitable land acquisition policies.

Perry Hill Mitigation Site is a full-delivery project that includes land acquisition. Notification of the fair market value of the project property and the lack of condemnation authority by Wildlands was included in the signed Option Agreement for the project property. A copy of the relevant section of the Option Agreement is included in the Appendix.

Endangered Species Act (ESA)

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.

The Orange County listed endangered species includes the dwarf wedgemussel (A*lasmidonta heterodon*), Michaux's sumac (*Rhus michauxii*), and smooth coneflower (*Echinacea laevigata*), all which are endangered, and the Atlantic pigtoe (*Fusconaia masoni*), which is listed as proposed threatened.

A pedestrian survey conducted on August 14, 2018, indicated that the Site did not provide suitable habitat for the dwarf wedgemussel. The pedestrian survey did indicate that the site provides suitable habitat for the Atlantic pigtoe, smooth coneflower and Michaux's sumac but no species were identified on the site. Therefore, due to the absence of the listed species on the site, the project has been determined by Wildlands to have "no effect" on the smooth coneflower and Michaux's sumac. Perry Hill Mitigation Site is an active cattle farm leading to poor water quality, due to this and the absence of the Atlantic pigtoe on the site, the project has been determined to "may affect, but not likely to adversely affect" the Atlantic pigtoe. The project will have "no effect" on the dwarf wedgemussel due to the absence of suitable habitat.

Per the United States Fish and Wildlife Service (USFWS) Raleigh Field Office standard, Wildlands submitted the Perry Hill Mitigation Site Self-Certification Letter on April 16, 2019. The Self-Certification Letter states, the USFWS does "concur with the "no effect" or "not likely to adversely affect" determinations for proposed and listed species and proposed and designated critical habitat; the "may affect" determination for Northern long-eared bat; and/or the "no Eagle Act permit required" determinations for eagles. Additional coordination with this office is not needed." USFWS had no additional comment during the thirty-day review period. All documents and correspondence submitted to the USFWS are included in the Appendix.

Farmland Protection Policy Act (FPPA)

The FPPA requires that, before taking or approving any federal action that would result in conversion of farmland, the agency must examine the effects of the action using the criteria set forth in the FPPA, and, if there are adverse effects, must consider alternatives to lessen them.

The Perry Hill Mitigation Site includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resources Conservation Service (NRCS). The completed form and correspondence documenting its submittal is included in the Appendix.

Fish and Wildlife Coordination Act (FWCA)

The FWCA requires consultation with the USFWS and the appropriate state wildlife agency on projects that alter or modify a water body. Reports and recommendations prepared by these agencies document project effects on wildlife and identify measures that may be adopted to prevent loss or damage to wildlife resources.

The Perry Hill Mitigation Site includes stream restoration. Wildlands requested comment on the project from the North Carolina Wildlife Resources Commission (NCWRC) on February 28, 2019. Wildlands submitted the Perry Hill Mitigation Site Self-Certification Letter on April 16, 2019. NCWRC responded on April 9, 2019 saying, "it is unlikely that stream mitigation will adversely affect any federal or state-listed species". USFWS had no comment during the thirty-day review period. All correspondence with the two agencies is included in the Appendix.

Migratory Bird Treaty Act (MBTA)

The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute a taking.

Wildlands submitted the Perry Hill Mitigation Site Self-Certification Letter on April 16, 2019. USFWS had no comment during the thirty-day review period. All correspondence with USFWS is included in the Appendix.

Perry Hill
2323 Frank Perry Road
Hillsborough, NC 27278

Inquiry Number: 5390419.2s
August 13, 2018

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
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 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

2323 FRANK PERRY ROAD
HILLSBOROUGH, NC 27278

COORDINATES

Latitude (North):	36.1093450 - 36° 6' 33.64''
Longitude (West):	79.1315400 - 79° 7' 53.54''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	668180.2
UTM Y (Meters):	3997492.2
Elevation:	680 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5947915 EFLAND, NC
Version Date:	2013
Northeast Map:	5947438 CALDWELL, NC
Version Date:	2013
Southeast Map:	5947925 HILLSBOROUGH, NC
Version Date:	2013
Northwest Map:	5947913 CEDAR GROVE, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140619
Source:	USDA

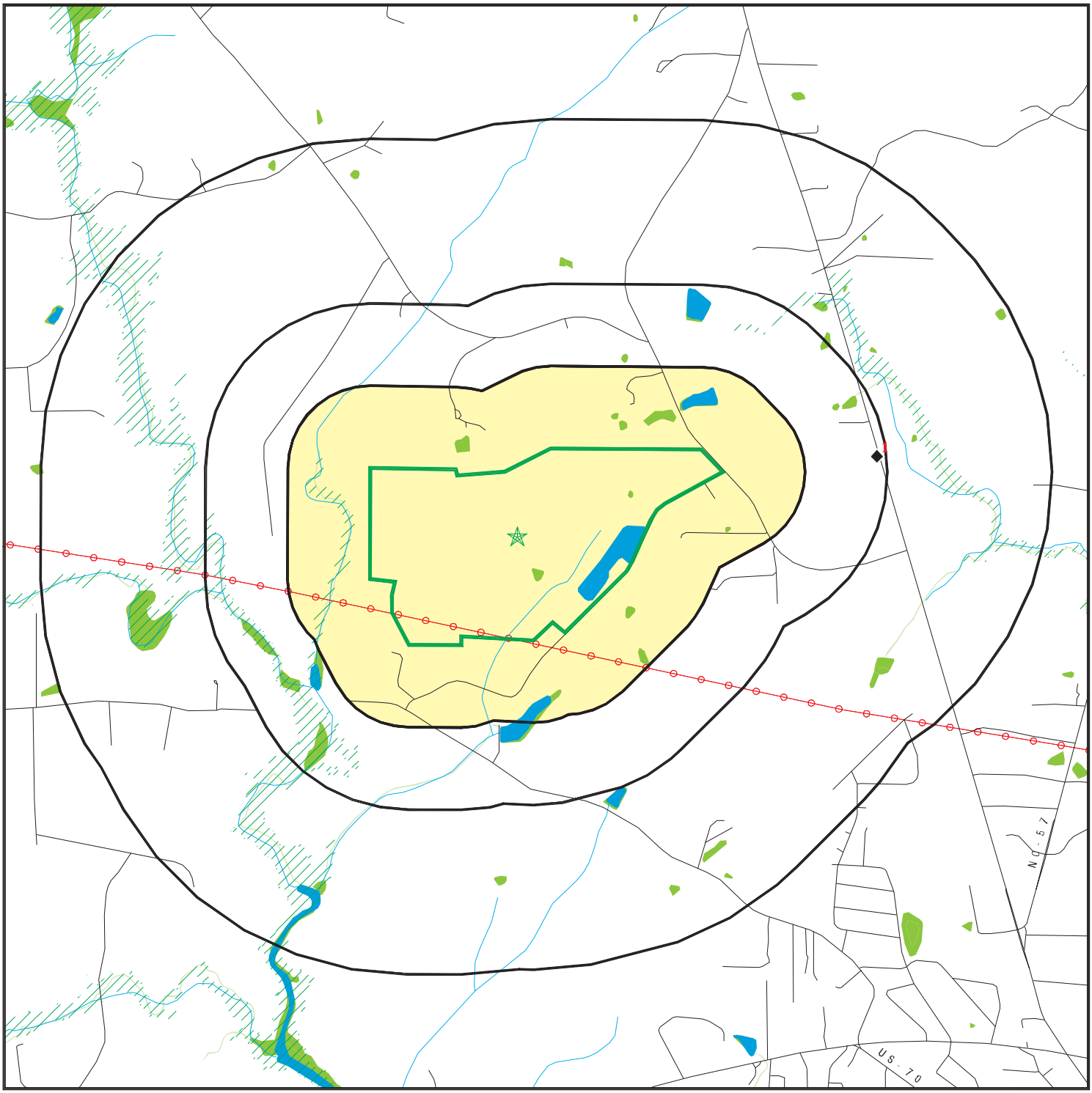
MAPPED SITES SUMMARY

Target Property Address:
2323 FRANK PERRY ROAD
HILLSBOROUGH, NC 27278

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1	WARREN, LILLIE	2421 N. HWY. 86	LAST, IMD	Lower	2486, 0.471, ENE

OVERVIEW MAP - 5390419.2S



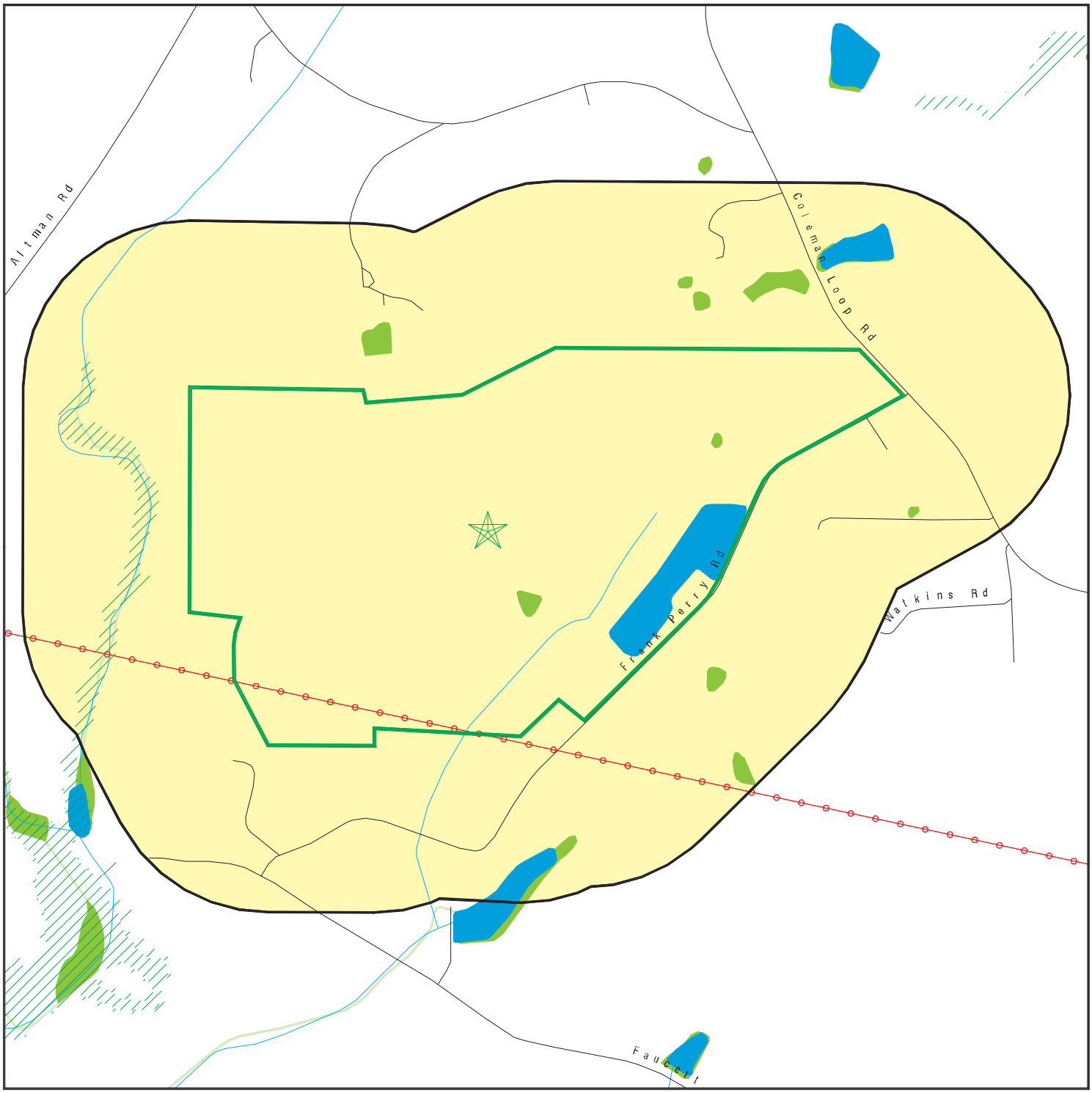
0 1/4 1/2 1 Miles

- 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
- Indian Reservations BIA
- Power transmission lines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Upgradient Area
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Perry Hill	CLIENT: Wildlands Eng, Inc.
ADDRESS: 2323 Frank Perry Road Hillsborough NC 27278	CONTACT: Chris Roessler
LAT/LONG: 36.109345 / 79.13154	INQUIRY #: 5390419.2s DATE: August 13, 2018 1:12 pm

DETAIL MAP - 5390419.2S



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

0 1/8 1/4 1/2 Miles

- Indian Reservations BIA
- Power transmission lines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Perry Hill ADDRESS: 2323 Frank Perry Road Hillsborough NC 27278 LAT/LONG: 36.109345 / 79.13154	CLIENT: Wildlands Eng, Inc. CONTACT: Chris Roessler INQUIRY #: 5390419.2s DATE: August 13, 2018 1:14 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	0.001		0	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	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								
LUCIS	0.500		0	0	0	NR	NR	0
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	0.001		0	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								
LAST	0.500		0	0	1	NR	NR	1

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	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
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
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								
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
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	0.001		0	NR	NR	NR	NR	0
US CDL	0.001		0	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	0.001		0	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	0.001		0	NR	NR	NR	NR	0
SPILLS	0.001		0	NR	NR	NR	NR	0
IMD	0.500		0	0	1	NR	NR	1
SPILLS 90	0.001		0	NR	NR	NR	NR	0
SPILLS 80	0.001		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	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
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	0.001		0	NR	NR	NR	NR	0
EPA WATCH LIST	0.001		0	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	0.001		0	NR	NR	NR	NR	0
TRIS	0.001		0	NR	NR	NR	NR	0
SSTS	0.001		0	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	0.001		0	NR	NR	NR	NR	0
RAATS	0.001		0	NR	NR	NR	NR	0
PRP	0.001		0	NR	NR	NR	NR	0
PADS	0.001		0	NR	NR	NR	NR	0
ICIS	0.001		0	NR	NR	NR	NR	0
FTTS	0.001		0	NR	NR	NR	NR	0
MLTS	0.001		0	NR	NR	NR	NR	0
COAL ASH DOE	0.001		0	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	0.001		0	NR	NR	NR	NR	0
RADINFO	0.001		0	NR	NR	NR	NR	0
HIST FTTS	0.001		0	NR	NR	NR	NR	0
DOT OPS	0.001		0	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	0.001		0	NR	NR	NR	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	0.001		0	NR	NR	NR	NR	0
US AIRS	0.001		0	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.001		0	NR	NR	NR	NR	0
FINDS	0.001		0	NR	NR	NR	NR	0
ECHO	0.001		0	NR	NR	NR	NR	0
DOCKET HWC	0.001		0	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	0.001		0	NR	NR	NR	NR	0
ASBESTOS	0.001		0	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	0.001		0	NR	NR	NR	NR	0
NPDES	0.001		0	NR	NR	NR	NR	0
UIC	0.001		0	NR	NR	NR	NR	0
AOP	0.001		0	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	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
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	0.001		0	NR	NR	NR	NR	0
RGA LF	0.001		0	NR	NR	NR	NR	0
RGA LUST	0.001		0	NR	NR	NR	NR	0
- Totals --		0	0	0	2	0	0	2

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

1
ENE
1/4-1/2
0.471 mi.
2486 ft.

WARREN, LILLIE
2421 N. HWY. 86
HILLSBOROUGH, NC 27278

LAST **S103130940**
IMD **N/A**

Relative:
Lower

Actual:
633 ft.

LAST:

Facility ID:	N/A	
UST Number:	RA-6521	
Incident Number:	6521	
Contamination Type:		SL
Source Type:	19	
Product Type:	P	
Date Reported:	04/10/1991	
Date Occur:	03/23/1991	
Cleanup:	04/10/1991	
Closure Request:	Not reported	
Close Out:	Not reported	
Level Of Soil Cleanup Achieved:		Not reported
Tank Regulated Status:		Not reported
# Of Supply Wells:	0	
Commercial/NonCommercial UST Site:		Not reported
Risk Classification:		H
Risk Class Based On Review:		H
Corrective Action Plan Type:		Not reported
NOV Issue Date:	Not reported	
NORR Issue Date:	Not reported	
Site Priority:	125	
Phase Of LSA Req:	Not reported	
Site Risk Reason:	Not reported	
Land Use:	RES	
MTBE:	No	
MTBE1:	Unknown	
Flag:	No	
Flag1:	No	
LUR Filed:	Not reported	
Release Detection:	0	
Current Status:	C	
RBCA GW:	Not reported	
PETOPT:	4	
RPL:	False	
CD Num:	0	
Reel Num:	0	
RPOW:	False	
RPOP:	False	
Error Flag:	0	
Error Code:	Not reported	
Valid:	False	
Lat/Long:	36 7 22.98 79 6 43.98	
Lat/Long Decimal:	36.12305 -79.11222	
Testlat:	Not reported	
Regional Officer Project Mgr:		CED
Region:		RAL
Company:		Not reported
Contact Person:		LILLIE WARREN
Telephone:		Not reported
RP Address:		2412 NC Hwy 86
RP City,St,Zip:		HILLSBOROUGH, NC 27278
RP County:		Not reported

WARREN, LILLIE (Continued) **S103130940**

Comments: Loss of ~100 gals #2 fuel oil. Envirochem hired to excavate 30 - 40 cu.yds of contaminated soil to rock. TPH conc. @2,000 ppm at bedrock interface. Site assessment report prepared for Allstate insurance. to be forwarded to NCDEM. Allstate contact Herbert Tyler @ 872-3200. File transfer from UST on 5-5-05. 03/11/08 - CED conducted file review. - No rpts in file, just release info. WSWs within 1500'. High Risk. ADDITIONAL ASSESSMENT NECESSARY - CED ////

5 Min Quad: Not reported

PIRF:

Facility Id:	6521
Date Occurred:	Not reported
Date Reported:	Not reported
Description Of Incident:	Not reported
Owner/Operator:	Not reported
Ownership:	5
Operation Type:	5
Type:	Not reported
Location:	Not reported
Site Priority:	125B
Priority Update:	Not reported
Wells Affected Y/N:	Not reported
Wells Affected Number:	Not reported
Samples Taken By:	Not reported
Samples Include:	Not reported
7#5 Min Quad:	Not reported
5 Min Quad:	Not reported
Pirf/Min Soil:	Not reported
Release Code:	Not reported
Cause:	Not reported
Source:	Not reported
Source Type:	0
Last Modified:	12/18/2006
Incident Phase:	**FU**
NOV Issued:	Not reported
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Signed:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	Not reported

IMD:

Region:	RAL
Facility ID:	6521
Date Occurred:	3/27/1991
Submit Date:	5/5/2005
GW Contam:	Groundwater Contamination status unknown
Soil Contam:	Not reported
Incident Desc:	Loss of 100 gals #2 fuel oil. Envirochem hired to excavate 30 - 40 cu.yds of contaminated soil to rock. TPH conc. @2,000 ppm at bedrock interface. Site assessm
Operator:	WARREN, LILLIE

WARREN, LILLIE (Continued) **S103130940**

Contact Phone: Not reported
Owner Company: Not reported
Operator Address: 2412 NC Hwy 86
Operator City: HILLSBOROUGH
Oper City,St,Zip: HILLSBOROUGH, NC
Ownership: Federal
Operation: Industrial
Material: Not reported
Qty Lost 1: Not reported
Qty Recovered 1: Not reported
Source: Spill-surface
Type: Heating Oil
Location: Not reported
Setting: Not reported
Risk Site: Not reported
Site Priority: 125
Priority Code: B
Priority Update: Not reported
Dem Contact: ERIC RICE
Wells Affected: No
Num Affected: Not reported
Wells Contam: Not reported
Sampled By: Not reported
Samples Include: Not reported
7.5 Min Quad: Not reported
5 Min Quad: Not reported
Latitude: 36.123055
Longitude: -79.112222
Latitude Number: Not reported
Longitude Number: Not reported
Latitude Decimal: Not reported
Longitude Decimal: Not reported
GPS: EST
Agency: DWQ
Facility ID: 6521
Last Modified: 5/5/2005
Incident Phase: Follow Up
NOV Issued: Not reported
NORR Issued: Not reported
45 Day Report: Not reported
Public Meeting Held: Not reported
Corrective Action Planned: Not reported
SOC Sighned: Not reported
Reclassification Report: Not reported
RS Designation: Not reported
Closure Request Date: Not reported
Close-out Report: Not reported

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

WILDLANDS
ENGINEERING

February 18, 2019

Ms. Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

RE: Coordination Request
North Carolina Division of Mitigation Services
PERRY HILL MITIGATION SITE
Orange County, North Carolina
Catalogue Unit 03020201

Dear Ms. Gledhill-Earley:

Wildlands Engineering, Inc. is contracted by the North Carolina Division of Mitigation Services (NCDMS) to conduct stream restoration/enhancement activities for the above- referenced project. We are requesting your office to review and comment on any possible issues that may emerge with respect to archaeological or cultural resources associated with the proposed stream restoration/enhancement project. Included in this package are USGS Site Topographic Map at 1:24,000 scale, and Site Map.

The project area is located in Orange County, North Carolina approximately 2 miles northwest of Hillsborough. The project is located on the Efland, North Carolina 7.5-minute topographic map from the United States Geological Survey (USGS). The project area begins at latitude 36° 06' 41.9"N and longitude 79° 07' 31.9"W and terminates at latitude 36° 06' 18"N and longitude 79° 07' 56.1"W. The site is located off Frank Perry Road, one mile west of Highway 86.

The Perry Hill Mitigation Site was identified to provide in-kind mitigation for unavoidable stream impacts. Segments of this stream have been identified as incised, eroding, and no longer connected to its floodplain. In total, 5,634 linear feet are proposed for stream restoration, enhancement I and enhancement II on four unnamed tributaries all which drain to the Eno River. Limits of Disturbance will be contained to the easement, with the exception of haul road to access the site from Frank Perry Road. Exact acreage of disturbance is subject to change. The enclosed map displays the areas proposed for restoration/enhancement.

There are no existing structures with the areas proposed for restoration or enhancement Furthermore, no architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. In addition, the majority of the site has historically been disturbed due to past and current management for cattle grazing and rearing.

Wildlands appreciates your timely attention to this matter. If we do not hear from you within 45 days, we will assume that there are no comments with regard to project and area archaeological or cultural resources. Please feel free to contact us if you have any questions regarding this project or the extent of proposed disturbance at clanza@wildlandseng.com or by phone (313)-969-7318.

Sincerely,

Carolyn Lanza

Carolyn Lanza
Environmental Scientist

ENCLOSURES
Figure 1 Site Map
Figure 2 USGS Site Topographic Map

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

April 2, 2019

Carolyn Lanza
Wildlands Engineering
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Re: Perry Hill Mitigation Site, Hillsborough, Orange County, ER 19-0946

Dear Ms. Lanza:

Thank you for your letter of February 28, 2019, 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, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

under any indemnification or defense provision in this agreement, nor for the award of attorney's fees and costs in conjunction with any action relating to this agreement.

3.3 **Well and Watering Device Allowance**. Buyer will pay Seller $40,000.00 at the start of construction of the Project to compensate Seller for wells and livestock watering devices. Buyer is not responsible for the installation, efficacy or maintenance of wells or watering devices. This paragraph survives Closing.

3.4 **Notices.** All notices required by this agreement shall be in writing, shall be given only in accordance with the provisions of this Section, shall be addressed to the Parties in the manner stated below, and shall be conclusively deemed properly delivered: (a) upon receipt when hand delivered during normal business hours; (b) upon the day of delivery if the notice has been deposited in an authorized receptacle of the United States Postal Service as first-class, registered or certified mail, postage prepaid, with a return receipt requested; (c) one business day after the notice has been deposited with either FedEx or United Parcel Service to be delivered by overnight delivery; or (d) if sent by email, upon receipt of an acknowledgement email sent to the sender's email address in which the party receiving the email notice acknowledges having received that email. An automatic "read receipt" is not acknowledgement for purposes of this paragraph. The addresses of the parties to receive notices are as follows:

TO BUYER:
Wildlands Engineering, Inc.
1430 S. Mint Street, Suite 104
Charlotte, North Carolina 28203
Attention: Robert W. Bugg
Email: rbugg@wildlandseng.com

TO SELLER:
Stuart Horne
1926 Chatwood Lane
Hillsborough, NC 27278
Email: stupathorne@icloud.com

Notice of change of address shall be given by written notice in the manner described in this paragraph.

3.5 **Assignment.** Buyer has the right to assign this agreement without the consent of Seller. No assignment will be effective unless the assignee has delivered to Seller a written assumption of Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

3.6 **Value of Conservation Easement; No Power of Eminent Domain.** In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer hereby notifies Seller that: (i) Buyer believes that the fair market value of the Conservation Easement is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

3.7 **Modification; Waiver.** No amendment of this agreement will be effective unless it is in writing and signed by the parties. No waiver of satisfaction of a condition or failure to comply with an obligation under this agreement will be effective unless it is in writing and signed by the party granting the waiver, and no such waiver will constitute a waiver of satisfaction of any other condition or failure to comply with any other obligation.

JH Buyer
Seller Seller Seller GK Seller Seller

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

Date: 02/28/2020

Self-Certification Letter

Project Name Perry Hill Mitigation Site

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Raleigh Ecological Services online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the project named above in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA and Eagle Act conclusions. Based on your analysis, mark all the determinations that apply:

- [x] "no effect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- [x] "may affect, not likely to adversely affect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- [ ] "may affect, likely to adversely affect" determination for the Northern long-eared bat (Myotis septentrionalis) and relying on the findings of the January 5, 2016, Programmatic Biological Opinion for the Final 4(d) Rule on the Northern long-eared bat;
- [x] "no Eagle Act permit required" determinations for eagles.

We certify that use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the “no effect” or “not likely to adversely affect” determinations for proposed and listed species and proposed and designated critical habitat; the “may affect” determination for Northern long-eared bat; and/or the “no Eagle Act permit required” determinations for eagles. Additional coordination with this office is not needed. Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species. Should project plans change or if additional information on the distribution of proposed or listed species, proposed or designated critical habitat, or bald eagles becomes available, this determination may be reconsidered. This certification letter is valid for 1 year. Information about the online project review process including instructions, species information, and other information regarding project reviews within North Carolina is available at our website http://www.fws.gov/raleigh/pp.html. If you have any questions, you can write to us at Raleigh@fws.gov or please contact Leigh Mann of this office at 919-856-4520, ext. 10.

Sincerely,

/s/Pete Benjamin

Pete Benjamin
Field Supervisor
Raleigh Ecological Services

Enclosures - project review package

Species Conclusions Table*

Project Name: Perry Hill Mitigation Site

Date: 02/28/2020

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Critical Habitat	None		
Bald Eagle	Unlikely to disturb nesting bald eagles	No Eagle Act Permit Required	Not within 660 feet of large bodies of water.
NLEB	No suitable habitat present	No Effect	No NLEB registered in Orange County
Atlantic Pigtoe (*Fusconaia masoni*)	Suitable habitat present, species not present	Not likely to adversely affect	Survey conducted August 14, 2018 and found that species are not likely to be found due to poor water quality.
Dwarf wedgemussel (*Alasmidonta heterodon*)	No suitable habitat present	No Effect	Habitat assessment indicated no potential habitat present.
Michaux's Sumac (*Rhus michauxii*)	Suitable habitat present, species not present	Not likely to adversely affect	USFWS-Historic Record Status, Survey conducted on August 14, 2018 and February 14, 2020 indicated species absence.
Smooth Coneflower (*Echinacea laevigata*)	Suitable habitat present, species not present	Not likely to adversely affect	USFWS-Historic Record Status, Survey conducted on August 14, 2018 and February 14, 2020 indicated species absence.
Neuse River Waterdog *(Necturus lewisi)*	No suitable habitat present	No Effect	A Field Survey was conducted on February 14, 2020 and no suitable habitat was found due to poor water quality and stream sizes. No individuals of the species were found. The proposed project is not in the proposed critical habitat area designated by USFWS for this species. Per NCNHP data explorer, no known element occurrences exist within the proposed project area.
Carolina Madtom *(Noturus furiosus)*	No suitable habitat present	No Effect	A Field Survey was conducted on February 14, 2020 and no suitable habitat was found due to poor water quality, siltation, and stream sizes. No individuals of the species were found. The proposed project is not in the proposed critical habitat area designated by USFWS for this species. Per NCNHP data explorer, no known element occurrences exist within the proposed project area.

Acknowledgement: I agree that the above information about my proposed project is true. I used all of the provided resources to make an informed decision about impacts in the immediate and surrounding areas.

Environmental Scientist 02/28/2020

Signature /Title Date

*Species conclusion table for this project was originally submitted 4/16/2019 and was included in the Categorical Exclusion that was approved on 6/6/2019. The table is being resubmitted to include the newly proposed threatened Neuse River Waterdog and proposed endangered Carolina Madtom.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To: February 12, 2020
Consultation Code: 04EN2000-2020-SLI-0634
Event Code: 04EN2000-2020-E-01422
Project Name: Perry Hill Mitigation Site

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The species list generated pursuant to the information you provided identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or

evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Not all Threatened and Endangered Species that occur in North Carolina are subject to section 7 consultation with the U.S Fish and Wildlife Service. Atlantic and shortnose sturgeon, sea turtles,when in the water, and certain marine mammals are under purview of the National Marine Fisheries Service. If your project occurs in marine, estuarine, or coastal river systems you should also contact the National Marine Fisheries Service, http://www.nmfs.noaa.gov/

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If you have any questions or comments, please contact John Ellis of this office at john_ellis@fws.gov.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

Project Summary

Consultation Code: 04EN2000-2020-SLI-0634

Event Code: 04EN2000-2020-E-01422

Project Name: Perry Hill Mitigation Site

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: The Perry Hill Mitigation Site is located approximately three miles northwest of Hillsborough, NC. The project area includes a DMS mitigation project, as well as an adjacent mitigation bank. The DMS mitigation site includes approximately 26.75 acres of restoration and enhancement of riparian buffer, part of Perry Branch, and 3 unnamed tributaries that flow to it. The mitigation bank will include restoration and enhancement of approximately 15 acres of buffer adjacent to the DMS site. Both projects will proved buffer and stream mitigation credits in the Neuse River Basin 03020201.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/36.10849714158877N79.12807503335586W

Counties: Orange, NC

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Amphibians

NAME	STATUS
Neuse River Waterdog *Necturus lewisi* There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6772	Proposed Threatened

Fishes

NAME	STATUS
Carolina Madtom *Noturus furiosus* There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/528	Proposed Endangered

Clams

NAME	STATUS
Atlantic Pigtoe *Fusconaia masoni* There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5164	Proposed Threatened
Dwarf Wedgemussel *Alasmidonta heterodon* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/784	Endangered

Flowering Plants

NAME	STATUS
Michaux's Sumac *Rhus michauxii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5217	Endangered
Smooth Coneflower *Echinacea laevigata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3473	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, **Governor**
Susi Hamilton, **Secretary**
Walter Clark, **Director, Land and Water Stewardship**

NCNHDE-11391

February 18, 2020

Tasha King
Wildlands Engineering
312 West Millbrook Rd
Raleigh, NC 27609
RE: Perry Hill Mitigation Site

Dear Tasha King:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources for the project referenced above.

Based on the project area mapped with your request, a query of the NCNHP database indicates that there are no records for rare species, important natural communities, natural areas, and/or conservation/managed areas within the proposed project boundary. Please note that although there may be no documentation of natural heritage elements within the project boundary, it does not imply or confirm their absence; the area may not have been surveyed. The results of this query should not be substituted for field surveys where suitable habitat exists. In the event that rare species are found within the project area, please contact the NCNHP so that we may update our records.

The attached 'Potential Occurrences' table summarizes rare species and natural communities that have been documented within a one-mile radius of the property boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists. Tables of natural areas and conservation/managed areas within a one-mile radius of the project area, if any, are also included in this report.

If a Federally-listed species is found within the project area or is indicated within a one-mile radius of the project area, the NCNHP recommends contacting the US Fish and Wildlife Service (USFWS) for guidance. Contact information for USFWS offices in North Carolina is found here: https://www.fws.gov/offices/Directory/ListOffices.cfm?statecode=37.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NCNHP data may not be redistributed without permission.

The NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve, Registered Heritage Area, Clean Water Management Trust Fund easement, or Federally-listed species are documented near the project area.

If you have questions regarding the information provided in this letter or need additional assistance, please contact Rodney A. Butler at rodney.butler@ncdcr.gov or 919-707-8603.

Sincerely,
NC Natural Heritage Program

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Perry Hill Mitigation Site
February 18, 2020
NCNHDE-11391

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Butterfly	34564	Erynnis martialis	Mottled Duskywing	1952-07-01	H	5-Very Low	---	Significantly Rare	G3	S2
Dragonfly or Damselfly	33764	Somatochlora georgiana	Coppery Emerald	2004-Pre	H?	5-Very Low	---	Significantly Rare	G3G4	S2?
Freshwater Bivalve	22593	Fusconaia masoni	Atlantic Pigtoe	2005-07-13	A	3-Medium	Proposed Threatened	Endangered	G2	S3
Freshwater Bivalve	21815	Strophitus undulatus	Creeper	2016-09-27	E	3-Medium	---	Threatened	G5	S3
Freshwater Bivalve	5202	Villosa constricta	Notched Rainbow	2015-07-20	E	3-Medium	---	Threatened	G3	S3
Freshwater Fish	29191	Etheostoma collis	Carolina Darter	1955-04-21	H	3-Medium	---	Special Concern	G3	S3

Natural Areas Documented Within a One-mile Radius of the Project Area

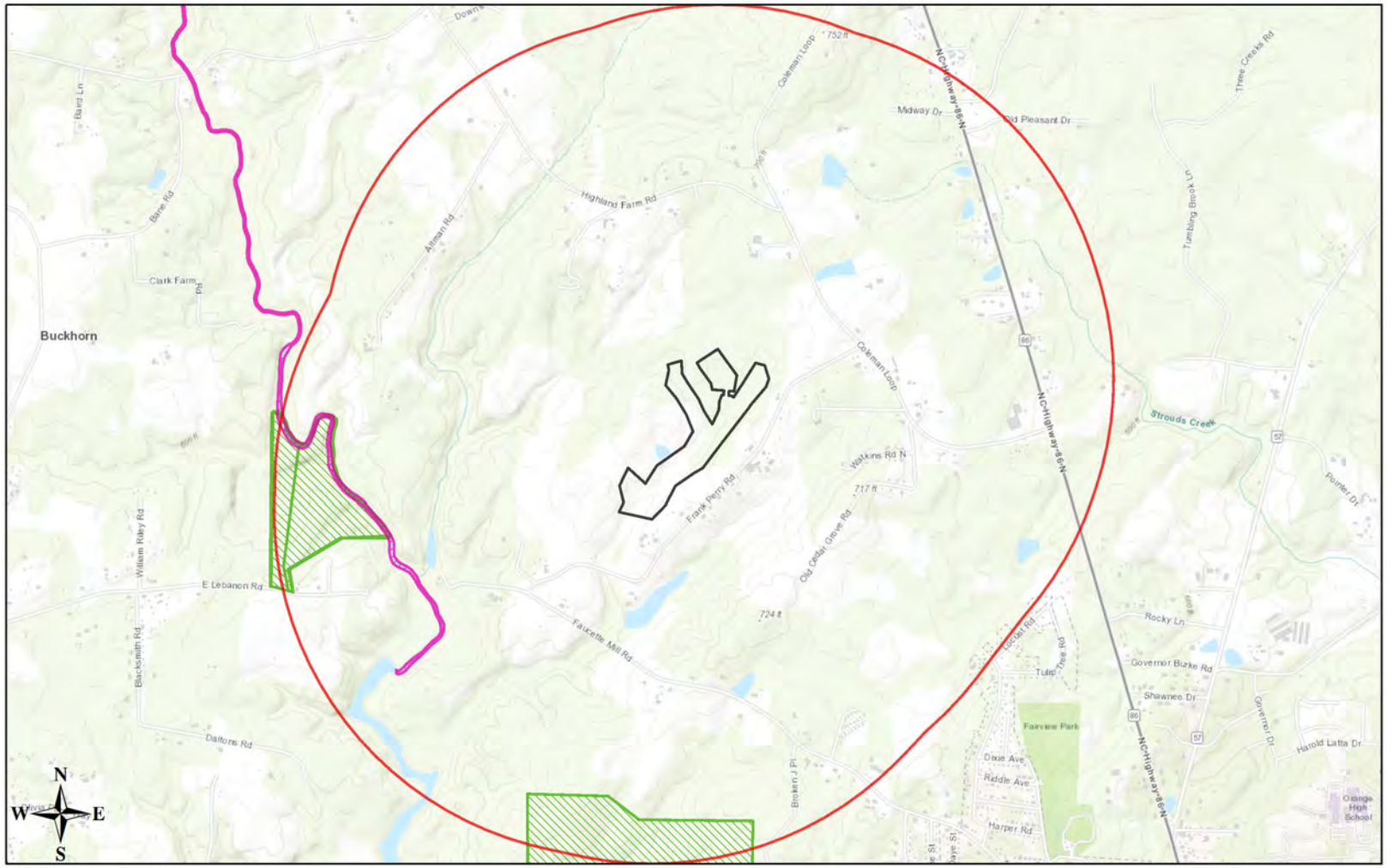
Site Name	Representational Rating	Collective Rating
NEU/Eno River Aquatic Habitat	R2 (Very High)	C3 (High)

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
Duke Forest	Duke University	Private
NC Clean Water Management Trust Fund Funded Project	NC DNCR, Clean Water Management Trust Fund	State
Orange County Easement	Orange County	Local Government
Orange County Easement	Orange County	Local Government

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on February 18, 2020; source: NCNHP, Q1 Jan 2020. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

NCNHDE-11391: Perry Hill Mitigation Site



February 18, 2020

- Project Boundary
- Buffered Project Boundary
- NHP Natural Area (NHNA)
- Managed Area (MAREA)

1:25,269

0 0.2 0.4 0.8 mi

0 0.325 0.65 1.3 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 05/09/2019
Name Of Project Perry Hill Mitigation Site	Federal Agency Involved NC Division of Mitigation Services
Proposed Land Use Stream Restoration	County And State Orange County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 05/09/2019

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 88 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 245,406 acres % 96		Amount Of Farmland As Defined in FPPA Acres: 203,636 acres % 90	
Name Of Land Evaluation System Used Orange Co., NC LESA	Name Of Local Site Assessment System N/A		Date Land Evaluation Returned By NRCS May 21, 2019 by eMail	

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	25.4			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	25.4	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	1.8			
B. Total Acres Statewide And Local Important Farmland	23.4			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0124			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	71.5			
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	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	20			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	15	0			
6. Distance To Urban Support Services	15	0			
7. Size Of Present Farm Unit Compared To Average	10	5			
8. Creation Of Nonfarmable Farmland	10	10			
9. Availability Of Farm Support Services	5	0			
10. On-Farm Investments	20	0			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	0			
TOTAL SITE ASSESSMENT POINTS	160	80	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	80	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	163	0	0	0

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

Reason For Selection:

This form was electronically produced by National Production Services Staff

Carolyn Lanza

From: Carolyn Lanza
Sent: Thursday, May 23, 2019 5:07 PM
To: 'Cortes, Milton - NRCS, Raleigh, NC'
Subject: RE: Request for AD1006 Form - Perry Hill Mitigation Site - Orange County, NC
Attachments: Farmland Conversion Impact Rating Complete .pdf

Milton,

I have attached the completed Farmland Conversion Impact Rating for Perry Hill Mitigation Site.

Thank you,

Carolyn Lanza | *Environmental Scientist*
O: 919.851.9986 x113 **M**: 313.969.7318

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

From: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Sent: Tuesday, May 21, 2019 4:50 PM
To: Carolyn Lanza <clanza@wildlandseng.com>
Subject: RE: Request for AD1006 Form - Perry Hill Mitigation Site - Orange County, NC
Importance: High

Carolyn;

Please find attached the Farmland Conversion Impact rating evaluation for Perry Hill Mitigation Site, Orange Co. NC

If I can be of further assistance please let me know

Best regards

Milton Cortes
State Soil Scientist
USDA NRCS
4407 Bland Rd., Suite 117
Raleigh, NC 27609
Desk: 919-873-2171

From: Carolyn Lanza <clanza@wildlandseng.com>
Sent: Thursday, May 9, 2019 11:46 AM
To: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Subject: Request for AD1006 Form - Perry Hill Mitigation Site - Orange County, NC

Milton,

I have a request for a completed AD-1006 form for a NCDENR Division of Mitigation Services (DMS) stream restoration project (Perry Hill Mitigation Site) located in Orange County. Please find a Soils Map attached in addition to the AD-1006 form with Parts I and III filled out. The soil breakdown is included on the Soils Map.

Thank you for your assistance and please let me know if you need any additional information.

Carolyn Lanza | *Environmental Scientist*
O: 919.851.9986 x113 **M**: 313.969.7318

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

WILDLANDS
ENGINEERING

February 28, 2019

Olivia Munzer
North Carolina Wildlife Resource Commission
Western Piedmont Coordinator
2430 Turner Road
Mebane, NC 27302

Subject: Perry Hill Mitigation Site
Orange County, North Carolina

Dear Ms. Deaton,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with the proposed Perry Hill Mitigation Site. A Site Map and USGS Topographic Map showing the approximate project area are enclosed.

The project area is located in Orange County, North Carolina approximately 2 miles northwest of Hillsborough. The project is located on the Efland, North Carolina 7.5-minute topographic map from the United States Geological Survey (USGS). The project area begins at latitude 36° 06' 41.9"N and longitude 79° 07' 31.9"W and terminates at latitude 36° 06' 18"N and longitude 79° 07' 56.1"W. The site is located off Frank Perry Road, one mile west of Highway 86.

The Perry Hill Mitigation Site was identified to provide in-kind mitigation for unavoidable stream impacts. Segments of this stream have been identified as incised, eroding, and no longer connected to its floodplain. In total, 5,634 linear feet are proposed for stream restoration, enhancement I and enhancement II on four unnamed tributaries all which drain to the Eno River. The site has historically been disturbed due to livestock use. Limits of Disturbance will be contained to the easement, with the exception of haul road to access the site from Frank Perry Road. Exact acreage of disturbance is subject to change. The enclosed map displays the areas proposed for restoration/enhancement.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Carolyn Lanza

Carolyn Lanza
Environmental Scientist

Attachment:
Figure 1 Site Map
Figure 2 USGS Topographic Map

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

09 April 2019

Ms. Carolyn Lanza
Wildlands Engineering
312 West Millbrook Street, Suite 225
Raleigh, North Carolina 27608

Subject: Request for Project Review and Comments
Perry Hill Mitigation Site
Orange County, North Carolina

Dear Ms. Lanza,

Biologists with the North Carolina Wildlife Resource Commission (NCWRC) received your letter requesting review and comment on any possible concerns regarding the Perry Hill Mitigation Site. Biologists with NCWRC have reviewed the provided documents. 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 Perry Hill Mitigation Site is located approximately 1 mile west of Highway 86 on Frank Perry Road, about 2 miles northwest of Hillsborough, Orange County, North Carolina. The site occurs within an existing livestock pasture and forested area. The project will provide in-kind mitigation for unavoidable impacts to streams and wetlands within the Neuse River Basin (HUC 03020201). The project will restore or enhance 5,634 linear feet of four unnamed tributaries to the Eno River. Eno River is classified as a Water Supply II, High Quality Water, Critical Area, and Nutrient Sensitive Water by the N.C. Division of Water Resources (NCDWR).

We have records for the federal endangered and state endangered dwarf wedgemussel (*Alasmidonta heterodon*) and smooth coneflower (*Echinacea laevigata*); state endangered Atlanta pigtoe (*Fusconaia masoni*) and American bluehearts (*Buchnera americana*); state threatened creeper (*Strophitus undulatus*), notched rainbow mussel (*Villosa constricta*), and mimic shiner (*Notropis volucellus*); special concern Neuse River waterdog (*Fusconaia masoni*) and Carolina darter (*Etheostoma collis*); and state significantly rare Roanoke bass (*Ambloplites cavifrons*) and glade wild quinine (*Parthenium auriculatum*) within the vicinity of the site. The Neuse/Eno River Aquatic Habitat Natural Heritage Natural Area (NHNA) and Eno River Mesic Slopes and Floodplain NHNA occur along the Eno River near site. The lack of records from the site does not imply or confirm the absence of federal or state-listed species.

Based upon the information provided to NCWRC, it is unlikely that stream mitigation will adversely affect any federal or state-listed species. If not already pursued, we suggest mitigation of Perry Branch

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

downstream of the site, particularly between Frank Perry Road and Faucette Mill Road, to further increase hydrologic function and restore ecological function in the watershed.

We recommend leaving snags and mature trees or if necessary, remove tees outside the maternity roosting season for bats (May 15 – August 15). Riparian buffers should be as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams to maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat. Due to the potential for rare, threatened, and endangered species to occur downstream of the site, we request stringent sediment and erosion control measures. The use of biodegradable and wildlife-friendly sediment and erosion control devices is strongly recommended.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats, and provide a travel corridor for wildlife species. Provided 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 provide comments. If I can be of additional assistance, please call (919) 707-0364 or email olivia.munzer@ncwildlife.org.

Sincerely,

Olivia Munzer
Western Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

IRT Field Meeting Notes – Perry Hill **March 7, 2019**

Meeting Attendees
Todd Tugwell/USACE
Mac Haupt/NCDWR
Katie Merritt/NCDWR
Travis Wilson/NCWRC
Olivia Munzer/NCWRC
Jeff Schaffer/NCDMS
Lindsay Crocker/NCDMS
John Hutton/Wildlands
Daniel Taylor/Wildlands

On February 26, 2019, John Hutton and Daniel Taylor of Wildlands Engineering, Inc. (Wildlands) led the group on a tour of the Perry Hill mitigation site in Hillsborough, NC. The purpose of the tour was to present the site to a group of IRT members and to get input on the management/mitigation options proposed for the site. During the tour, the group openly discussed the condition of the stream channels on the site and the design options and crediting scenarios they felt would be most appropriate to restore and enhance the channels. The accompanying map identifies the stream reach names.

The tour began at the downstream end of Perry Branch and moved upstream to UT1, UT2 (&EC2), UT3 (&EC3) and the rest of Perry Branch. Comments provided during the site visit are listed below by reach.

Perry Branch

On Perry Branch, the group started at Reach 3 and walked upstream. The IRT recommended changing the enhancement 2 approach on Reach 3 in the proposal to Priority 1 restoration. The IRT requested that Wildlands check with the landowners about moving the crossing to the downstream end of Perry Branch, in the vicinity of the power line easement.

The proposed approach of Priority 1 restoration for Perry Hill Reach 2 was approved by the IRT. A toe ditch running parallel to and northwest of Perry Branch should be filled. In areas that are mostly maple and sweet gum, the IRT requested that Wildlands plant understory species.

The IRT generally agreed with the Enhancement Level I approach for Perry Hill Reach 1 but suggested that Wildlands consider breaking this into restoration on the upper end and Enhancement Level II on the lower end. Wildlands should remove all of the pond embankment and use it to fill the old pond bed.

Last, the IRT requested that Wildlands extend the easement upstream to the start of a JD stream.

UT1

The IRT agreed with the restoration approach at 1.5:1 for UT1. A request was made to add a flow diffusion feature/marsh treatment area at the head of the reach. Wildlands will complete the preliminary JD and define the start of the reach, then work with the landowners to see if a BMP can be incorporated. A crossing was planned above the UT1 project area so that will also need to be accounted for.

UT2

The IRT agreed with the Enhancement Level I approach on UT2 Reach 2 and the Enhancement Level II approach on UT2 Reach 1. There are a couple areas in Reach 2 that have shallow channel and wetlands; those areas should not be disturbed by grading activities.

The IRT requested that Wildlands include the wetland at the head of UT2 in the conservation easement, as a measure to justify the UT2 stream approaches. Wildlands will map the JD wetland feature and work with the landowners to incorporate at least a good portion of this wetland.

UT3

The IRT agreed with the proposed Enhancement Level II approach on UT3. Katie Merritt requested that the start of the buffer and nutrient area on EC3 be moved approximately 150 feet downstream.

Katie also asked for confirmation that the cows have been in the wooded areas along UT2 and Perry Branch Reach 1 prior to the effective date of the rule (1997). Wildlands will review the historical aerial photos and ask the landowners for this evidence.

Summary and Conclusion

The IRT generally agreed with the approaches proposed by Wildlands for the Site. Changes to the approaches are captured in these meeting minutes.

Contacts

Jeff Schaffer will serve as the Project Manager for NCDMS and the main point of contact. Chris Roessler will be the Wildlands Project Manager and coordinate/submit project deliverables directly to Jeff Schaffer for distribution to all NCIRT team members.

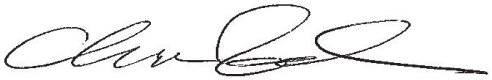
Action Items and Next Steps

- Project Schedule – Wildlands is ready to proceed immediately with the Task 1 deliverable (Categorical Exclusion) and does not anticipate project delays.
- After the jurisdictional determination has been conducted, any wetland areas that will be impacted by the proposed work (filled or drained) will need to be identified and functional replacement for those losses should be proposed and discussed in the draft mitigation plan.
- USACE requires Jurisdictional (JD) stream/wetland calls for the project. Wildlands will coordinate with Samantha Daley (or assigned) for on-site JD verification prior to mitigation plan submittal.
- Signage will be needed on all conservation easement areas.

This represents Wildlands' interpretation of the meeting discussions. If any meeting attendees should find any information contained in these meeting minutes to be in error and/or incomplete based on

individual comments or conversations, please notify Chris Roessler with corrections/additions as soon as possible.

Sincerely,



Chris Roessler
croessler@wildlandseng.com
919.624.0905

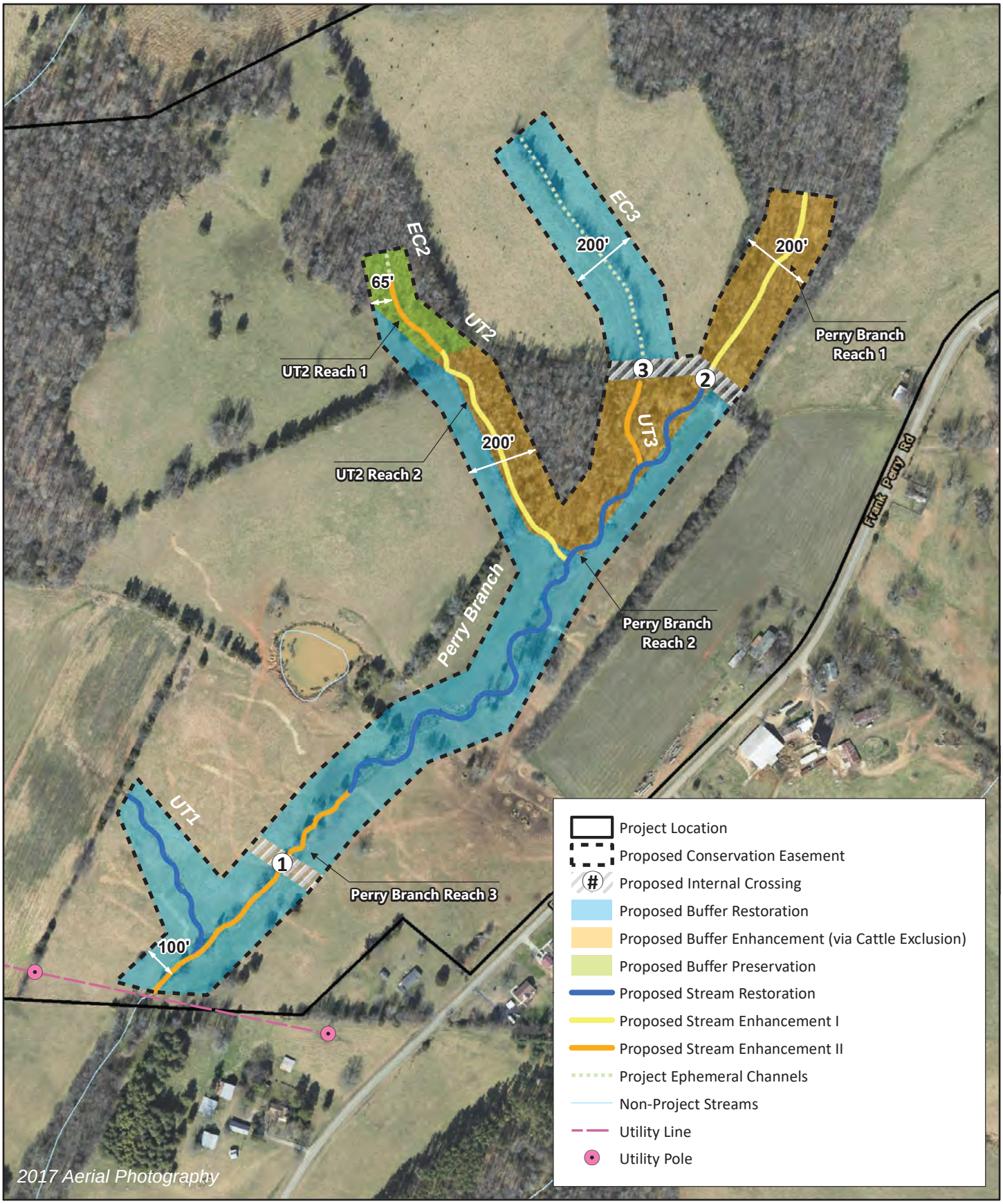


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Figure 7 Concept Map
Perry Hill Mitigation Site
Neuse River Basin (03020201)

Orange County, NC

Appendix 7

Existing Geomorphic Parameters

	Notation	Units	Perry Branch Reach 1		Perry Branch Reach 2		Perry Branch Reach 3		Perry Branch Reach 4		UT1 Reach 1		UT1 Reach 2		UT2 Reach 1		UT2 Reach 2		UT3	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
stream type			G4c		C4		G4c		F4		E6b		F4b		C6		E4		C4	
drainage area	DA	*sq mi*	0.090		0.103		0.182		0.273		0.014		0.015		0.023		0.036		0.031	
discharge	Q	*cfs*	2.8	5.9	4.2	4.5	9.1	10.2	10.8	16.9	7.5		3.2	3.7	3.2		6.2	10.9	5.9	8.6
bankfull cross-sectional area	A_{bkf}	*SF*	1.1	2.0	2.3	2.4	3.4	3.6	4.0	5.9	1.4		1.4	1.6	2.9		2.0	3.3	2.4	3.0
average velocity during bankfull event	v_{bkf}	*fps*	2.5	3.0	1.8	1.8	2.7	2.9	2.7	2.9	5.4		2.0	2.5	1.1		2.3	4.5	2.5	2.8
Cross-Section																				
width at bankfull	w_{bkf}	*feet*	2.7	3.1	5.1	5.5	5.3	6.1	5.7	9.3	1.7		3.7	5.4	8.6		3.2	4.1	5.9	6.1
maximum depth at bankfull	d_{max}	*feet*	0.6	0.8	0.7	0.7	0.7	0.8	1.1	1.3	1.1		0.6	0.7	0.6		1.0	1.2	0.8	0.8
mean depth at bankfull	d_{bkf}	*feet*	0.4	0.6	0.4	0.4	0.6	0.7	0.7	0.8	0.8		0.3	0.4	0.3		0.6	0.8	0.4	0.5
bankfull width to depth ratio	w_{bkf}/d_{bkf}		5.2	6.8	12.8	13.8	8.7	8.8	8.1	11.6	2.1		12.3	13.5	28.7		5.1	5.3	12.2	14.8
depth ratio	d_{max}/d_{bkf}	*feet*	1.3	1.5	1.8	1.8	1.1	1.2	1.6	1.6	1.4		1.8	2.0	2.0		1.7	1.5	1.6	2.0
bank height ratio	BHR		2.1	2.7	1.3	1.3	1.9	2.3	1.9	3.0	1.9		2.6	3.0	1.1		1.2	1.4	1.2	1.2
floodprone area width	w_{fpa}	*feet*	4	4	50	108	11	14	9	13	6		7	9	23		20	69	109	111
entrenchment ratio	ER		1.3	1.4	9.8	19.5	2.1	2.2	1.4	2.0	3.3		1.6	2.0	2.6		6.2	17.3	18.3	18.5
Slope																				
valley slope	S_{valley}	*feet/ foot*	0.0154		0.0102		0.0166		0.0111		0.0514		0.0233		0.0086		0.0196		0.0212	
channel slope	S_{chnl}	*feet/ foot*	0.0129		0.0104		0.0155		0.0109		0.0473		0.0204		0.0058		0.0187		0.0144	
Profile																				
riffle slope	S_{riffle}	*feet/ foot*	0.0111	0.0435	0.0036	0.0228	0.0120	0.0273	0.0095	0.0370	0.0099	0.1378	0.0270	0.0522	0.0116	0.0157	0.0086	0.0478	0.0105	0.0464
riffle slope ratio	S_{riffle}/S_{chnl}		0.9	3.4	0.3	2.2	0.8	1.8	0.9	3.4	0.2	2.9	1.3	2.6	2.0	2.7	0.5	2.6	0.7	3.2
pool slope	S_p	*feet/ foot*	0.0014	0.0028	0.0018	0.0049	0.0000	0.0094	0.0000	0.0061	0.0116	0.0172	0.0000	0.0027	0.0000	0.0120	0.0050	0.0081	0.0000	0.0096
pool slope ratio	S_p/S_{chnl}		0.1	0.2	0.2	0.5	0.0	0.6	0.0	0.6	0.2	0.4	0.0	0.1	0.0	2.1	0.3	0.4	0.0	0.7
pool-to-pool spacing	$L_{p\text{-}p}$	*feet*	39	71	41	81	29	63	30	88	18	38	15	63	30		41	63	19	51
pool spacing ratio	$L_{p\text{-}p}/w_{bkf}$		14.3	23.0	8.1	14.7	5.4	10.4	5.2	9.5	10.6	22.5	3.9	11.7	3.5		13.0	15.3	3.2	8.3
pool cross-sectional area	A_{pool}	*SF*	3.2		3.4		7.5		4.1	11.3	-	-	2.9		1.8		4.6		3.9	
pool area ratio	A_{pool}/A_{bkf}		1.6	2.9	1.4	1.5	2.1	2.2	0.7	1.0	-	-	1.8	2.1	0.6		1.4	2.3	1.3	1.6
maximum pool depth	d_{pool}	*feet*	0.8		0.9		1.6		1.4	1.4	-	-	0.8		0.6		1.7		1.1	
pool depth ratio	d_{pool}/d_{bkf}		1.3	2.0	2.3	2.3	2.3	2.7	1.8	2.0	-	-	2.0	2.7	2.0		2.1	2.8	2.2	2.8
pool width at bankfull	w_{pool}	*feet*	5.3		5.7		6.3		4.1	12.0	-	-	4.8		4.6		4.5		5.3	
pool width ratio	w_{pool}/w_{bkf}		1.7	2.0	1.0	1.1	1.0	1.2	0.4	0.7	-	-	0.9	1.3	0.5		1.1	1.4	0.9	0.9
Pattern																				
sinuosity	K		1.10		1.10		1.15		1.11		1.04		1.14		1.14		1.13		1.20	
belt width	w_{blt}	feet	15	19	6	18	5	16	8	15	4	9	6	13	8	11	4	13	10	15
meander width ratio	w_{blt}/w_{bkf}		5.6	6.1	1.2	3.3	0.9	2.6	1.4	1.6	2.4	5.3	1.6	2.4	0.9	1.3	1.0	3.2	1.7	2.5
linear wavelength	LW	feet	53	92	28	46	22	39	29	101	19	57	31	69	NA	NA	14	42	48	73
linear wavelength ratio	LW/w_{bkf}		19.6	29.7	5.5	8.4	4.2	6.4	5.1	10.9	11.2	33.5	8.4	12.8	NA	NA	3.5	10.2	8.1	12.0
meander length	L_m	feet	60	101	28	56	22	43	52	102	19	59	20	75	NA	NA	14	43	55	75
meander length ratio	L_m/w_{bkf}		22.2	37.4	5.6	10.2	4.2	7.1	9.1	10.9	11.2	34.7	5.4	13.9	NA	NA	3.5	10.4	9.3	12.4
radius of curvature	R_c	feet	8	23	5	26	6	16	9	24	6	35	8	21	12	16	13	15	8	19
radius of curvature ratio	R_c/w_{bkf}		3.0	7.4	1.0	4.7	1.1	2.6	1.6	2.6	3.5	20.6	2.2	3.9	1.4	1.9	4.1	3.7	1.4	3.1
Particle Size Distribution																				
d50 Description																				
	d_{16}	mm	2.4		2.4		4.0		5.2		-		Silt/Clay		Silt/Clay		Silt/Clay		Silt/Clay	
	d_{35}	mm	7.2		4.3		8.8		9.5		-		2.1		Silt/Clay		4.2		3.7	
	d_{50}	mm	13.9		5.9		13.5		12.6		-		3.2		Silt/Clay		5.7		5.1	
	d_{84}	mm	37.4		11.8		28.5		26.9		-		16.0		Silt/Clay		13.9		12.9	
	d_{95}	mm	90.0		15.0		40.6		37.2		-		30.4		Silt/Clay		21.5		21.1	
	d_{100}	mm	>2048		22.6		90.0		45.0		-		45.0		0.1		90.0		128.0	

Reference Reach Geomorphic Parameters																	Kentwood Park	
	Notation	Units	Agony Acres		UT to Sandy Run		UT to Wells Creek		UT4 (UT to Cedar)		UT to Richland Reach 1		UT to Cane Creek		UT Mine Creek	
			min	max	min	max	min	max	min	max	min	max	min	max	min	max
stream type			B3		E4		C4		C4		C4/E4		C4/E4		B4/1	
drainage area	DA	*sq mi*	0.15		0.15		0.13		0.11		0.28		0.29		0.17	
design discharge	Q	*cfs*	37.0		20.0		15.0		21.7	25.8	29.1	32.0	40.0		51.1	
bankfull cross-sectional area	A_{bkf}	*SF*	7.4		5.7	6.2	3.9	6.3	4.2		7.8	8.5	8.9	12.2	8.9	10.9
average velocity during bankfull event	v_{bkf}	*fps*	4.9		3.4		3.8		5.2	6.1	4.1	5.2	3.8		4.5	5.6
Cross-Section																
width at bankfull	w_{bkf}	*feet*	11.1		7.3	7.8	6.2	8.6	7.3		8.8	10.4	11.5	12.3	10.1	10.5
maximum depth at bankfull	d_{max}	*feet*	1.0		1.1	1.4	0.6	1.4	1.1		1.1	1.3	1.2	1.6	1.5	1.7
mean depth at bankfull	d_{bkf}	*feet*	0.7		0.7	0.8	0.6	1.0	0.6		0.8	0.9	0.8	1.0	0.8	1.1
bankfull width to depth ratio	w_{bkf}/d_{bkf}		16.6		6.6	9.8	6.1	12.6	12.6		10.0	12.8	12.3	14.4	9.0	12.0
depth ratio	d_{max}/d_{bkf}	*feet*	1.0		1.6	1.8	0.8	1.8	1.9		1.4	1.4	1.7		-	-
bank height ratio	BHR		1.0		-	-	1.0	1.8	1.0		-	-	-	-	-	-
floodprone area width	w_{fpa}	*feet*	25		12	16	15	25	20		28	31	31		12	23
entrenchment ratio	ER		2.3		1.6	2.1	1.9	4.1	2.7		2.5	4.0	>2.5		1.2	2.2
Slope																
valley slope	S_{valley}	*feet/ foot*	0.0500		0.0200		0.0280		0.0173		-		0.0262		0.0270	
channel slope	S_{chnl}	*feet/ foot*	0.0490		0.0150		0.0199		0.0156		0.0131	0.0178	0.0150		0.0220	
Profile																
riffle slope	S_{riffle}	*feet/ foot*	-	-	0.0036	0.0420	0.0160	0.0850	0.0064	0.0493	0.0183	0.0355	0.0188	0.0704	0.0100	0.0550
riffle slope ratio	S_{riffle}/S_{chnl}		-	-	0.2	2.8	0.8	4.3	0.4	3.2	1.3	2.5	1.3	4.7	0.5	2.4
pool slope	S_p	*feet/ foot*	-	-	0.0000	0.0070	0.0000	0.0090	0.0078	0.0136	0.0003	0.0038	0.0005	0.0108	0.0000	0.0040
pool slope ratio	S_p/S_{chnl}		-	-	0.0	0.5	0.0	0.4	0.5	0.9	0.0	0.3	0.0	0.7	0.0	0.2
pool-to-pool spacing	L_{p-p}	*feet*	-	-	9.3	54.8	17.0	63.0	17.6	24.1	33.0	93.0	27.0	73.0	27.0	43.0
pool spacing ratio	L_{p-p}/w_{bkf}		-	-	1.3	7.0	2.3	8.8	2.4	3.3	2.5	6.1	2.3	6.1	2.6	4.1
pool cross-sectional area	A_{pool}	*SF*	9.8		5.5	8.7	6.2	9.0	4.4		1.8	1.8	11.9		7.6	12.4
pool area ratio	A_{pool}/A_{bkf}		1.3		1.0	1.4	1.2	1.7	1.0		1.4	1.6	1.0	1.3	0.7	1.2
maximum pool depth	d_{pool}	*feet*	1.6		1.3	1.5	-	-	1.4	1.5	14.7	16.0	2.6		1.7	2.3
pool depth ratio	d_{pool}/d_{bkf}		2.3		1.9	1.9	-	-	2.3	2.5	1.0	1.2	1.7		1.7	2.4
pool width at bankfull	w_{pool}	*feet*	8.5		7.6	9.2	7.1	10.5	4.1		14.7	15.8	8.5		9.1	12.1
pool width ratio	w_{pool}/w_{bkf}		0.8		1.0	1.2	1.0	1.5	0.6		0.9	0.9	0.7		0.9	1.2
Pattern																
sinuosity	K		1.0		1.6		1.4		1.1		1.1		1.4		1.2	
belt width	w_{blt}	feet	-	-	24	60	10	35	3	6	-	-	102		19	49
meander width ratio	w_{blt}/w_{bkf}		-	-	3.3	7.6	1.4	4.9	0.4	0.8	-	-	8.3	8.9	1.8	4.7
linear wavelength (formerly meander length)	L_m	feet	-	-	63	72	35	70	10	17	-	-	45	81	-	-
linear wavelength ratio (formerly meander length ratio)	L_m/w_{bkf}		-	-	8.6	9.2	4.9	9.8	1.4	2.3	-	-	3.9	6.6	-	-
meander length		feet	-	-	-	-	-	-	-	-	-	-	-	-	127	
meander length ratio			-	-	-	-	-	-	-	-	-	-	-	-	12.2	
radius of curvature	R_c	feet	-	-	14	29	2	32	5	13	-	-	23	38	12	23
radius of curvature ratio	R_c/ w_{bkf}		-	-	1.9	3.8	0.3	4.5	0.7	1.7	-	-	2.0	3.1	1.2	2.3
Particle Size Distribution																
d50 Description																
d_{16}	d_{16}	mm	2.0		0.1		-		-		-		-		0.04	
d_{35}	d_{35}	mm	12.9		1.0		-		-		-		-		1	
d_{50}	d_{50}	mm	50.6		19.0		-		-		-		-		11	
d_{84}	d_{84}	mm	168		76		-		-		-		-		176	
d_{95}	d_{95}	mm	2048		150		-		-		-		-		2438	
d_{100}	d_{100}	mm	>2048		-		-		-		-		-		-	

Proposed Geomorphic Parameters

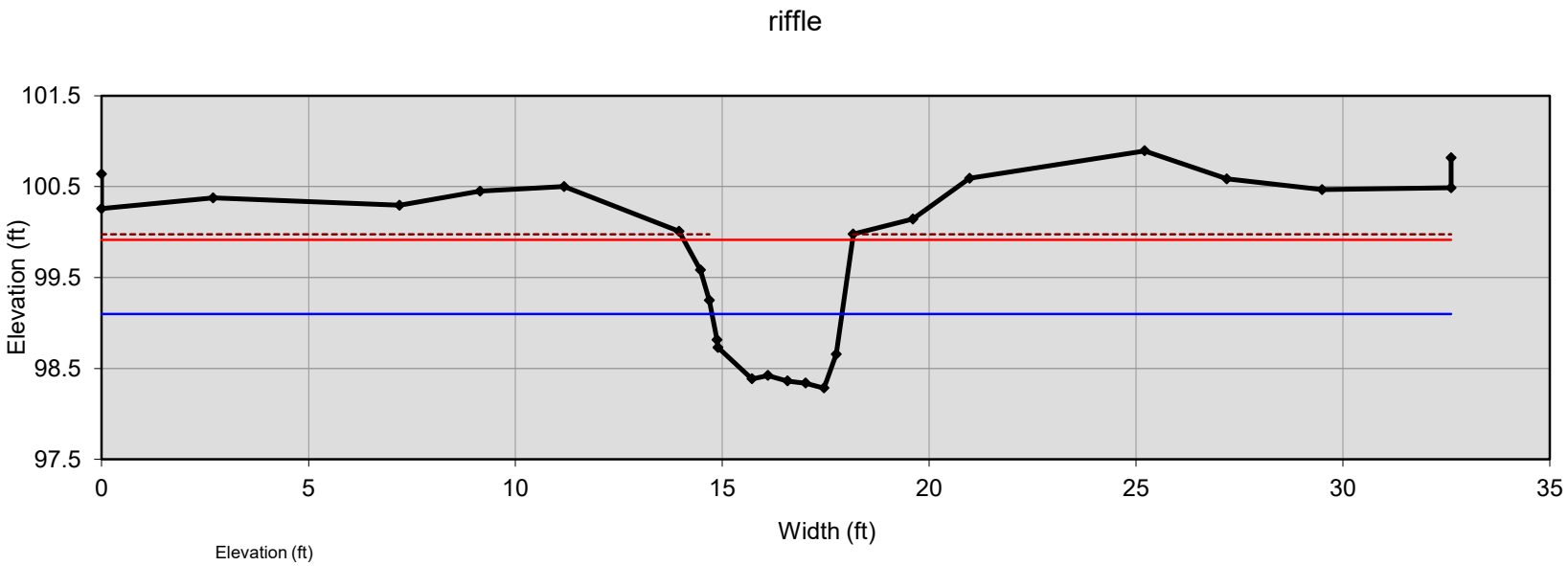
	Notation	Units	Perry Branch Reach 1		Perry Branch Reach 2		Perry Branch Reach 3		Perry Branch Reach 4		UT1 Reach 1		UT1 Reach 2		UT2 Reach 1**		UT2 Reach 2		UT3	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
stream type			C4		C4		C4		C4		B4		C4b		C6		C4		C4	
drainage area	DA	*sq mi*	0.090		0.103		0.182		0.273		0.014		0.015		0.023		0.036		0.031	
discharge	Q	*cfs*	14.9		16.3		25.1		35.5		9.4*		7.6		-		8.2		6.5	
bankfull cross-sectional area	A_{bkf}	*SF*	5.0		5.6		7.2		10.1		2.5		2.9		-		2.7		2.5	
average velocity during bankfull event	v_{bkf}	*fps*	3.0		2.9		3.5		3.5		3.7		2.6		-		3.0		2.7	
Cross-Section																				
width at bankfull	w_{bkf}	*feet*	8.0		8.6		9.6		11.4		6.0		6.0		-		6.0		5.6	
maximum depth at bankfull	d_{max}	*feet*	1.0		1.0		1.2		1.4		0.6		0.8		-		0.7		0.7	
mean depth at bankfull	d_{bkf}	*feet*	0.6		0.7		0.8		0.9		0.4		0.5		-		0.5		0.4	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		12.8		13.2		12.8		12.9		14.3		12.5		-		13.2		12.8	
depth ratio	d_{max}/d_{bkf}	*feet*	1.7		1.5		1.5		1.6		1.4		1.7		-		1.5		1.6	
bank height ratio	BHR		1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	-		1.0	1.1	1.0	1.1
min. floodprone area width	w_{fpa}	*feet*	61		55		156		123		11		113		-		44		54	
entrenchment ratio	ER		7.6		6.4		16.3		10.8		1.8		18.8		-		7.3		9.6	
Slope																				
valley slope	S_{valley}	*feet/ foot*	0.0143		0.0124		0.0146		0.0126		0.0551		0.0290		0.0097		0.0197		0.0233	
channel slope	S_{chnl}	*feet/ foot*	0.0127		0.0114		0.0135		0.0111		0.0522		0.0221		0.0060		0.0177		0.0161	
Profile																				
riffle slope	S_{riffle}	*feet/ foot*	0.0185	0.0322	-	-	0.0172	0.0301	0.0115	0.0339	0.0533	0.0630	0.0260	0.0380	-	-	-	-	-	-
riffle slope ratio	S_{riffle}/S_{chnl}		1.5	2.5	-	-	1.3	2.2	1.0	3.1	1.0	1.2	1.2	1.7	-	-	-	-	-	-
pool slope	S_p	*feet/ foot*	0.0000	0.0000	-	-	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-
pool slope ratio	S_p/S_{chnl}		0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-
pool-to-pool spacing	$L_{p\text{-}p}$	*feet*	30	45	-	-	46	70	50	87	13	23	36	49	-	-	-	-	-	-
pool spacing ratio	$L_{p\text{-}p}/w_{bkf}$		3.8	5.6	-	-	4.8	7.3	4.4	7.6	2.2	3.8	6.0	8.2	-	-	-	-	-	-
pool cross-sectional area	A_{pool}	*SF*	13.2		13.6		16.5		23.7		5.6		6.2		-		6.9		6.4	
pool area ratio	A_{pool}/A_{bkf}		2.6		2.4		2.3		2.3		2.2		2.1		-		2.6		2.6	
maximum pool depth	d_{pool}	*feet*	2.2		2.2		2.8		3.0		1.5		1.3		-		1.6		1.6	
pool depth ratio	d_{pool}/d_{bkf}		3.7		3.1		3.5		3.3		3.8		2.6		-		3.2		4.0	
pool width at bankfull	w_{pool}	*feet*	11.6		11.8		13.0		15.6		7.6		8.4		-		8.4		8.1	
pool width ratio	w_{pool}/w_{bkf}		1.5		1.4		1.4		1.4		1.3		1.4		-		1.4		1.4	
Pattern																				
sinuosity	K		1.16		1.09		1.12		1.14		1.06		1.15		-		1.11		1.18	
belt width	w_{blt}	feet	18	28	-	-	24	42	24	56	-	-	21	28	-	-	-	-	-	-
meander width ratio	w_{blt}/w_{bkf}		2.3	3.5	-	-	2.5	4.4	2.1	4.9	-	-	3.5	4.7	-	-	-	-	-	-
linear wavelength	LW	feet	58	74	-	-	88	119	88	142	-	-	63	75	-	-	-	-	-	-
linear wavelength ratio	LW/w_{bkf}		7.3	9.3	-	-	9.2	12.4	7.7	12.5	-	-	10.5	12.5	-	-	-	-	-	-
meander length	L_m	feet	62	83	-	-	93	133	107	166	-	-	75	89	-	-	-	-	-	-
meander length ratio	L_m/w_{bkf}		7.8	10.4	-	-	9.7	13.9	9.4	14.6	-	-	12.5	14.8	-	-	-	-	-	-
radius of curvature	R_c	feet	10	27	-	-	21	32	22	45	-	-	13	25	-	-	-	-	-	-
radius of curvature ratio	R_c/w_{bkf}		1.3	3.4	-	-	2.2	3.3	1.9	3.9	-	-	2.2	4.2	-	-	-	-	-	-

*Variations in discharge between UT1 R1 and UT1 R2 are a result of slope and constructability constraints.

**UT2 Reach 1 no design metrics needed. Construction activity on this reach relates to bank stabilization only.

Note: All values have been rounded for construction.

Cross Section 1

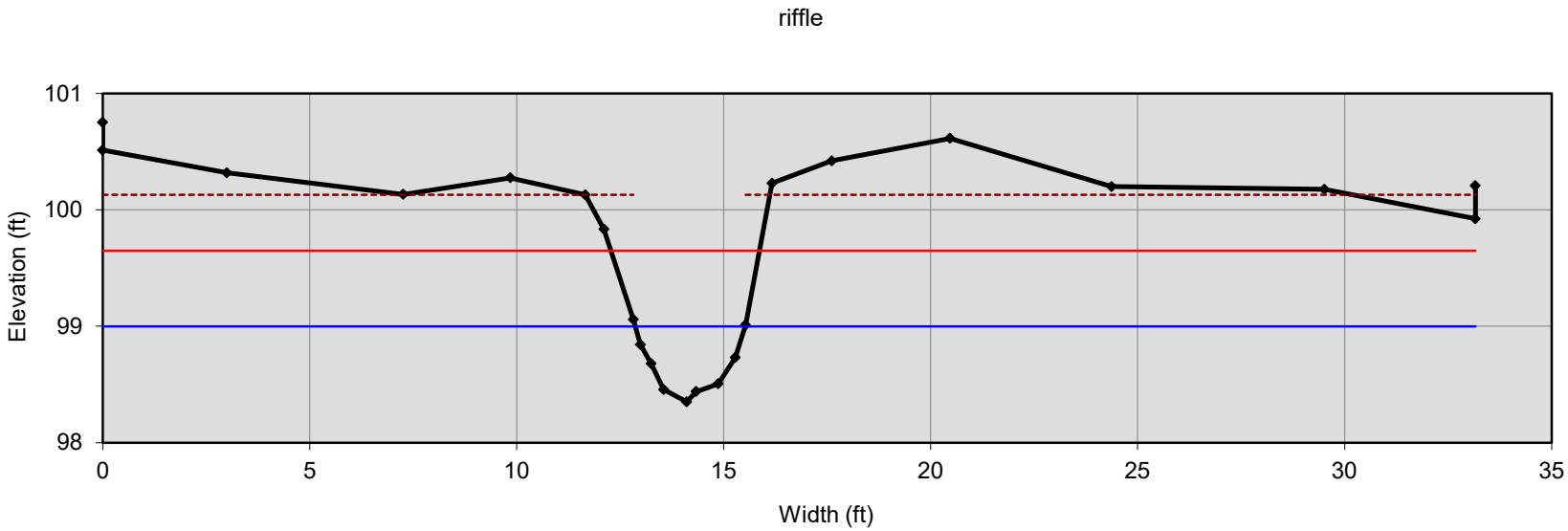


Elevation (ft)

Bankfull Dimensions		Flood Dimensions		Materials	
2.0	x-section area (ft.sq.)	4.1	W flood prone area (ft)	---	D50 (mm)
3.1	width (ft)	1.3	entrenchment ratio	---	D84 (mm)
0.6	mean depth (ft)	1.7	low bank height (ft)	25	threshold grain size (mm):
0.8	max depth (ft)	2.1	low bank height ratio		
4.0	wetted perimeter (ft)				
0.5	hydraulic radius (ft)				
5.0	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.0	velocity (ft/s)	0.040	Manning's roughness	1.66	channel slope (%)
5.9	discharge rate (cfs)	0.23	Darcy-Weisbach fric.	0.51	shear stress (lb/sq.ft.)
0.75	Froude number	---	resistance factor u/u*	0.51	shear velocity (ft/s)
		---	relative roughness	1.95	unit strm power (lb/ft/s)

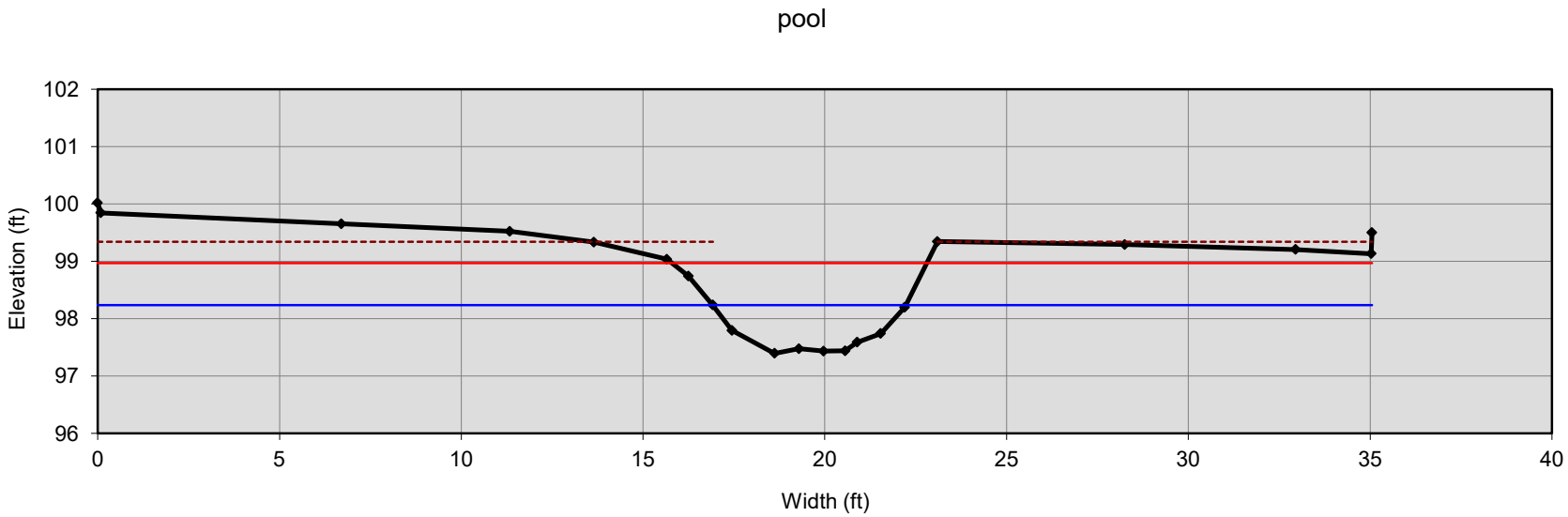
Cross Section 2



Bankfull Dimensions		Flood Dimensions		Materials	
1.1	x-section area (ft.sq.)	3.6	W flood prone area (ft)	---	D50 (mm)
2.7	width (ft)	1.4	entrenchment ratio	---	D84 (mm)
0.4	mean depth (ft)	1.8	low bank height (ft)	19	threshold grain size (mm):
0.6	max depth (ft)	2.7	low bank height ratio		
3.1	wetted perimeter (ft)				
0.4	hydraulic radius (ft)				
6.2	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.5	velocity (ft/s)	0.040	Manning's roughness	1.66	channel slope (%)
2.8	discharge rate (cfs)	0.26	Darcy-Weisbach fric.	0.39	shear stress (lb/sq.ft.)
0.72	Froude number	---	resistance factor u/u*	0.45	shear velocity (ft/s)
		---	relative roughness	1.11	unit strm power (lb/ft/s)

Cross Section 3



Bankfull Dimensions

3.2	x-section area (ft.sq.)
5.3	width (ft)
0.6	mean depth (ft)
0.8	max depth (ft)
5.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
8.8	width-depth ratio

Flood Dimensions

7.0	W flood prone area (ft)
1.3	entrenchment ratio
1.9	low bank height (ft)
2.3	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
28	threshold grain size (mm):

Bankfull Flow

3.3	velocity (ft/s)
10.4	discharge rate (cfs)
0.77	Froude number

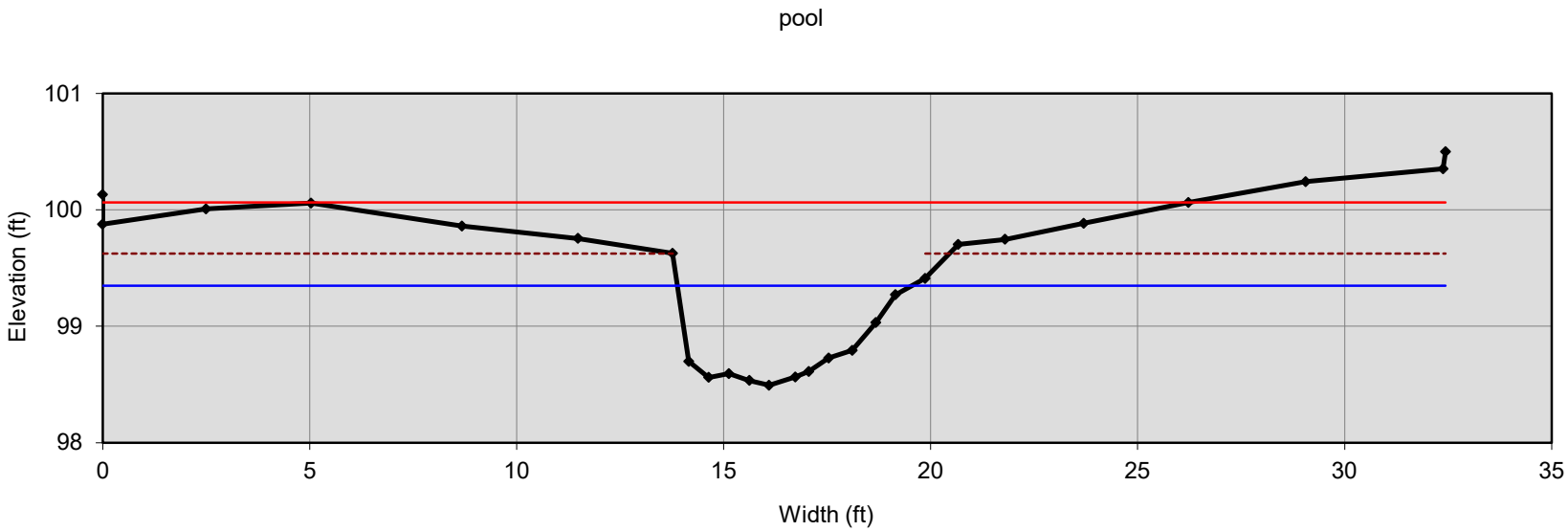
Flow Resistance

0.040	Manning's roughness
0.23	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.66	channel slope (%)
0.58	shear stress (lb/sq.ft.)
0.55	shear velocity (ft/s)
2	unit strm power (lb/ft/s)

Cross Section 4

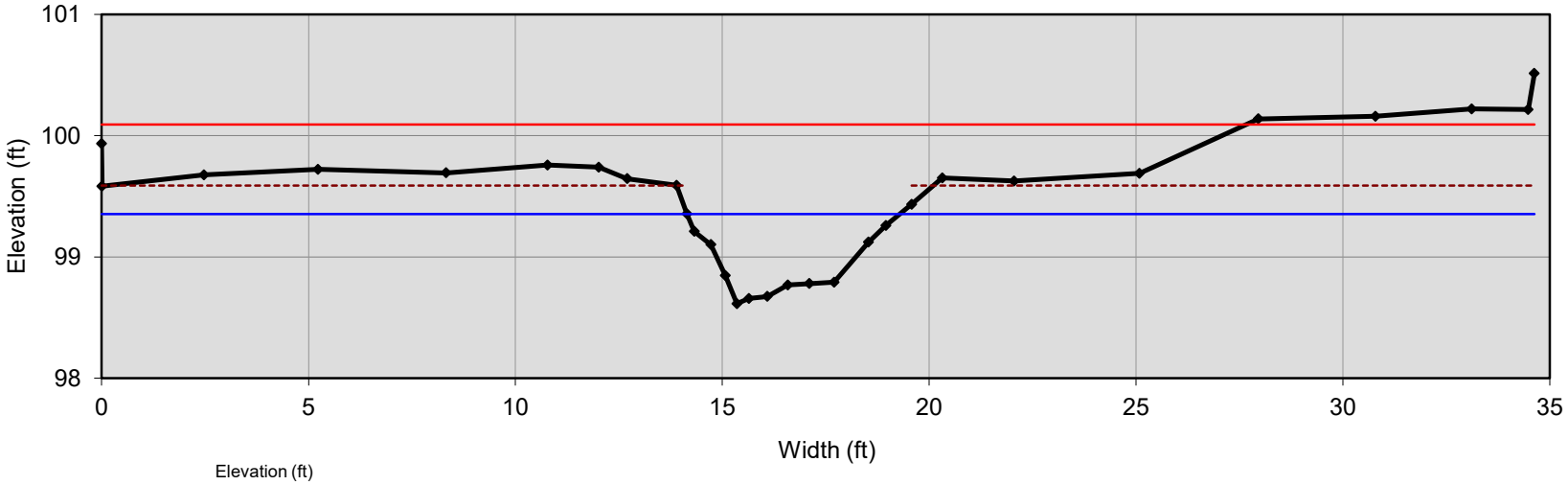


Bankfull Dimensions		Flood Dimensions		Materials	
3.4	x-section area (ft.sq.)	26.3	W flood prone area (ft)	---	D50 (mm)
5.7	width (ft)	4.6	entrenchment ratio	---	D84 (mm)
0.6	mean depth (ft)	1.1	low bank height (ft)	13	threshold grain size (mm):
0.9	max depth (ft)	1.3	low bank height ratio		
6.3	wetted perimeter (ft)				
0.5	hydraulic radius (ft)				
9.5	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.2	velocity (ft/s)	0.040	Manning's roughness	0.77	channel slope (%)
7.4	discharge rate (cfs)	0.23	Darcy-Weisbach fric.	0.26	shear stress (lb/sq.ft.)
0.52	Froude number	---	resistance factor u/u*	0.37	shear velocity (ft/s)
		---	relative roughness	0.62	unit strm power (lb/ft/s)

Cross Section 5

riffle



Elevation (ft)

Bankfull Dimensions

2.3	x-section area (ft.sq.)
5.1	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
5.5	wetted perimeter (ft)
0.4	hydraulic radius (ft)
11.6	width-depth ratio

Flood Dimensions

50.3	W flood prone area (ft)
9.8	entrenchment ratio
1.0	low bank height (ft)
1.3	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
10	threshold grain size (mm):

Bankfull Flow

1.8	velocity (ft/s)
4.2	discharge rate (cfs)
0.50	Froude number

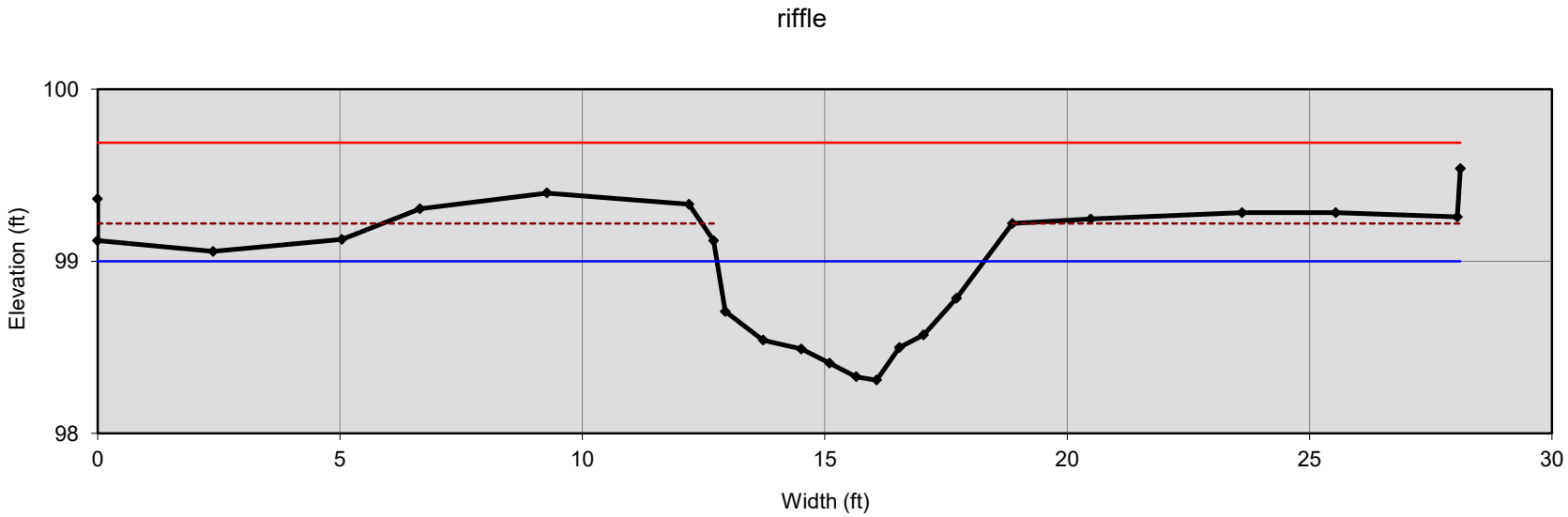
Flow Resistance

0.040	Manning's roughness
0.25	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.77	channel slope (%)
0.20	shear stress (lb/sq.ft.)
0.32	shear velocity (ft/s)
0.39	unit strm power (lb/ft/s)

Cross Section 6



Bankfull Dimensions

2.4	x-section area (ft.sq.)
5.5	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
5.8	wetted perimeter (ft)
0.4	hydraulic radius (ft)
12.4	width-depth ratio

Flood Dimensions

107.5	W flood prone area (ft)
19.5	entrenchment ratio
0.9	low bank height (ft)
1.3	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
10	threshold grain size (mm):

Bankfull Flow

1.8	velocity (ft/s)
4.5	discharge rate (cfs)
0.50	Froude number

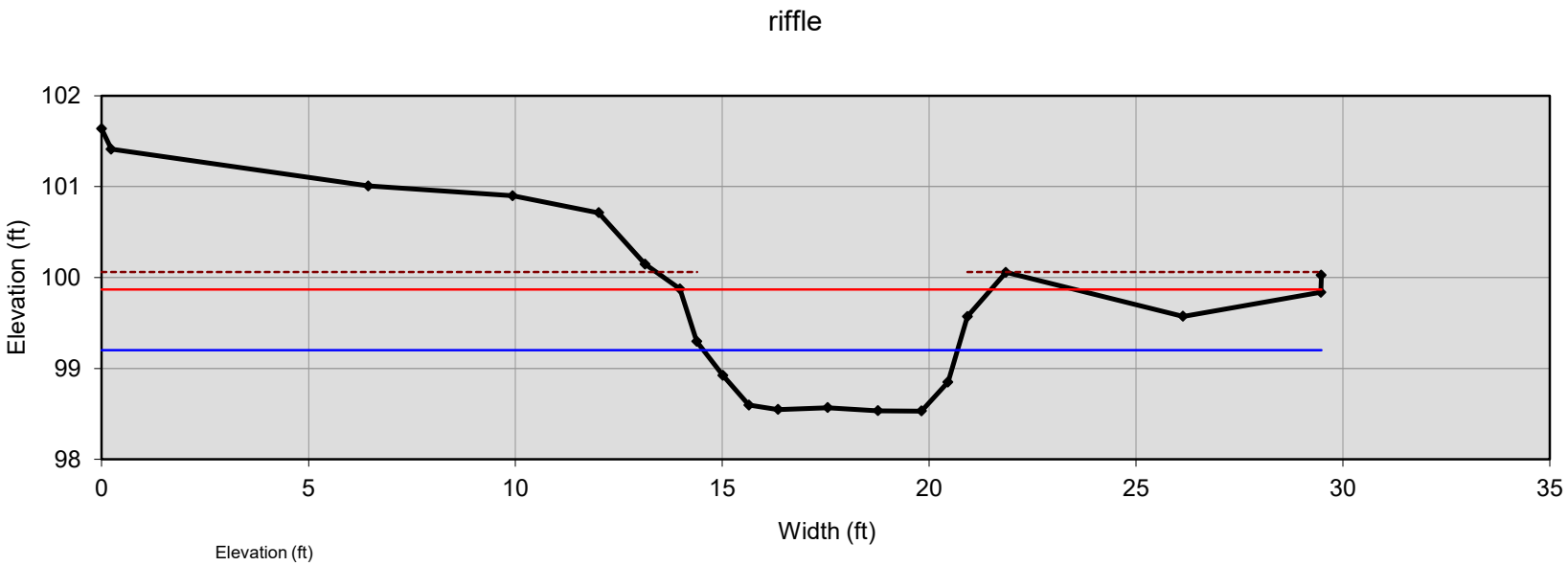
Flow Resistance

0.040	Manning's roughness
0.25	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.77	channel slope (%)
0.20	shear stress (lb/sq.ft.)
0.32	shear velocity (ft/s)
0.39	unit strm power (lb/ft/s)

Cross Section 7



Bankfull Dimensions

3.4	x-section area (ft.sq.)
6.1	width (ft)
0.6	mean depth (ft)
0.7	max depth (ft)
6.6	wetted perimeter (ft)
0.5	hydraulic radius (ft)
11.0	width-depth ratio

Flood Dimensions

13.5	W flood prone area (ft)
2.2	entrenchment ratio
1.5	low bank height (ft)
2.3	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
19	threshold grain size (mm):

Bankfull Flow

2.7	velocity (ft/s)
9.1	discharge rate (cfs)
0.65	Froude number

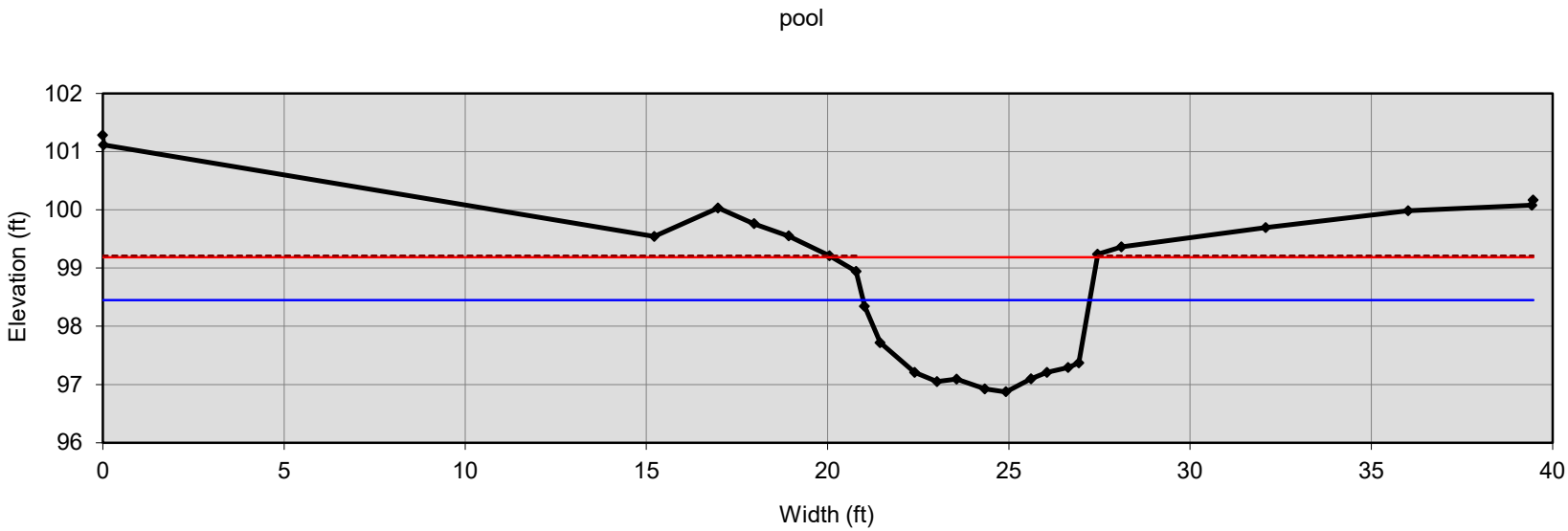
Flow Resistance

0.040	Manning's roughness
0.23	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.22	channel slope (%)
0.40	shear stress (lb/sq.ft.)
0.45	shear velocity (ft/s)
1.13	unit strm power (lb/ft/s)

Cross Section 8



Bankfull Dimensions

7.5	x-section area (ft.sq.)
6.3	width (ft)
1.2	mean depth (ft)
1.6	max depth (ft)
7.7	wetted perimeter (ft)
1.0	hydraulic radius (ft)
5.2	width-depth ratio

Flood Dimensions

7.3	W flood prone area (ft)
1.2	entrenchment ratio
2.3	low bank height (ft)
1.5	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
36	threshold grain size (mm):

Bankfull Flow

4.0	velocity (ft/s)
30.2	discharge rate (cfs)
0.72	Froude number

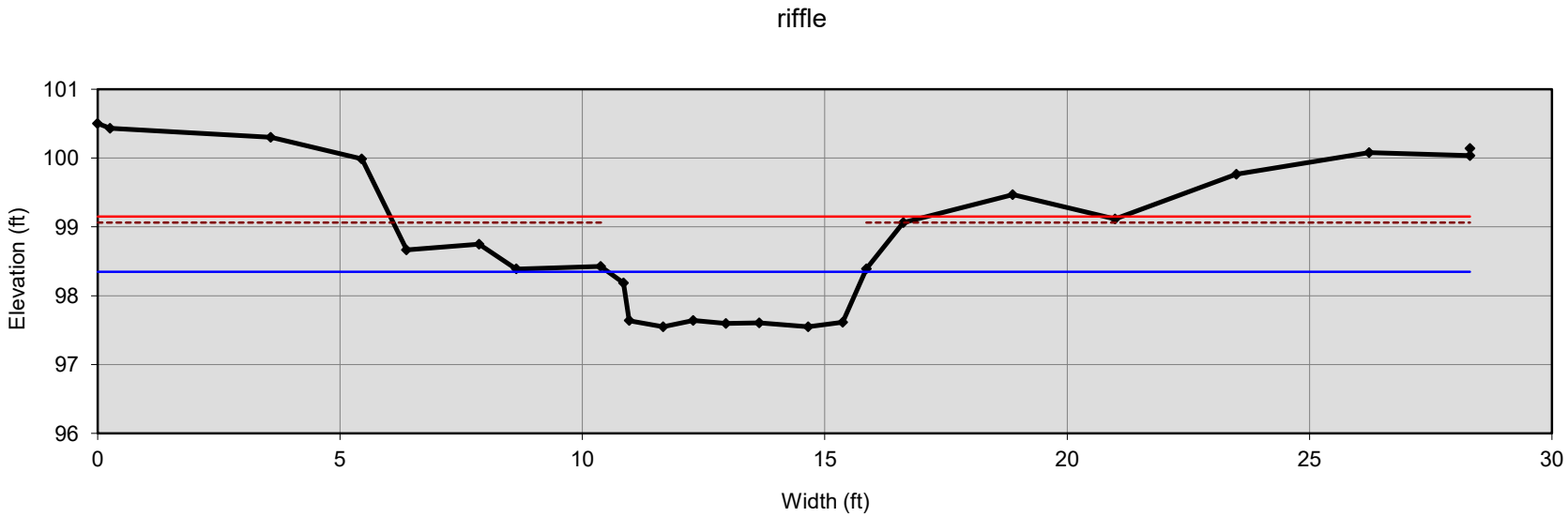
Flow Resistance

0.040	Manning's roughness
0.19	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.22	channel slope (%)
0.74	shear stress (lb/sq.ft.)
0.62	shear velocity (ft/s)
3.7	unit strm power (lb/ft/s)

Cross Section 9



Bankfull Dimensions

3.6	x-section area (ft.sq.)
5.3	width (ft)
0.7	mean depth (ft)
0.8	max depth (ft)
6.2	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.9	width-depth ratio

Flood Dimensions

11.4	W flood prone area (ft)
2.1	entrenchment ratio
1.5	low bank height (ft)
1.9	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
22	threshold grain size (mm):

Bankfull Flow

2.9	velocity (ft/s)
10.2	discharge rate (cfs)
0.66	Froude number

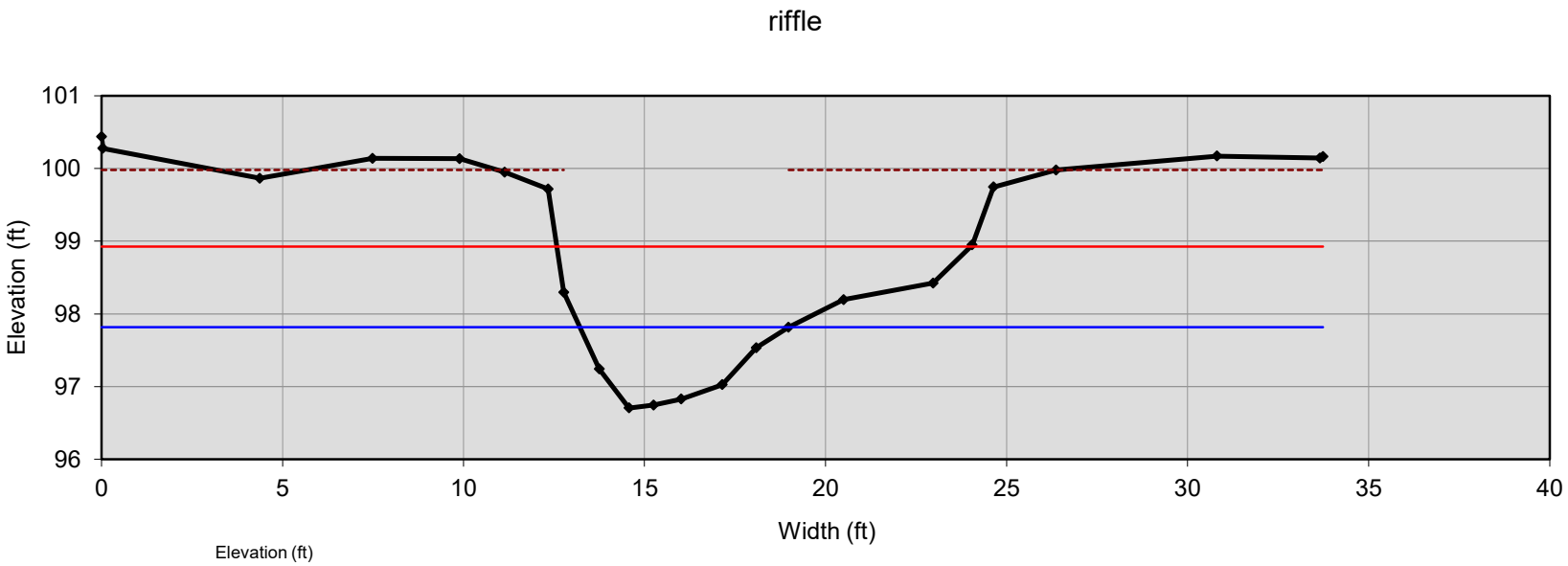
Flow Resistance

0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.22	channel slope (%)
0.44	shear stress (lb/sq.ft.)
0.48	shear velocity (ft/s)
1.46	unit strm power (lb/ft/s)

Cross Section 10



Elevation (ft)

Bankfull Dimensions

4.0	x-section area (ft.sq.)
5.8	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
6.4	wetted perimeter (ft)
0.6	hydraulic radius (ft)
8.3	width-depth ratio

Flood Dimensions

11.4	W flood prone area (ft)
2.0	entrenchment ratio
3.3	low bank height (ft)
3.0	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
19	threshold grain size (mm):

Bankfull Flow

2.7	velocity (ft/s)
10.8	discharge rate (cfs)
0.60	Froude number

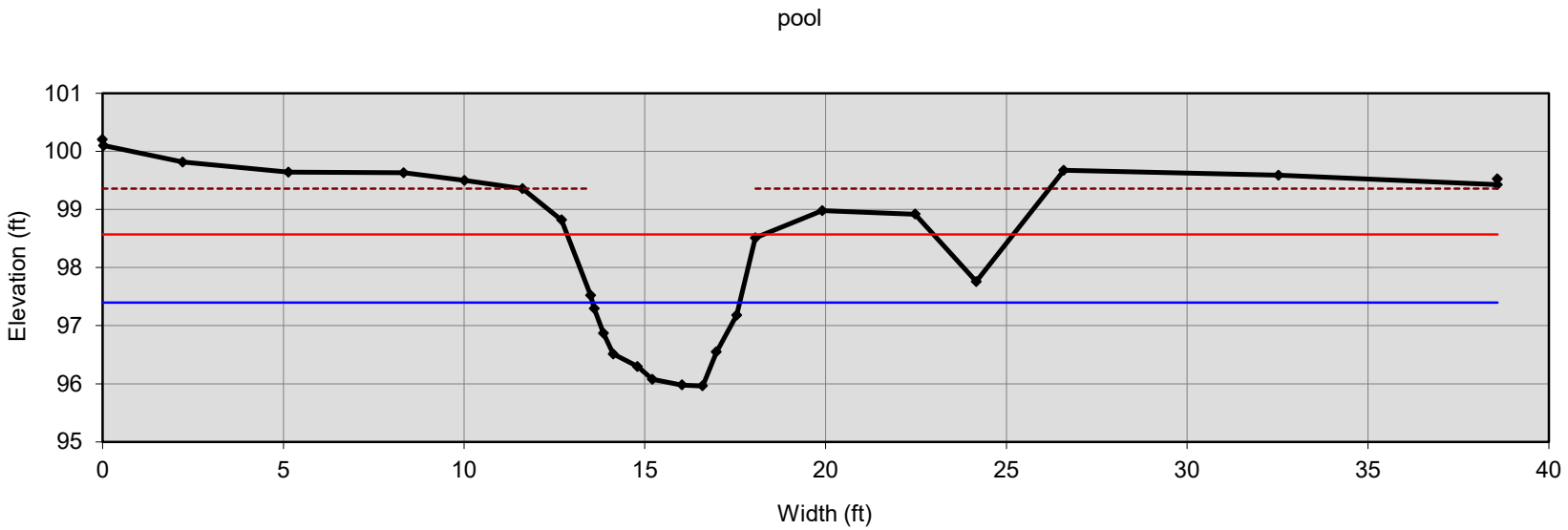
Flow Resistance

0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.97	channel slope (%)
0.38	shear stress (lb/sq.ft.)
0.44	shear velocity (ft/s)
1.14	unit strm power (lb/ft/s)

Cross Section 11

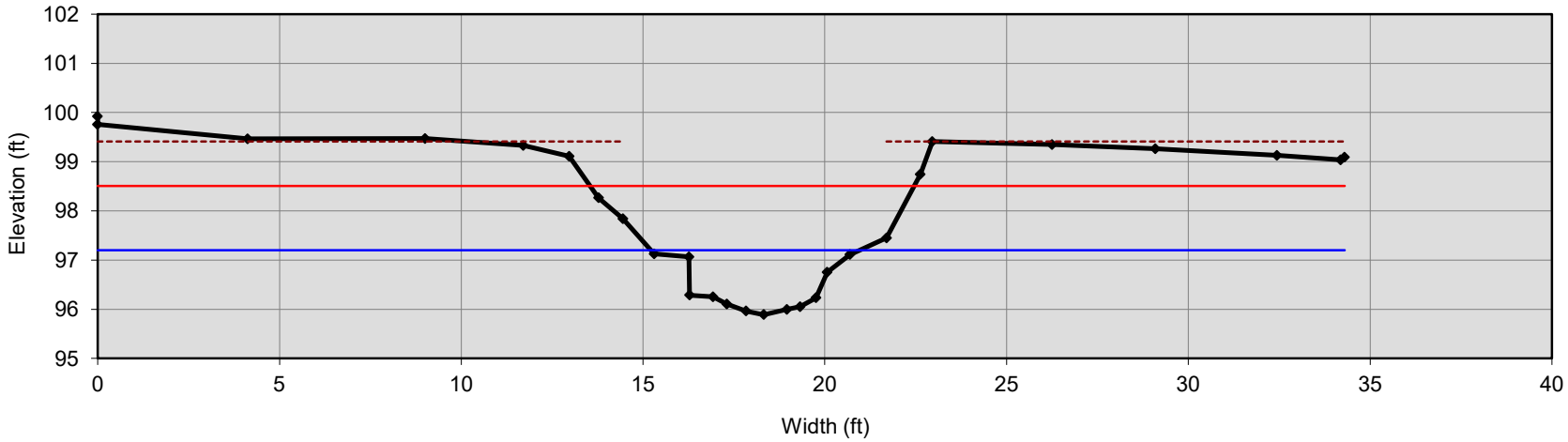


Bankfull Dimensions		Flood Dimensions		Materials	
4.1	x-section area (ft.sq.)	7.7	W flood prone area (ft)	---	D50 (mm)
4.1	width (ft)	1.9	entrenchment ratio	---	D84 (mm)
1.0	mean depth (ft)	3.4	low bank height (ft)	23	threshold grain size (mm):
1.4	max depth (ft)	2.4	low bank height ratio		
5.4	wetted perimeter (ft)				
0.8	hydraulic radius (ft)				
4.0	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.1	velocity (ft/s)	0.040	Manning's roughness	0.97	channel slope (%)
12.6	discharge rate (cfs)	0.20	Darcy-Weisbach fric.	0.46	shear stress (lb/sq.ft.)
0.62	Froude number	---	resistance factor u/u*	0.49	shear velocity (ft/s)
		---	relative roughness	1.88	unit strm power (lb/ft/s)

Cross Section 12

riffle



Bankfull Dimensions

4.4	x-section area (ft.sq.)
5.7	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
7.0	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.4	width-depth ratio

Flood Dimensions

8.9	W flood prone area (ft)
1.6	entrenchment ratio
3.5	low bank height (ft)
2.7	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
19	threshold grain size (mm):

Bankfull Flow

2.7	velocity (ft/s)
11.9	discharge rate (cfs)
0.60	Froude number

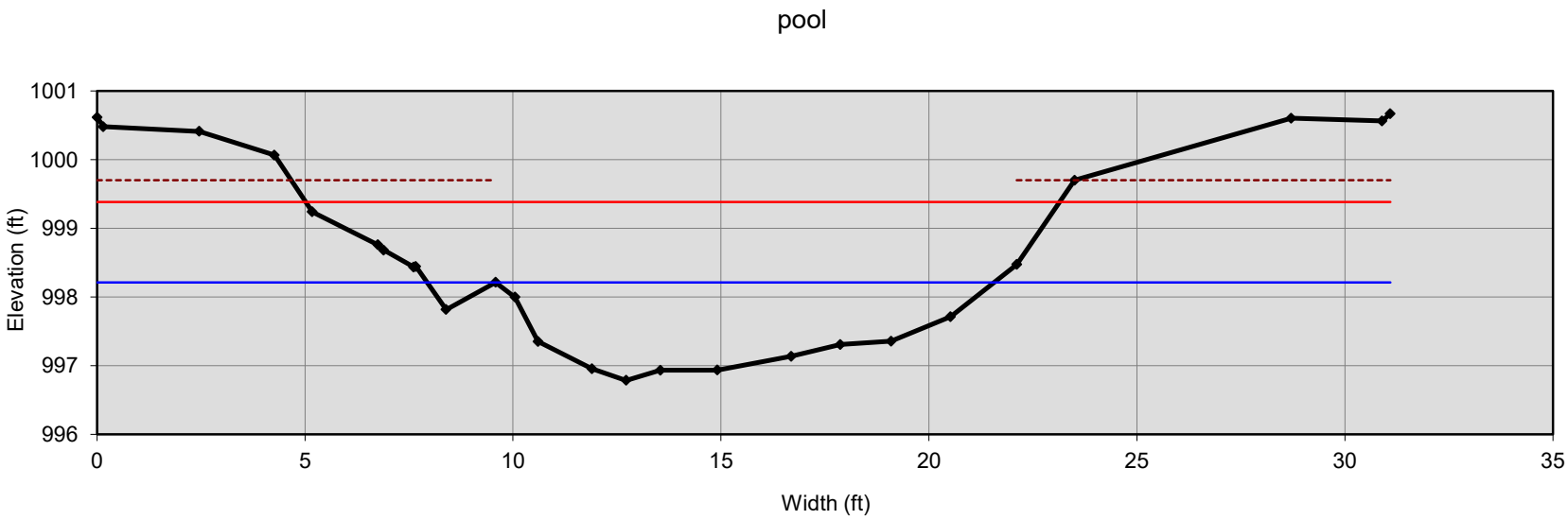
Flow Resistance

0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.97	channel slope (%)
0.38	shear stress (lb/sq.ft.)
0.44	shear velocity (ft/s)
1.26	unit strm power (lb/ft/s)

Cross Section 13

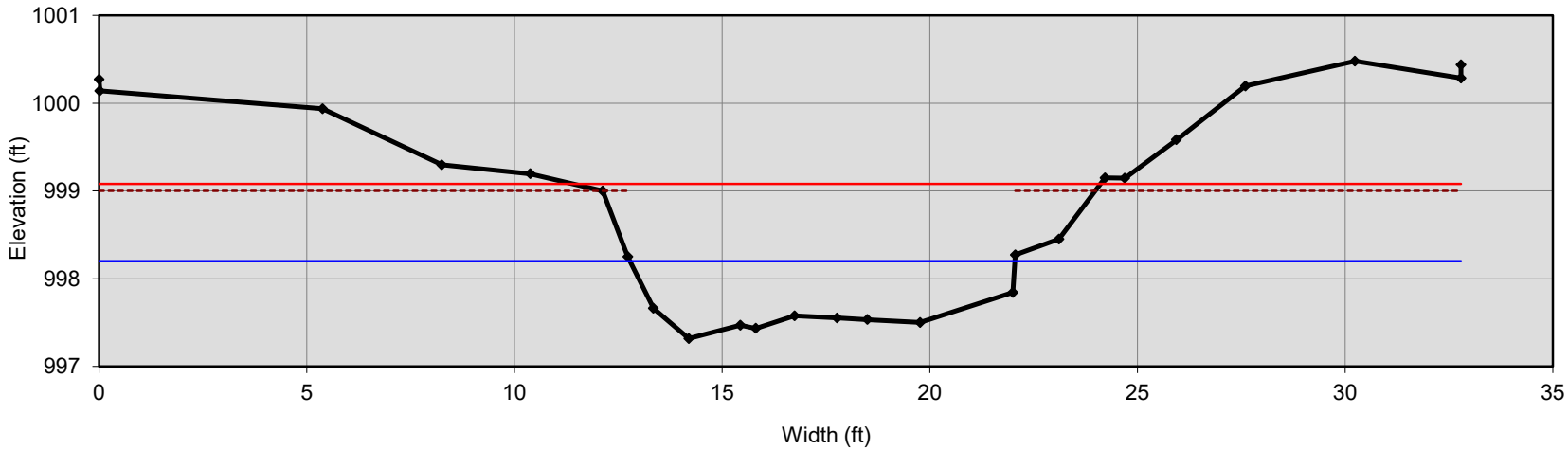


Bankfull Dimensions		Flood Dimensions		Materials	
11.3	x-section area (ft.sq.)	18.1	W flood prone area (ft)	---	D50 (mm)
12.0	width (ft)	1.5	entrenchment ratio	---	D84 (mm)
0.9	mean depth (ft)	2.9	low bank height (ft)	33	threshold grain size (mm):
1.4	max depth (ft)	2.0	low bank height ratio		
12.6	wetted perimeter (ft)				
0.9	hydraulic radius (ft)				
12.8	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.8	velocity (ft/s)	0.040	Manning's roughness	1.2	channel slope (%)
42.6	discharge rate (cfs)	0.19	Darcy-Weisbach fric.	0.67	shear stress (lb/sq.ft.)
0.71	Froude number	---	resistance factor u/u*	0.59	shear velocity (ft/s)
		---	relative roughness	2.7	unit strm power (lb/ft/s)

Cross Section 14

riffle



Bankfull Dimensions

5.9	x-section area (ft.sq.)
9.3	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
9.9	wetted perimeter (ft)
0.6	hydraulic radius (ft)
14.6	width-depth ratio

Flood Dimensions

12.7	W flood prone area (ft)
1.4	entrenchment ratio
1.7	low bank height (ft)
1.9	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
22	threshold grain size (mm):

Bankfull Flow

2.9	velocity (ft/s)
16.9	discharge rate (cfs)
0.66	Froude number

Flow Resistance

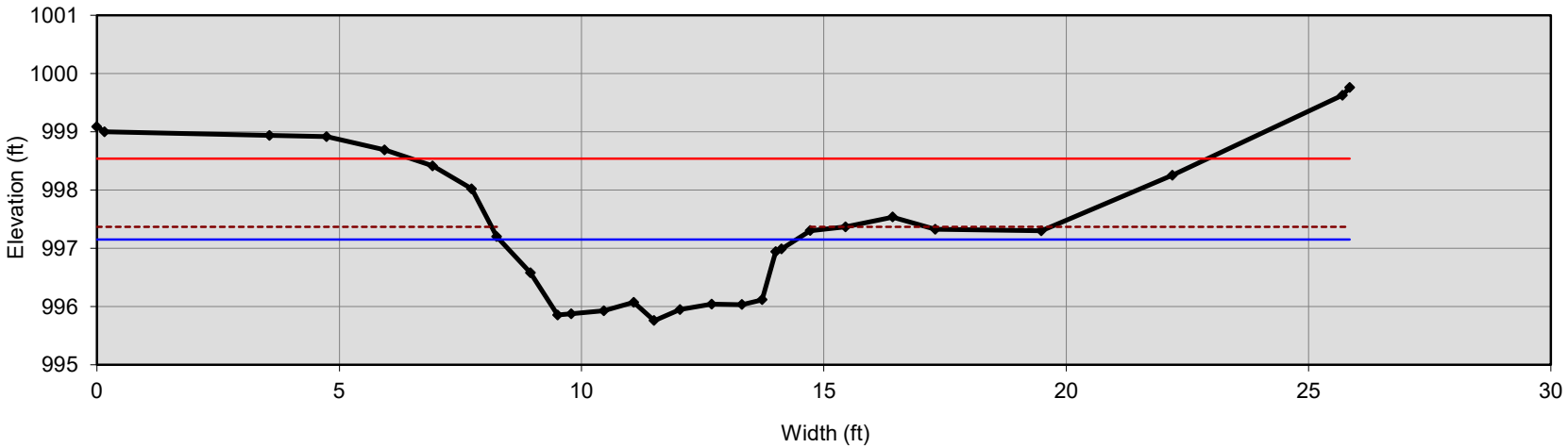
0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.2	channel slope (%)
0.44	shear stress (lb/sq.ft.)
0.48	shear velocity (ft/s)
1.36	unit strm power (lb/ft/s)

Cross Section 15

riffle



Bankfull Dimensions

5.9	x-section area (ft.sq.)
6.1	width (ft)
1.0	mean depth (ft)
1.4	max depth (ft)
7.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
6.3	width-depth ratio

Flood Dimensions

16.5	W flood prone area (ft)
2.7	entrenchment ratio
1.6	low bank height (ft)
1.2	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
29	threshold grain size (mm):

Bankfull Flow

3.5	velocity (ft/s)
20.7	discharge rate (cfs)
0.69	Froude number

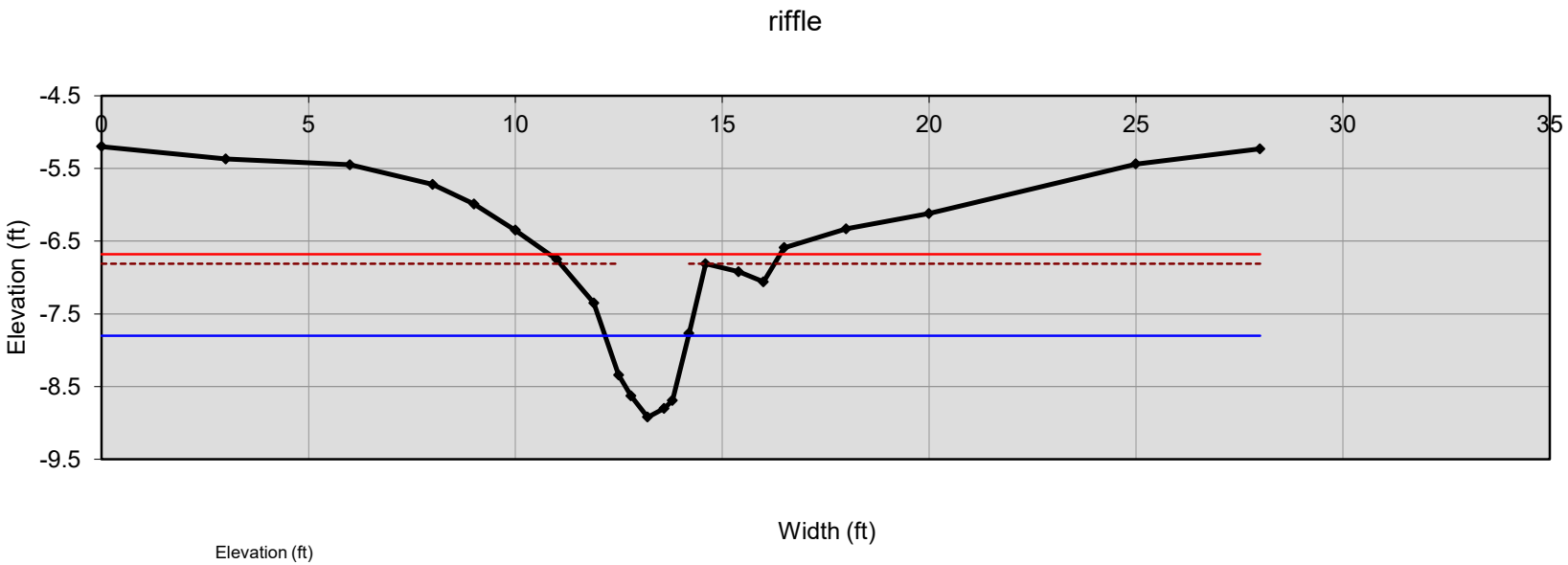
Flow Resistance

0.040	Manning's roughness
0.20	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.2	channel slope (%)
0.59	shear stress (lb/sq.ft.)
0.55	shear velocity (ft/s)
2.5	unit strm power (lb/ft/s)

Cross Section 27



Elevation (ft)

Bankfull Dimensions

1.4	x-section area (ft.sq.)
1.7	width (ft)
0.8	mean depth (ft)
1.1	max depth (ft)
2.5	wetted perimeter (ft)
0.5	hydraulic radius (ft)
2.1	width-depth ratio

Flood Dimensions

5.6	W flood prone area (ft)
3.3	entrenchment ratio
2.1	low bank height (ft)
1.9	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
79	threshold grain size (mm):

Bankfull Flow

5.4	velocity (ft/s)
7.5	discharge rate (cfs)
1.29	Froude number

Flow Resistance

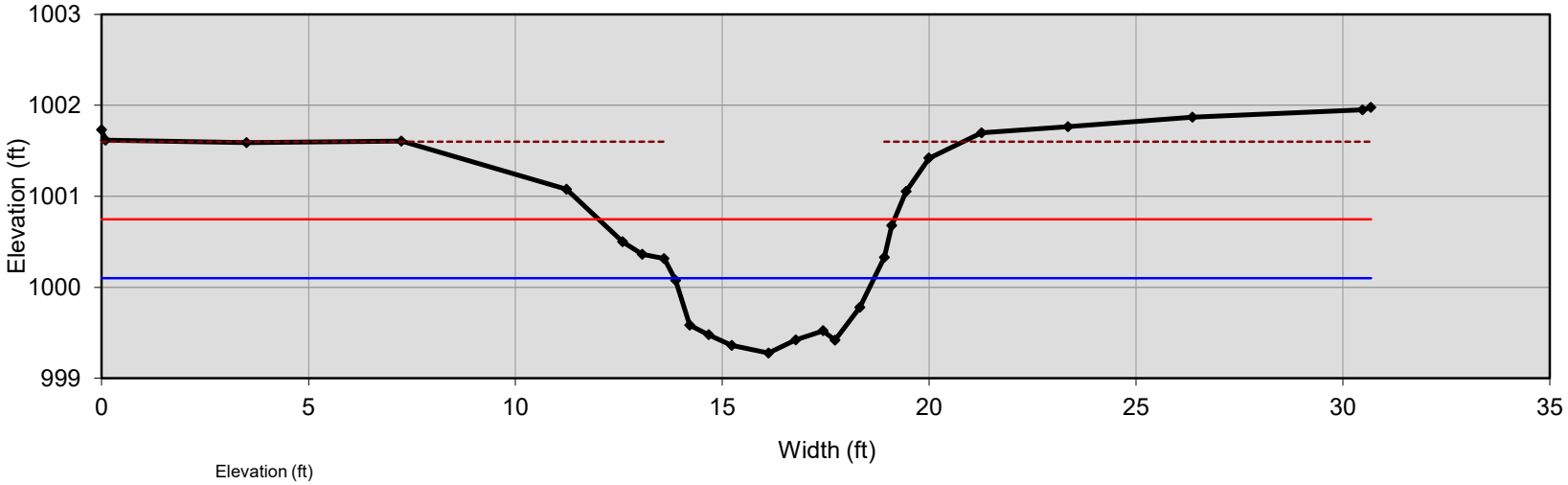
0.040	Manning's roughness
0.23	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

4.73	channel slope (%)
1.61	shear stress (lb/sq.ft.)
0.91	shear velocity (ft/s)
13.1	unit strm power (lb/ft/s)

Cross Section 16

pool



Elevation (ft)

Bankfull Dimensions

2.9	x-section area (ft.sq.)
4.8	width (ft)
0.6	mean depth (ft)
0.8	max depth (ft)
5.4	wetted perimeter (ft)
0.5	hydraulic radius (ft)
8.1	width-depth ratio

Flood Dimensions

7.2	W flood prone area (ft)
1.5	entrenchment ratio
2.3	low bank height (ft)
2.8	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
29	threshold grain size (mm):

Bankfull Flow

3.3	velocity (ft/s)
9.4	discharge rate (cfs)
0.79	Froude number

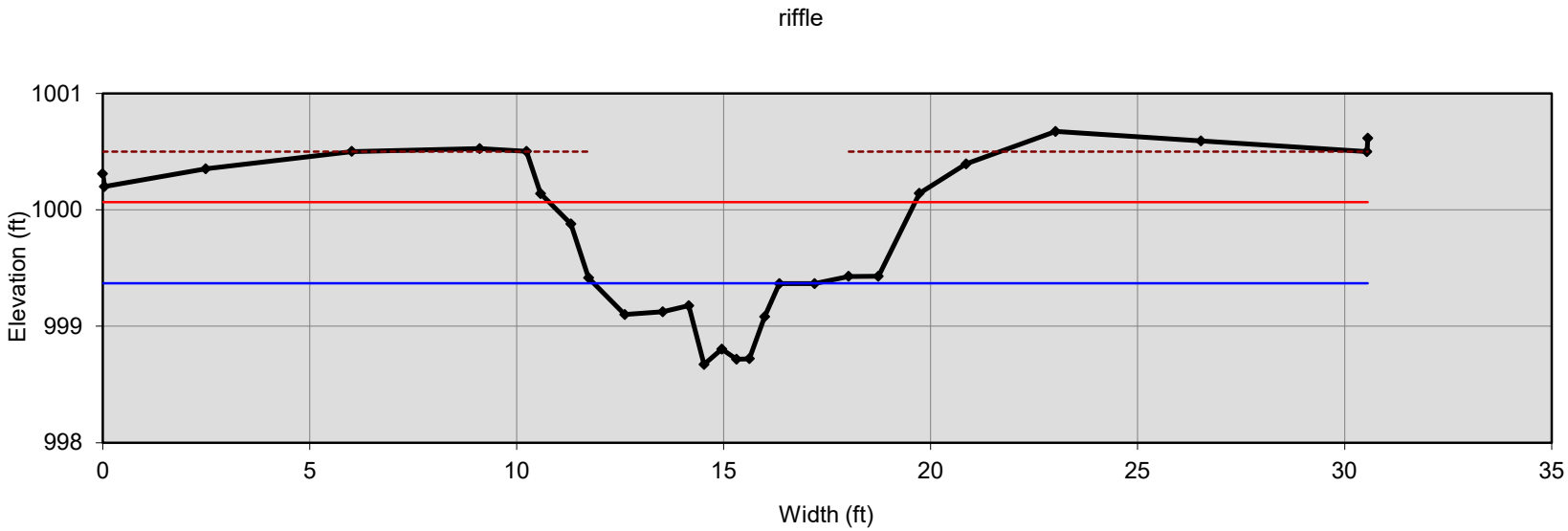
Flow Resistance

0.040	Manning's roughness
0.23	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.78	channel slope (%)
0.59	shear stress (lb/sq.ft.)
0.55	shear velocity (ft/s)
2.2	unit strm power (lb/ft/s)

Cross Section 17

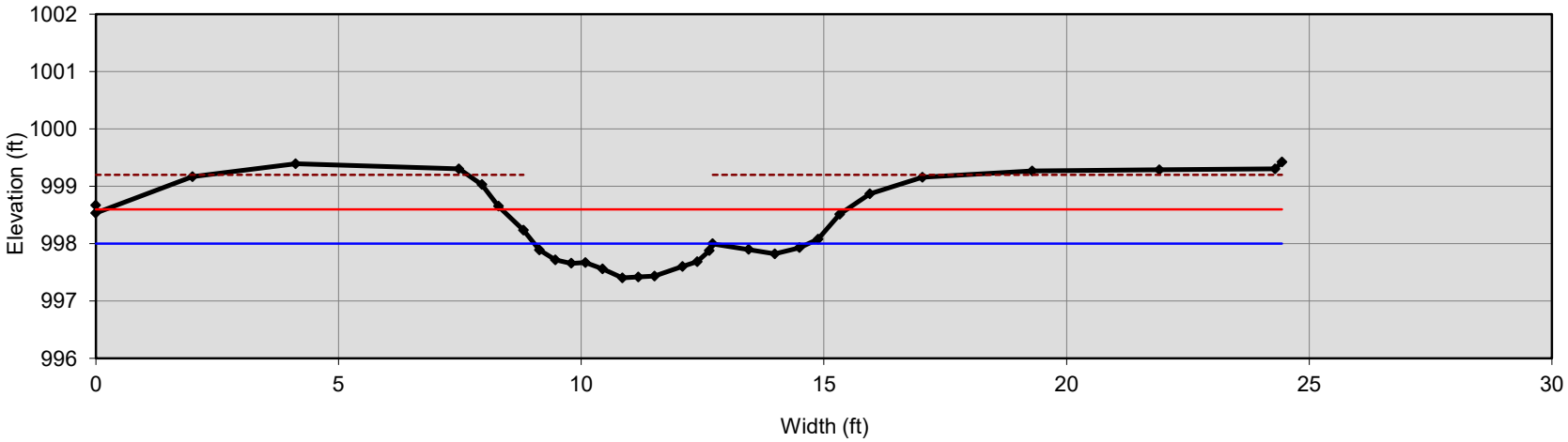


Bankfull Dimensions		Flood Dimensions		Materials	
1.6	x-section area (ft.sq.)	8.8	W flood prone area (ft)	---	D50 (mm)
5.4	width (ft)	1.6	entrenchment ratio	---	D84 (mm)
0.3	mean depth (ft)	1.8	low bank height (ft)	14	threshold grain size (mm):
0.7	max depth (ft)	2.6	low bank height ratio		
6.0	wetted perimeter (ft)				
0.3	hydraulic radius (ft)				
18.7	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.0	velocity (ft/s)	0.040	Manning's roughness	1.78	channel slope (%)
3.2	discharge rate (cfs)	0.29	Darcy-Weisbach fric.	0.29	shear stress (lb/sq.ft.)
0.70	Froude number	---	resistance factor u/u*	0.39	shear velocity (ft/s)
		---	relative roughness	0.65	unit strm power (lb/ft/s)

Cross Section 18

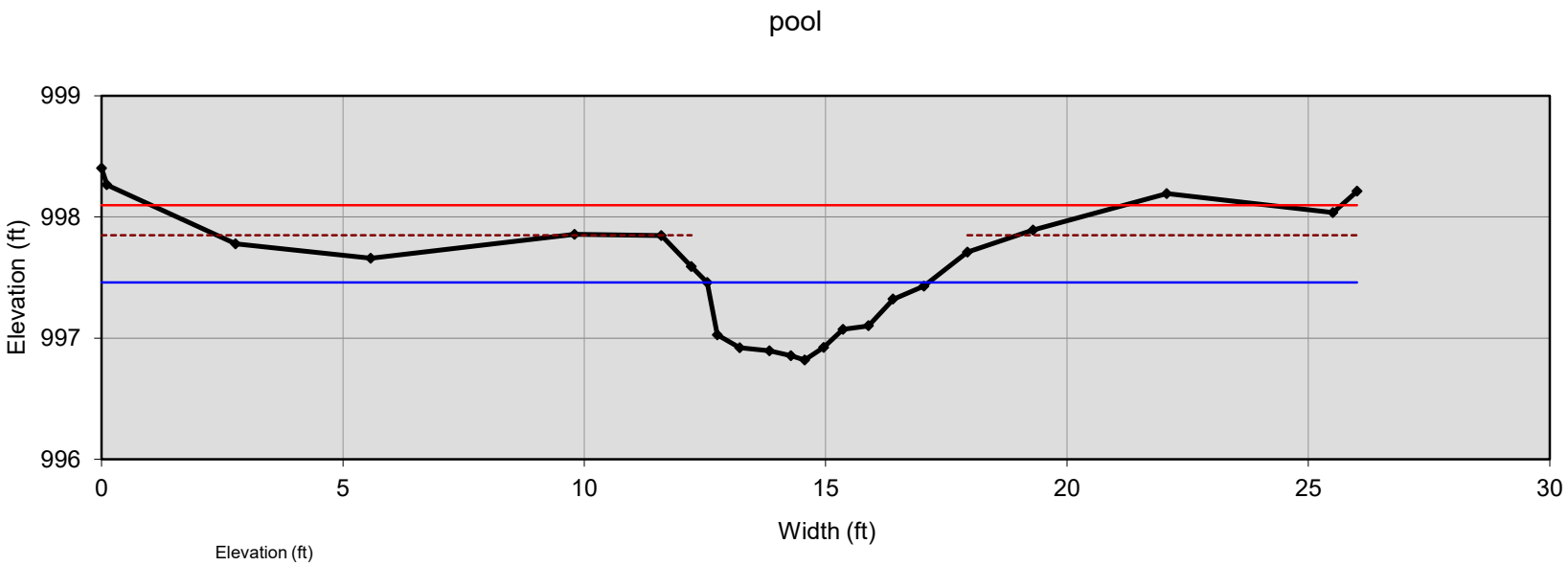
riffle



Bankfull Dimensions		Flood Dimensions		Materials	
1.4	x-section area (ft.sq.)	7.3	W flood prone area (ft)	---	D50 (mm)
3.7	width (ft)	2.0	entrenchment ratio	---	D84 (mm)
0.4	mean depth (ft)	1.8	low bank height (ft)	20	threshold grain size (mm):
0.6	max depth (ft)	3.0	low bank height ratio		
4.0	wetted perimeter (ft)				
0.4	hydraulic radius (ft)				
9.3	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.5	velocity (ft/s)	0.040	Manning's roughness	1.78	channel slope (%)
3.7	discharge rate (cfs)	0.26	Darcy-Weisbach fric.	0.40	shear stress (lb/sq.ft.)
0.74	Froude number	---	resistance factor u/u*	0.46	shear velocity (ft/s)
		---	relative roughness	1.11	unit strm power (lb/ft/s)

Cross Section 19



Elevation (ft)

Bankfull Dimensions

1.8	x-section area (ft.sq.)
4.6	width (ft)
0.4	mean depth (ft)
0.6	max depth (ft)
5.0	wetted perimeter (ft)
0.4	hydraulic radius (ft)
11.4	width-depth ratio

Flood Dimensions

21.7	W flood prone area (ft)
4.7	entrenchment ratio
1.0	low bank height (ft)
1.6	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
5	threshold grain size (mm):

Bankfull Flow

1.2	velocity (ft/s)
2.3	discharge rate (cfs)
0.36	Froude number

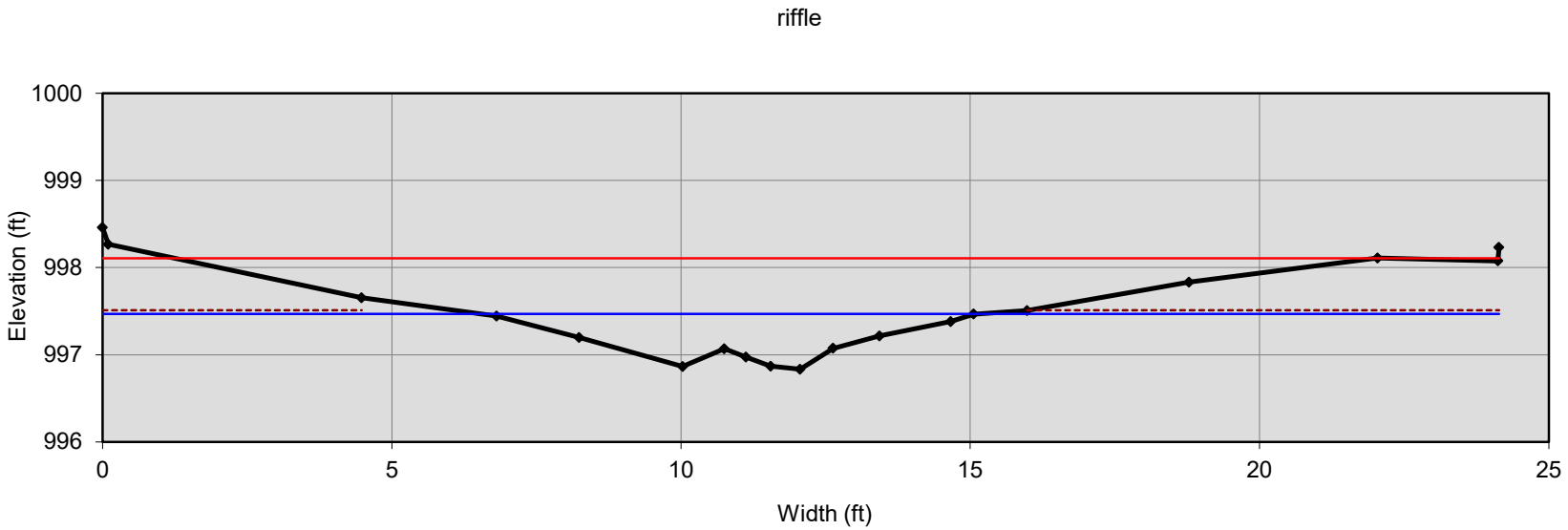
Flow Resistance

0.040	Manning's roughness
0.26	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.41	channel slope (%)
0.09	shear stress (lb/sq.ft.)
0.22	shear velocity (ft/s)
0.13	unit strm power (lb/ft/s)

Cross Section 20



Bankfull Dimensions

2.9	x-section area (ft.sq.)
8.6	width (ft)
0.3	mean depth (ft)
0.6	max depth (ft)
8.8	wetted perimeter (ft)
0.3	hydraulic radius (ft)
26.0	width-depth ratio

Flood Dimensions

22.8	W flood prone area (ft)
2.6	entrenchment ratio
0.7	low bank height (ft)
1.1	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
4	threshold grain size (mm):

Bankfull Flow

1.1	velocity (ft/s)
3.2	discharge rate (cfs)
0.35	Froude number

Flow Resistance

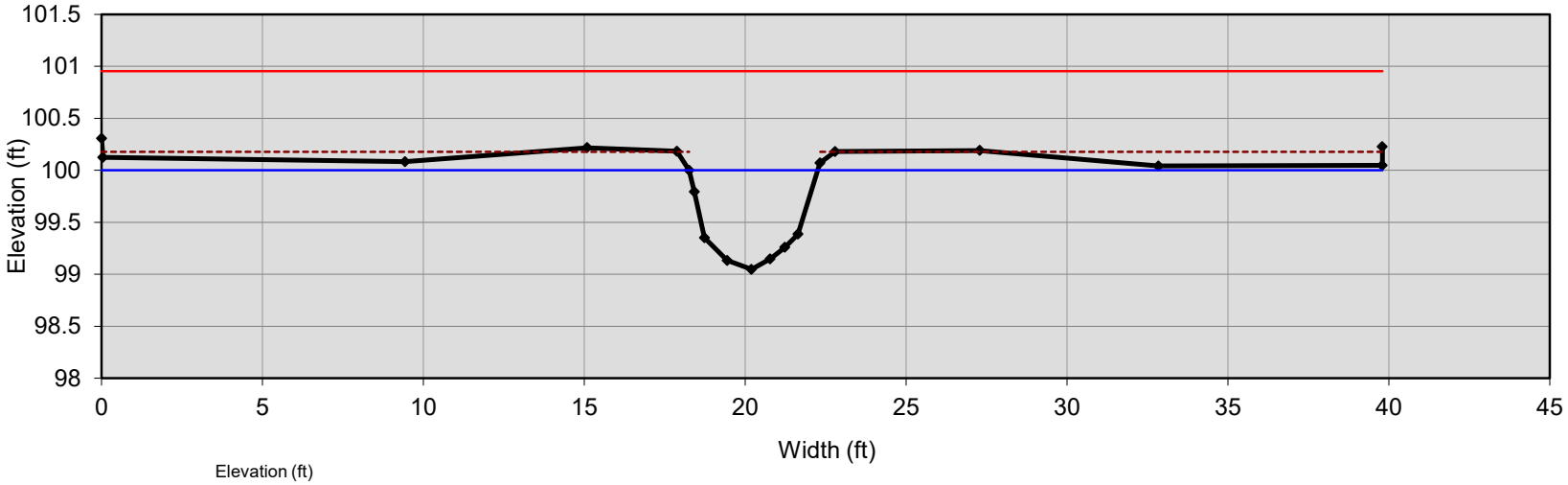
0.040	Manning's roughness
0.27	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.41	channel slope (%)
0.08	shear stress (lb/sq.ft.)
0.21	shear velocity (ft/s)
0.096	unit strm power (lb/ft/s)

Cross Section 21

riffle



Elevation (ft)

Bankfull Dimensions

2.7	x-section area (ft.sq.)
4.0	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
4.7	wetted perimeter (ft)
0.6	hydraulic radius (ft)
5.9	width-depth ratio

Flood Dimensions

69.3	W flood prone area (ft)
17.3	entrenchment ratio
1.1	low bank height (ft)
1.2	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
14	threshold grain size (mm):

Bankfull Flow

2.3	velocity (ft/s)
6.2	discharge rate (cfs)
0.53	Froude number

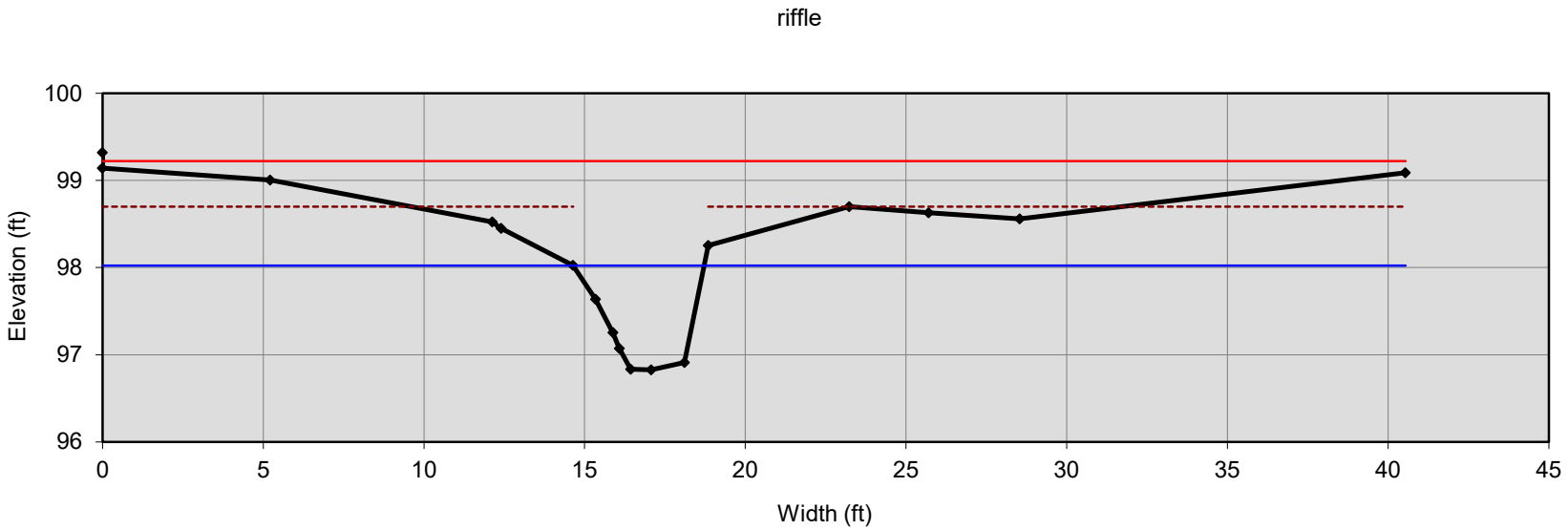
Flow Resistance

0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.77	channel slope (%)
0.28	shear stress (lb/sq.ft.)
0.38	shear velocity (ft/s)
0.75	unit strm power (lb/ft/s)

Cross Section 22



Bankfull Dimensions

3.3	x-section area (ft.sq.)
4.1	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
5.1	wetted perimeter (ft)
0.6	hydraulic radius (ft)
5.0	width-depth ratio

Flood Dimensions

42.0	W flood prone area (ft)
10.3	entrenchment ratio
1.9	low bank height (ft)
1.6	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
28	threshold grain size (mm):

Bankfull Flow

3.3	velocity (ft/s)
10.9	discharge rate (cfs)
0.72	Froude number

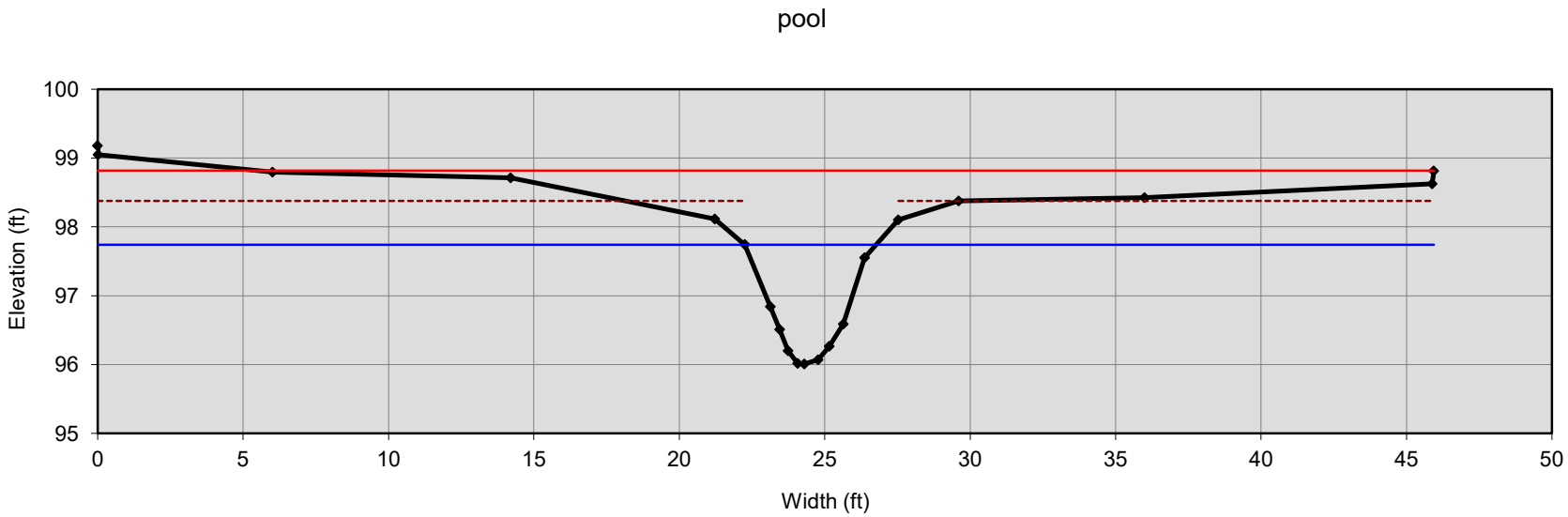
Flow Resistance

0.040	Manning's roughness
0.21	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.4	channel slope (%)
0.57	shear stress (lb/sq.ft.)
0.54	shear velocity (ft/s)
2.3	unit strm power (lb/ft/s)

Cross Section 23



Bankfull Dimensions

4.6	x-section area (ft.sq.)
4.5	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
5.9	wetted perimeter (ft)
0.8	hydraulic radius (ft)
4.4	width-depth ratio

Flood Dimensions

55.3	W flood prone area (ft)
12.2	entrenchment ratio
2.4	low bank height (ft)
1.4	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
34	threshold grain size (mm):

Bankfull Flow

3.8	velocity (ft/s)
17.5	discharge rate (cfs)
0.75	Froude number

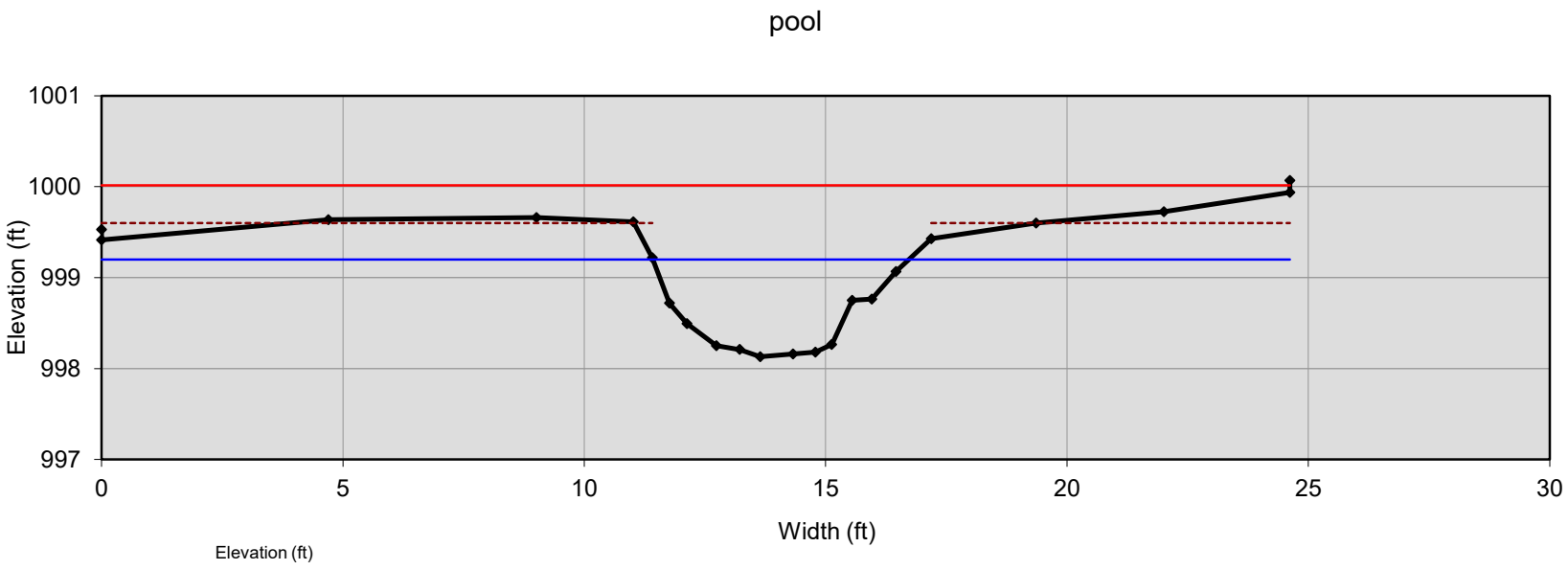
Flow Resistance

0.040	Manning's roughness
0.20	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.4	channel slope (%)
0.69	shear stress (lb/sq.ft.)
0.60	shear velocity (ft/s)
3.4	unit strm power (lb/ft/s)

Cross Section 24



Elevation (ft)

Bankfull Dimensions

3.9	x-section area (ft.sq.)
5.3	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
6.0	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.3	width-depth ratio

Flood Dimensions

111.2	W flood prone area (ft)
21.0	entrenchment ratio
1.5	low bank height (ft)
1.4	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
32	threshold grain size (mm):

Bankfull Flow

3.5	velocity (ft/s)
13.6	discharge rate (cfs)
0.77	Froude number

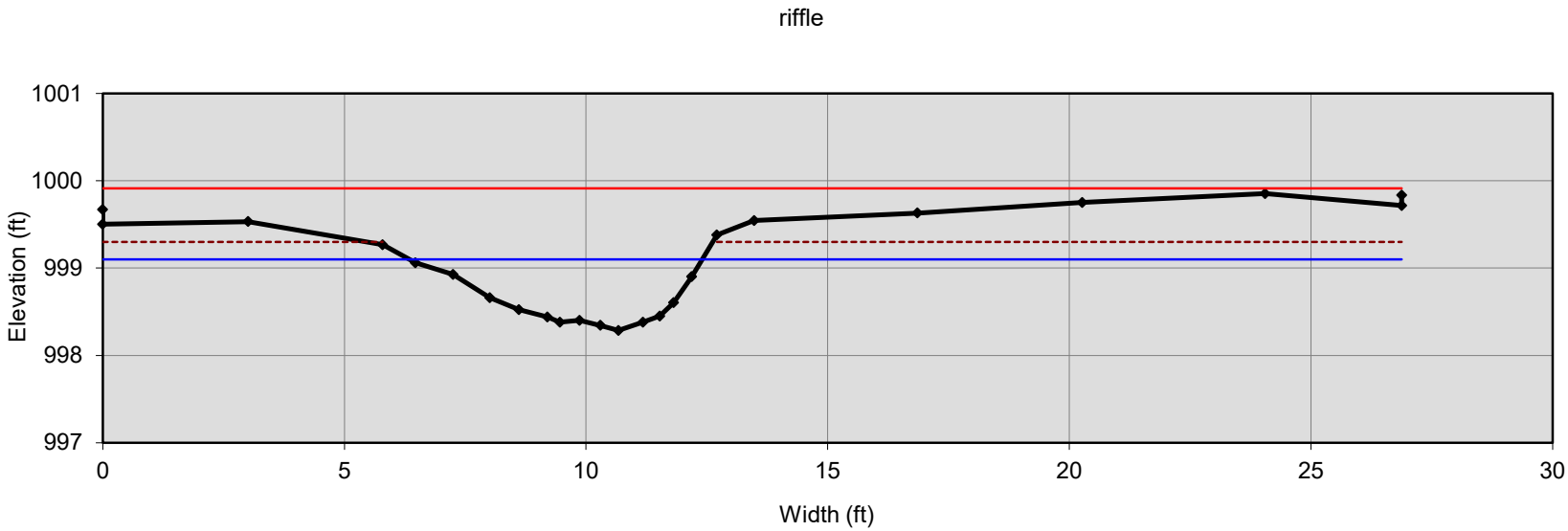
Flow Resistance

0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.6	channel slope (%)
0.64	shear stress (lb/sq.ft.)
0.58	shear velocity (ft/s)
2.6	unit strm power (lb/ft/s)

Cross Section 25

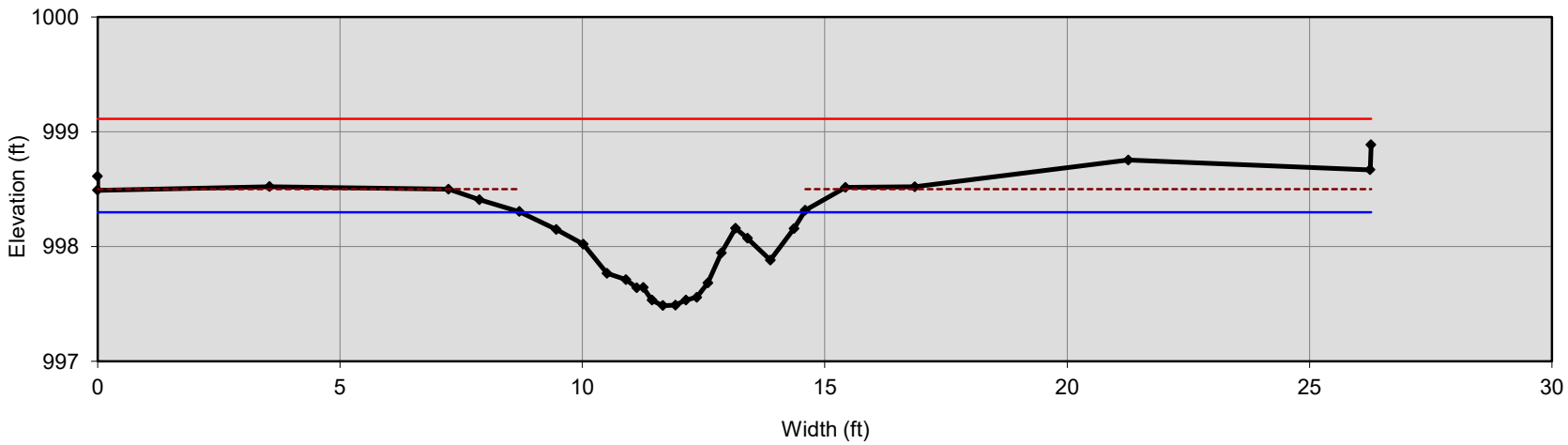


Bankfull Dimensions		Flood Dimensions		Materials	
3.0	x-section area (ft.sq.)	111.2	W flood prone area (ft)	---	D50 (mm)
6.1	width (ft)	18.3	entrenchment ratio	---	D84 (mm)
0.5	mean depth (ft)	1.0	low bank height (ft)	23	threshold grain size (mm):
0.8	max depth (ft)	1.2	low bank height ratio		
6.4	wetted perimeter (ft)				
0.5	hydraulic radius (ft)				
12.3	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.8	velocity (ft/s)	0.040	Manning's roughness	1.6	channel slope (%)
8.6	discharge rate (cfs)	0.24	Darcy-Weisbach fric.	0.47	shear stress (lb/sq.ft.)
0.73	Froude number	---	resistance factor u/u*	0.49	shear velocity (ft/s)
		---	relative roughness	1.41	unit strm power (lb/ft/s)

Cross Section 26

riffle



Bankfull Dimensions

2.4	x-section area (ft.sq.)
5.9	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
6.4	wetted perimeter (ft)
0.4	hydraulic radius (ft)
14.3	width-depth ratio

Flood Dimensions

108.5	W flood prone area (ft)
18.5	entrenchment ratio
1.0	low bank height (ft)
1.2	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
18	threshold grain size (mm):

Bankfull Flow

2.5	velocity (ft/s)
5.9	discharge rate (cfs)
0.71	Froude number

Flow Resistance

0.040	Manning's roughness
0.26	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

1.6	channel slope (%)
0.37	shear stress (lb/sq.ft.)
0.44	shear velocity (ft/s)
1	unit strm power (lb/ft/s)

Reachwide and Cross-Section Pebble Count Plots

Perry Hill

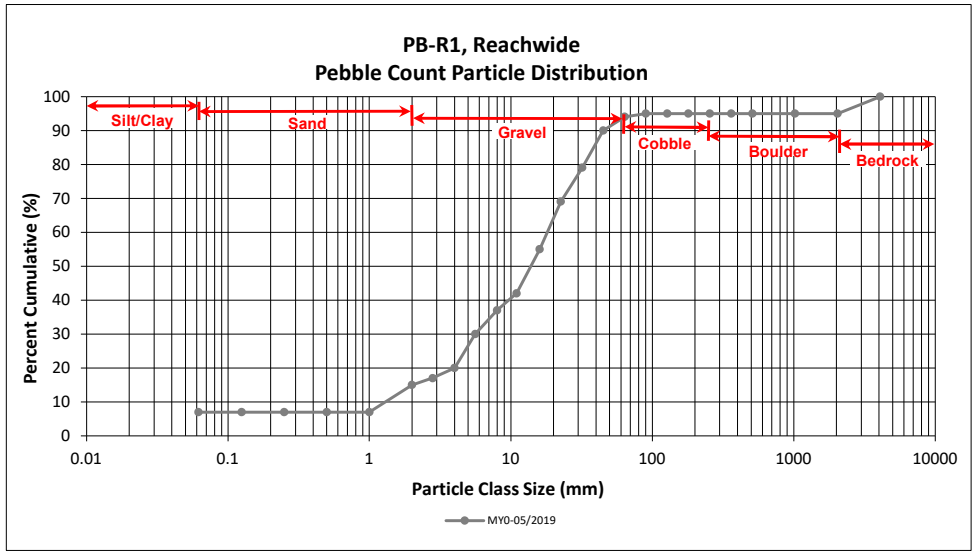
DMS Project No. 100093

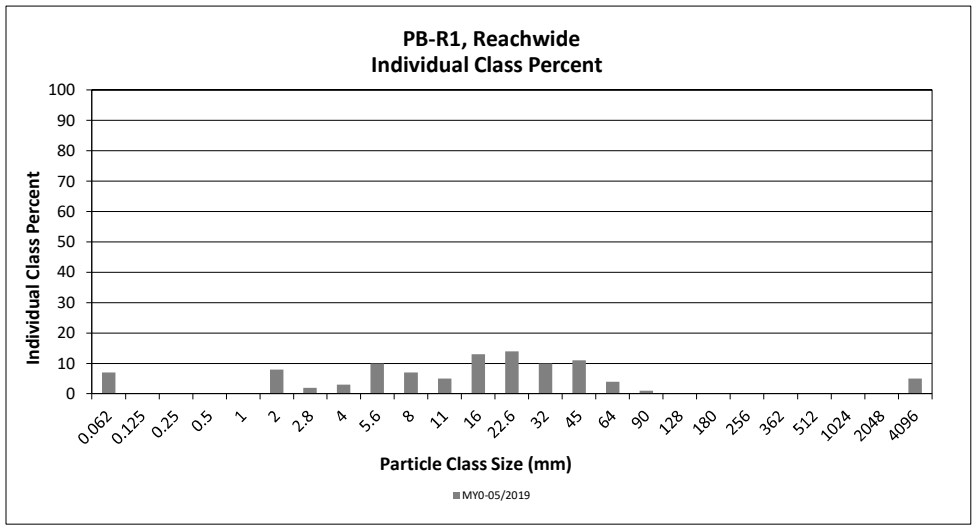
Existing Conditions

PB-R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	6	7	7	7
SAND	Very fine	0.062	0.125					7
	Fine	0.125	0.250					7
	Medium	0.25	0.50					7
	Coarse	0.5	1.0					7
	Very Coarse	1.0	2.0	2	6	8	8	15
GRAVEL	Very Fine	2.0	2.8		2	2	2	17
	Very Fine	2.8	4.0	2	1	3	3	20
	Fine	4.0	5.6	4	6	10	10	30
	Fine	5.6	8.0	5	2	7	7	37
	Medium	8.0	11.0	4	1	5	5	42
	Medium	11.0	16.0	8	5	13	13	55
	Coarse	16.0	22.6	8	6	14	14	69
	Coarse	22.6	32	5	5	10	10	79
	Very Coarse	32	45	6	5	11	11	90
	Very Coarse	45	64	2	2	4	4	94
COBBLE	Small	64	90	1		1	1	95
	Small	90	128					95
	Large	128	180					95
	Large	180	256					95
BOULDER	Small	256	362					95
	Small	362	512					95
	Medium	512	1024					95
	Large/Very Large	1024	2048					95
BEDROCK	Bedrock	2048	>2048	2	3	5	5	100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	2.37
D_{35} =	7.22
D_{50} =	13.9
D_{84} =	37.4
D_{95} =	90.0
D_{100} =	>2048





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

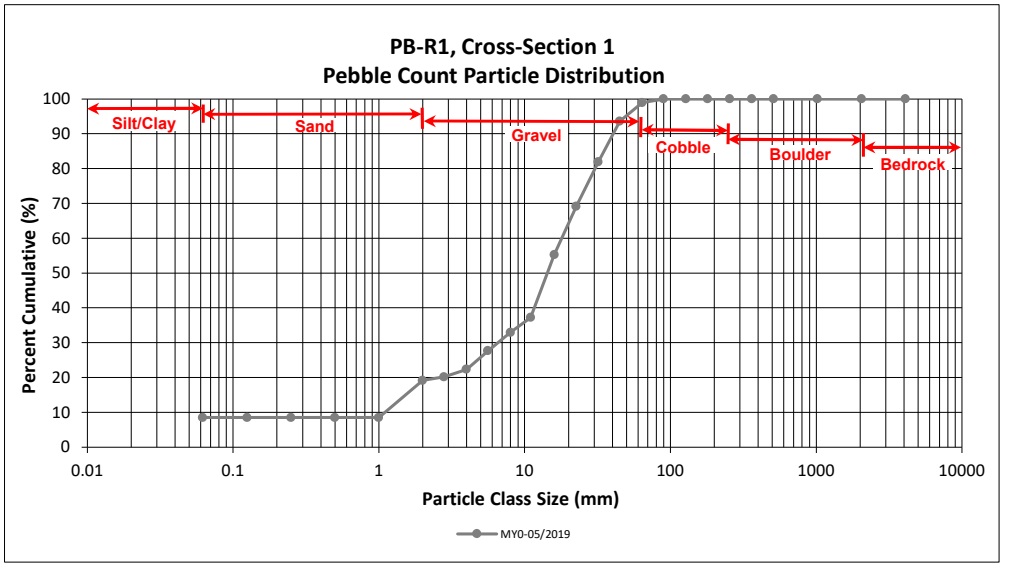
DMS Project No. 100093

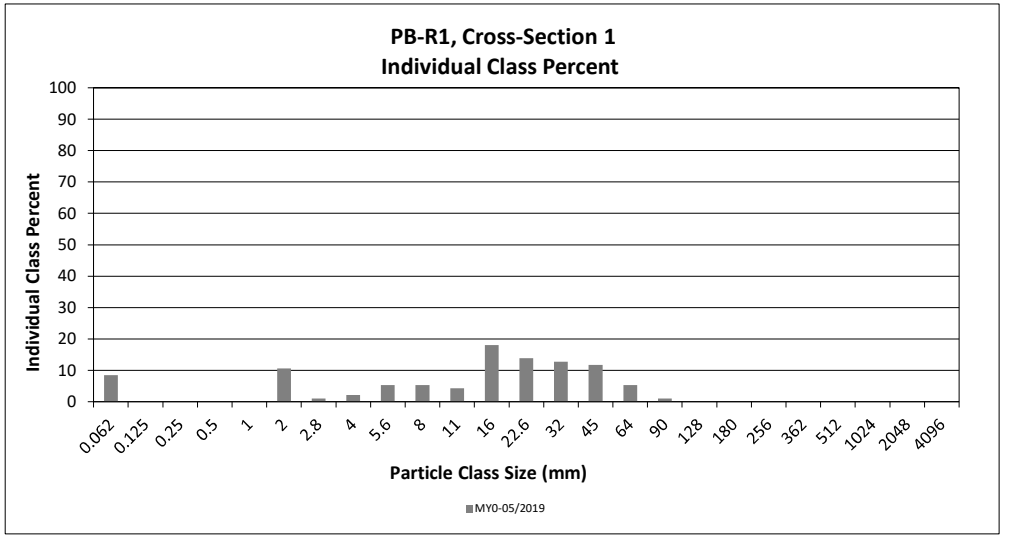
Existing Conditions

PB-R1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	8	9	9
SAND	Very fine	0.062	0.125			9
	Fine	0.125	0.250			9
	Medium	0.25	0.50			9
	Coarse	0.5	1.0			9
	Very Coarse	1.0	2.0	10	11	19
GRAVEL	Very Fine	2.0	2.8	1	1	20
	Very Fine	2.8	4.0	2	2	22
	Fine	4.0	5.6	5	5	28
	Fine	5.6	8.0	5	5	33
	Medium	8.0	11.0	4	4	37
	Medium	11.0	16.0	17	18	55
	Coarse	16.0	22.6	13	14	69
	Coarse	22.6	32	12	13	82
	Very Coarse	32	45	11	12	94
	Very Coarse	45	64	5	5	99
COBBLE	Small	64	90	1	1	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**94**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	1.63
D_{35} =	9.31
D_{50} =	14.3
D_{84} =	34.0
D_{95} =	49.3
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

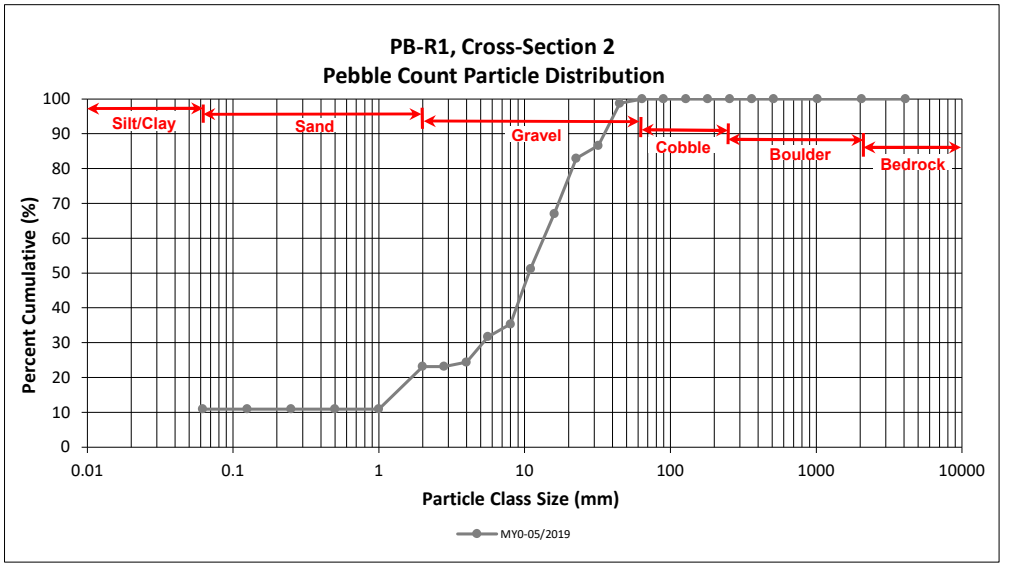
DMS Project No. 100093

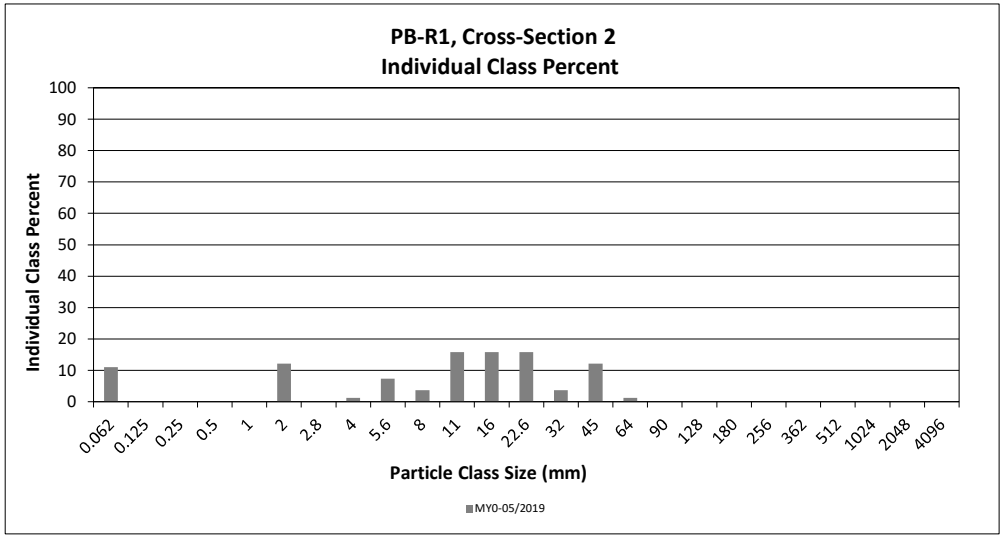
Existing Conditions

PB-R1, Cross-Section 2

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	9	11	11
SAND	Very fine	0.062	0.125			11
	Fine	0.125	0.250			11
	Medium	0.25	0.50			11
	Coarse	0.5	1.0			11
	Very Coarse	1.0	2.0	10	12	23
GRAVEL	Very Fine	2.0	2.8			23
	Very Fine	2.8	4.0	1	1	24
	Fine	4.0	5.6	6	7	32
	Fine	5.6	8.0	3	4	35
	Medium	8.0	11.0	13	16	51
	Medium	11.0	16.0	13	16	67
	Coarse	16.0	22.6	13	16	83
	Coarse	22.6	32	3	4	87
	Very Coarse	32	45	10	12	99
	Very Coarse	45	64	1	1	100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**82**	**100**	**100**

Cross-Section 2	
Channel materials (mm)	
D_{16} =	1.33
D_{35} =	7.72
D_{50} =	10.7
D_{84} =	25.0
D_{95} =	40.5
D_{100} =	64.0





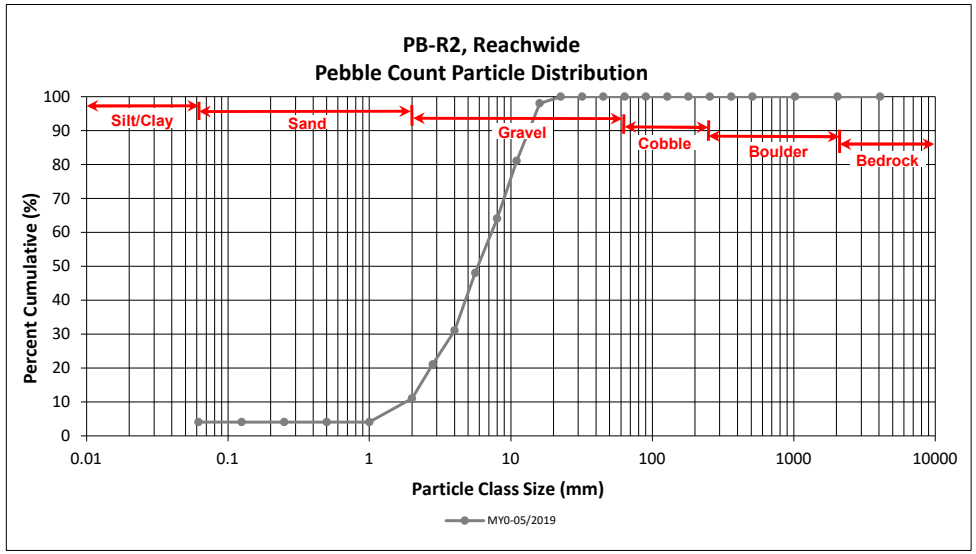
Reachwide and Cross-Section Pebble Count Plots

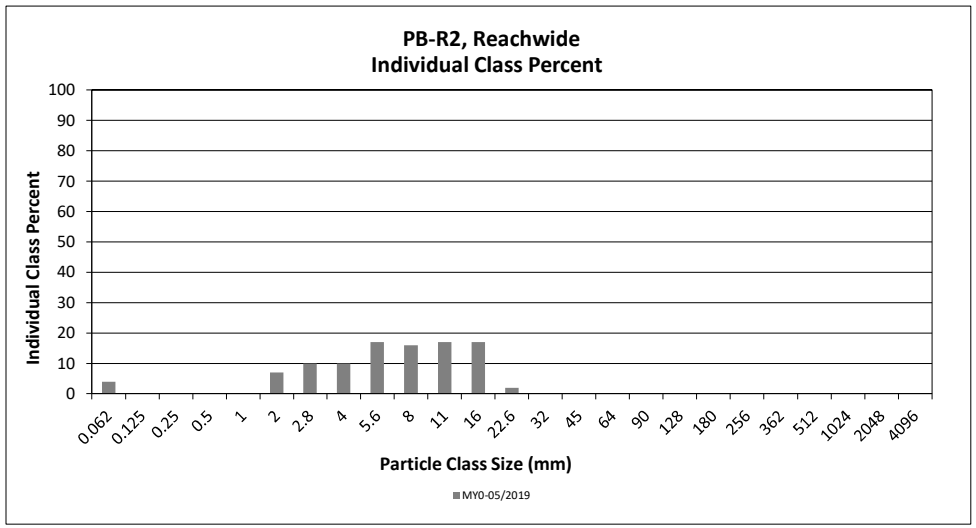
Perry Hill
DMS Project No. 100093
Existing Conditions

PB-R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125					4
	Fine	0.125	0.250					4
	Medium	0.25	0.50					4
	Coarse	0.5	1.0					4
	Very Coarse	1.0	2.0	2	5	7	7	11
GRAVEL	Very Fine	2.0	2.8	5	5	10	10	21
	Very Fine	2.8	4.0	9	1	10	10	31
	Fine	4.0	5.6	14	3	17	17	48
	Fine	5.6	8.0	11	5	16	16	64
	Medium	8.0	11.0	13	4	17	17	81
	Medium	11.0	16.0	14	3	17	17	98
	Coarse	16.0	22.6	1	1	2	2	100
	Coarse	22.6	32					100
	Very Coarse	32	45					100
	Very Coarse	45	64					100
COBBLE	Small	64	90					100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	2.37
D_{35} =	4.33
D_{50} =	5.9
D_{84} =	11.8
D_{95} =	15.0
D_{100} =	22.6





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

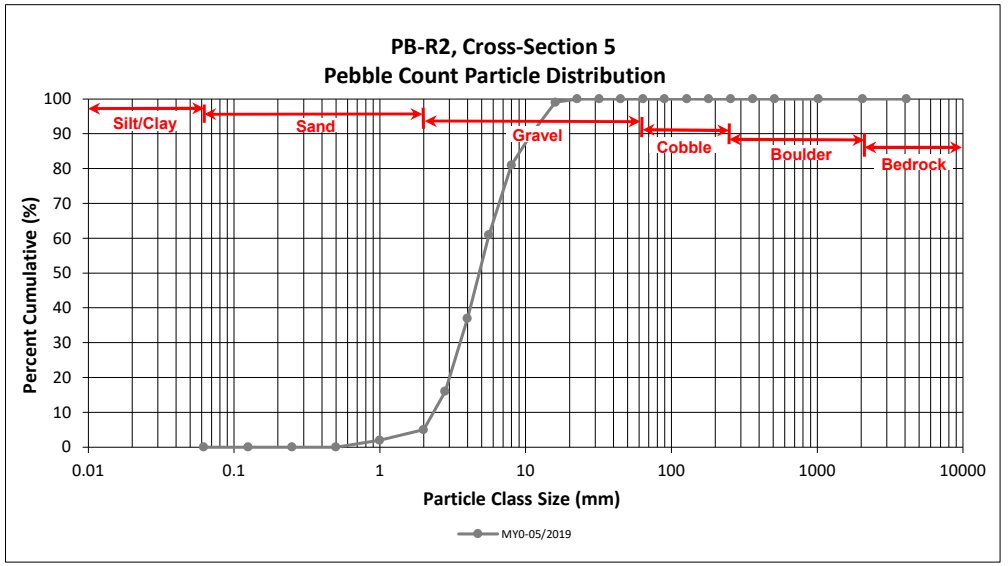
DMS Project No. 100093

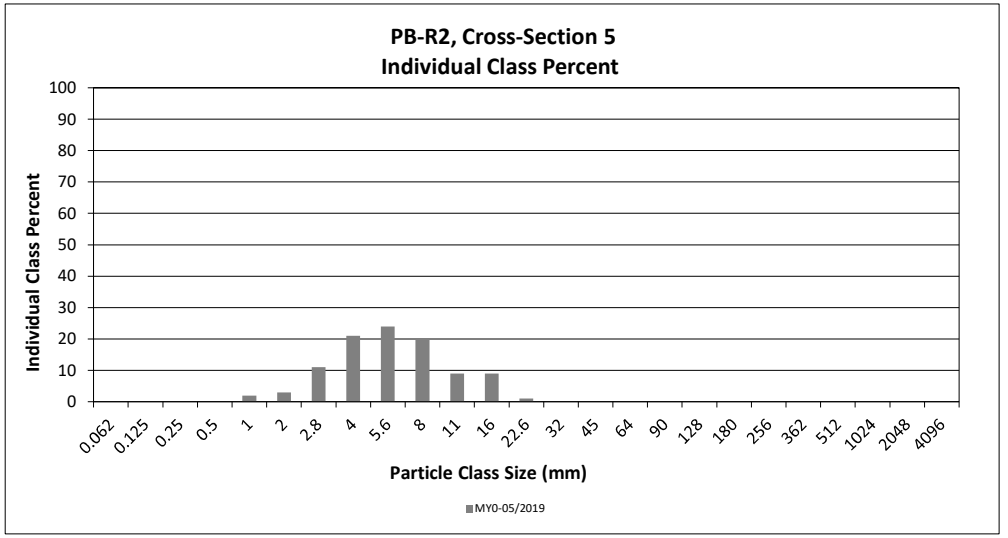
Existing Conditions

PB-R2, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	2	2	2
	Very Coarse	1.0	2.0	3	3	5
GRAVEL	Very Fine	2.0	2.8	11	11	16
	Very Fine	2.8	4.0	21	21	37
	Fine	4.0	5.6	24	24	61
	Fine	5.6	8.0	20	20	81
	Medium	8.0	11.0	9	9	90
	Medium	11.0	16.0	9	9	99
	Coarse	16.0	22.6	1	1	100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 5	
Channel materials (mm)	
D_{16} =	2.80
D_{35} =	3.87
D_{50} =	4.8
D_{84} =	8.9
D_{95} =	13.5
D_{100} =	22.6





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

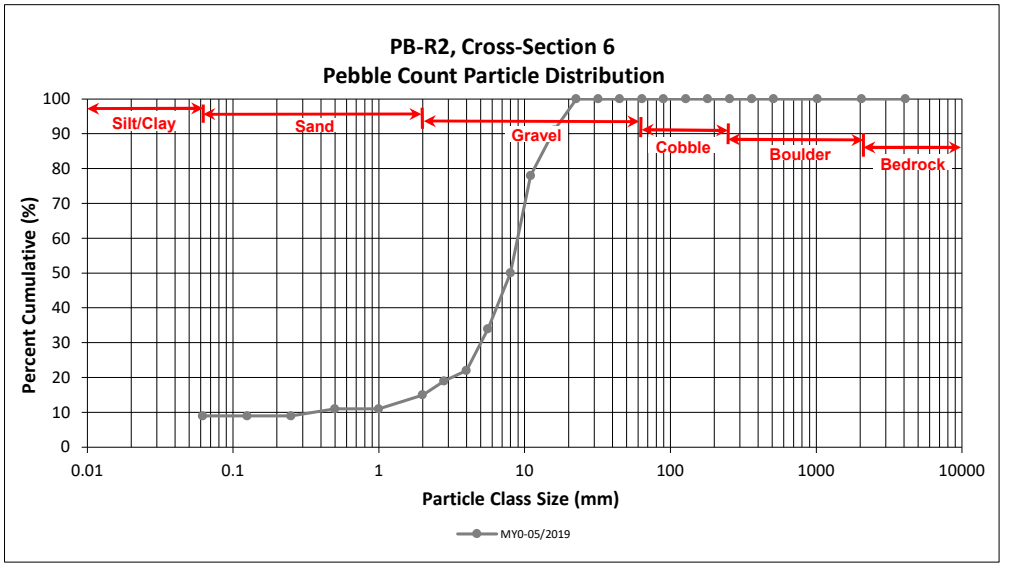
DMS Project No. 100093

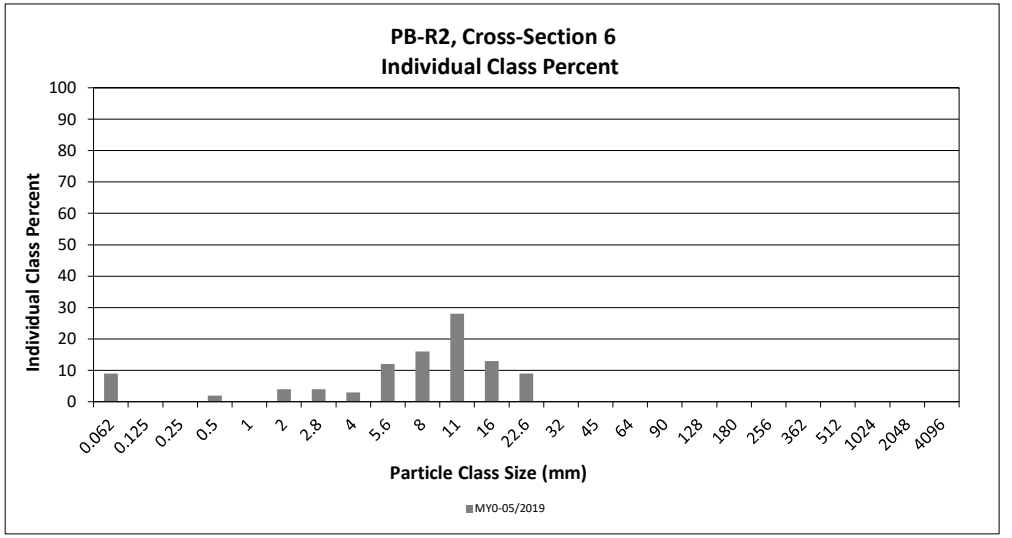
Existing Conditions

PB-R2, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	9	9	9
SAND	Very fine	0.062	0.125			9
	Fine	0.125	0.250			9
	Medium	0.25	0.50	2	2	11
	Coarse	0.5	1.0			11
	Very Coarse	1.0	2.0	4	4	15
GRAVEL	Very Fine	2.0	2.8	4	4	19
	Very Fine	2.8	4.0	3	3	22
	Fine	4.0	5.6	12	12	34
	Fine	5.6	8.0	16	16	50
	Medium	8.0	11.0	28	28	78
	Medium	11.0	16.0	13	13	91
	Coarse	16.0	22.6	9	9	100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	2.18
D_{35} =	5.73
D_{50} =	8.0
D_{84} =	13.1
D_{95} =	18.7
D_{100} =	22.6





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

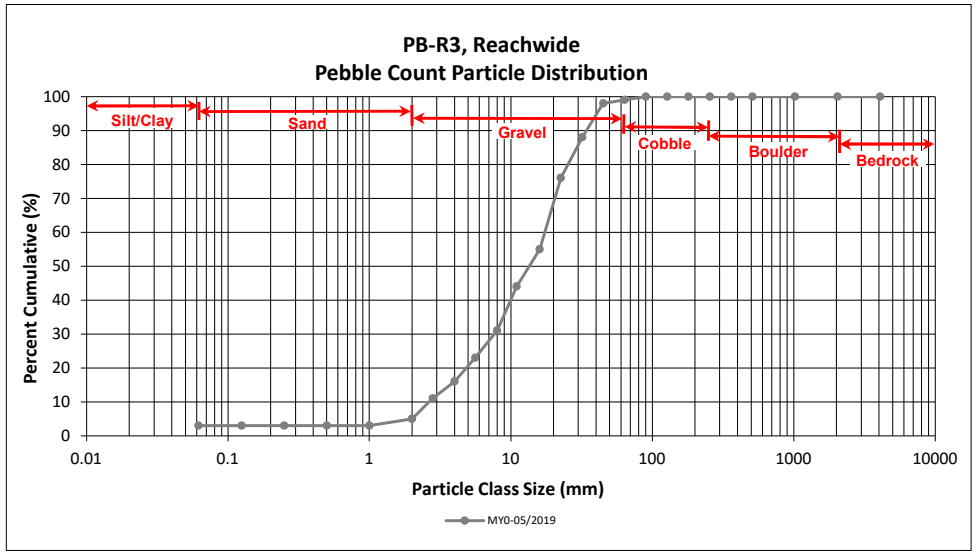
DMS Project No. 100093

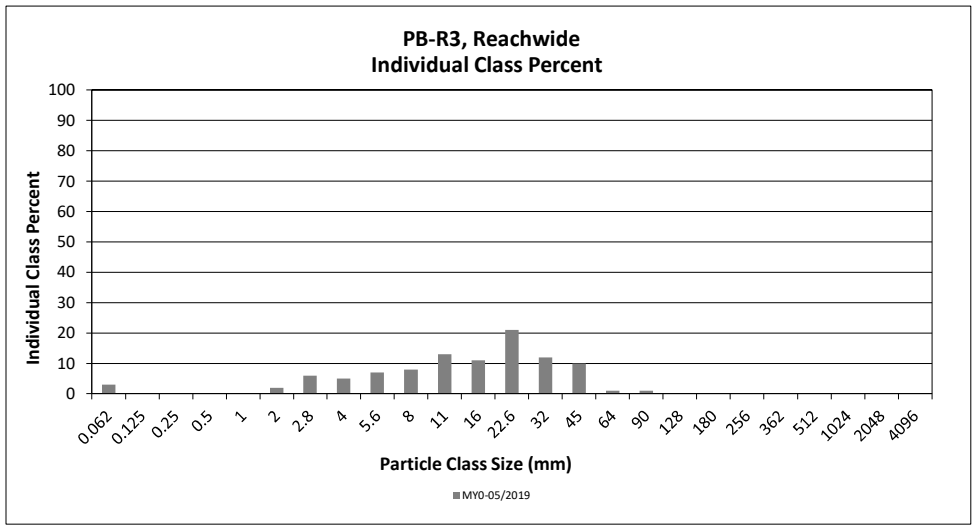
Existing Conditions

PB-R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	1	3	3	3
SAND	Very fine	0.062	0.125					3
	Fine	0.125	0.250					3
	Medium	0.25	0.50					3
	Coarse	0.5	1.0					3
	Very Coarse	1.0	2.0	2		2	2	5
GRAVEL	Very Fine	2.0	2.8	3	3	6	6	11
	Very Fine	2.8	4.0	1	4	5	5	16
	Fine	4.0	5.6	4	3	7	7	23
	Fine	5.6	8.0	5	3	8	8	31
	Medium	8.0	11.0	10	3	13	13	44
	Medium	11.0	16.0	10	1	11	11	55
	Coarse	16.0	22.6	18	3	21	21	76
	Coarse	22.6	32	9	3	12	12	88
	Very Coarse	32	45	5	5	10	10	98
	Very Coarse	45	64	1		1	1	99
COBBLE	Small	64	90		1	1	1	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	4.00
D_{35} =	8.82
D_{50} =	13.5
D_{84} =	28.5
D_{95} =	40.6
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

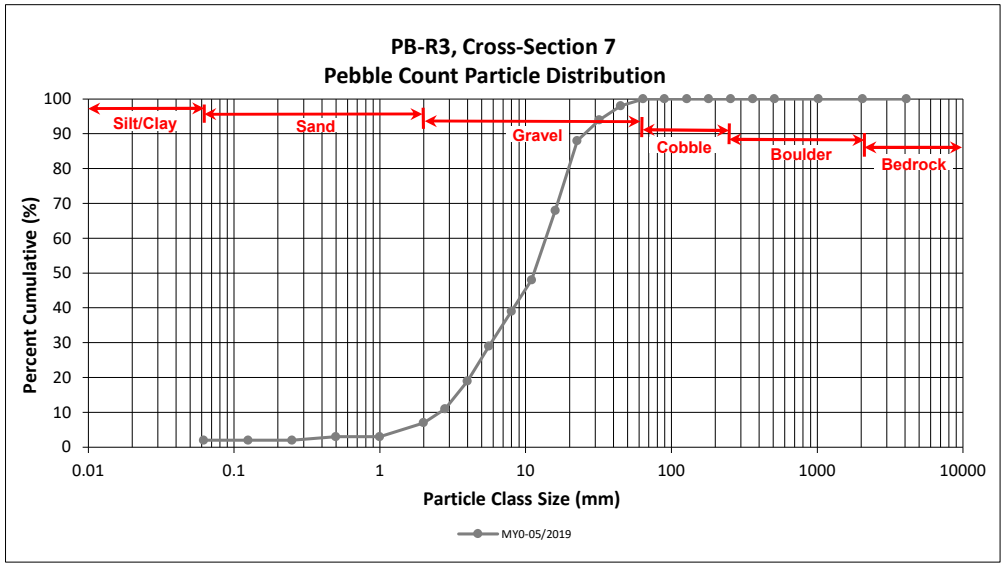
DMS Project No. 100093

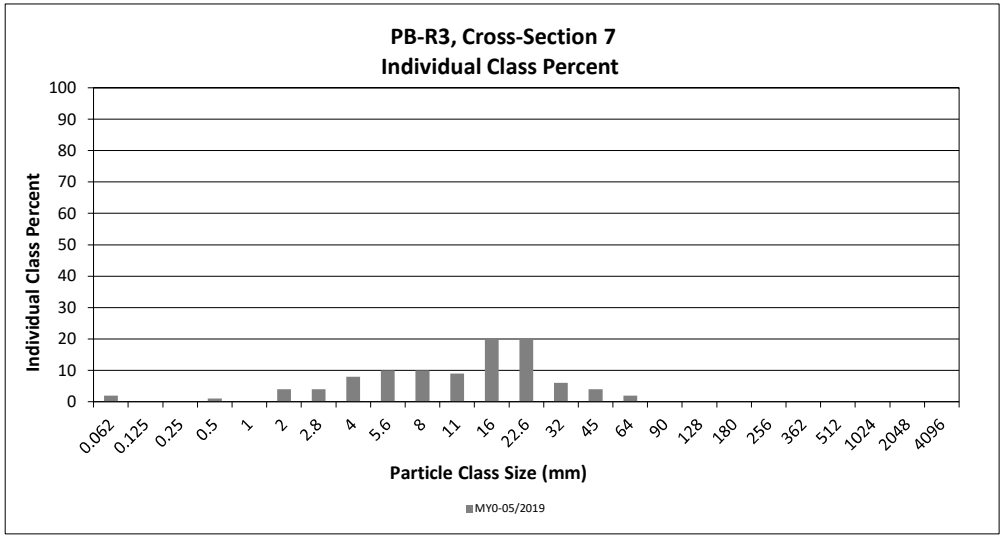
Existing Conditions

PB-R3, Cross-Section 7

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	1	1	3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0	4	4	7
GRAVEL	Very Fine	2.0	2.8	4	4	11
	Very Fine	2.8	4.0	8	8	19
	Fine	4.0	5.6	10	10	29
	Fine	5.6	8.0	10	10	39
	Medium	8.0	11.0	9	9	48
	Medium	11.0	16.0	20	20	68
	Coarse	16.0	22.6	20	20	88
	Coarse	22.6	32	6	6	94
	Very Coarse	32	45	4	4	98
	Very Coarse	45	64	2	2	100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 7	
Channel materials (mm)	
D_{16} =	3.50
D_{35} =	6.94
D_{50} =	11.4
D_{84} =	21.1
D_{95} =	34.8
D_{100} =	64.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

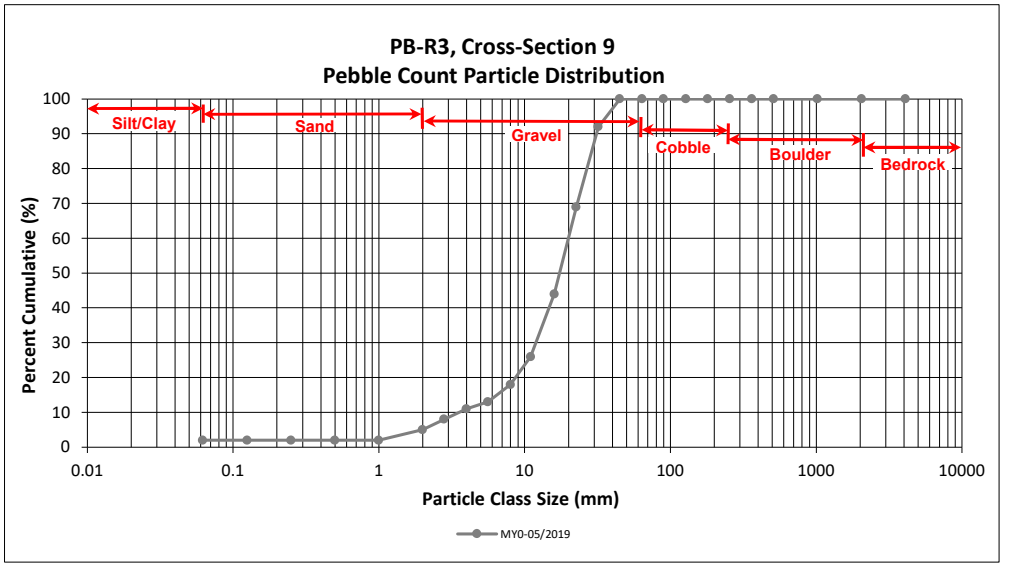
DMS Project No. 100093

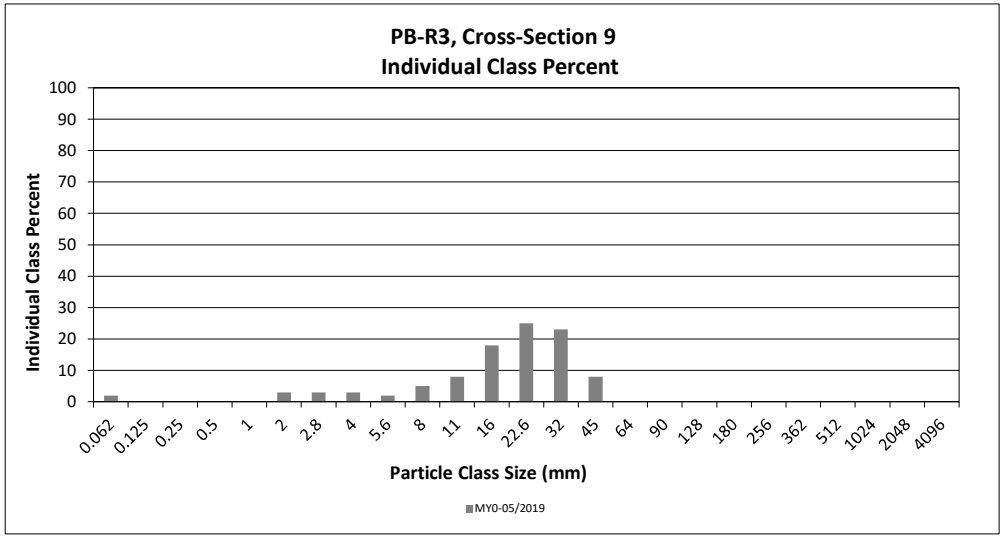
Existing Conditions

PB-R3, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	3	3	5
GRAVEL	Very Fine	2.0	2.8	3	3	8
	Very Fine	2.8	4.0	3	3	11
	Fine	4.0	5.6	2	2	13
	Fine	5.6	8.0	5	5	18
	Medium	8.0	11.0	8	8	26
	Medium	11.0	16.0	18	18	44
	Coarse	16.0	22.6	25	25	69
	Coarse	22.6	32	23	23	92
	Very Coarse	32	45	8	8	100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	6.94
D_{35} =	13.27
D_{50} =	17.4
D_{84} =	28.4
D_{95} =	36.4
D_{100} =	45.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

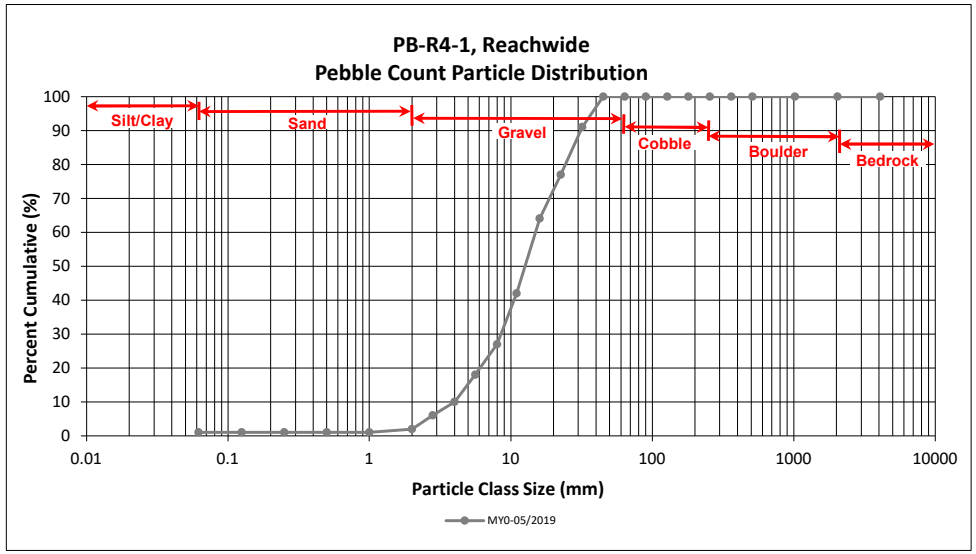
DMS Project No. 100093

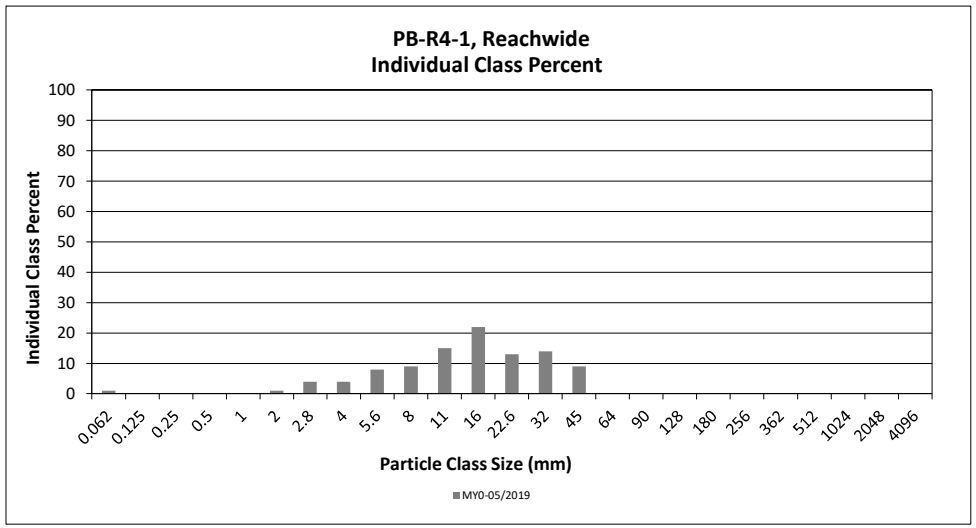
Existing Conditions

PB-R4-1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		1	1	1	1
SAND	Very fine	0.062	0.125					1
	Fine	0.125	0.250					1
	Medium	0.25	0.50					1
	Coarse	0.5	1.0					1
	Very Coarse	1.0	2.0	1		1	1	2
GRAVEL	Very Fine	2.0	2.8	2	2	4	4	6
	Very Fine	2.8	4.0	3	1	4	4	10
	Fine	4.0	5.6	6	2	8	8	18
	Fine	5.6	8.0	5	4	9	9	27
	Medium	8.0	11.0	9	6	15	15	42
	Medium	11.0	16.0	13	9	22	22	64
	Coarse	16.0	22.6	9	4	13	13	77
	Coarse	22.6	32	6	8	14	14	91
	Very Coarse	32	45	6	3	9	9	100
	Very Coarse	45	64					100
COBBLE	Small	64	90					100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	5.15
D_{35} =	9.48
D_{50} =	12.6
D_{84} =	26.9
D_{95} =	37.2
D_{100} =	45.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

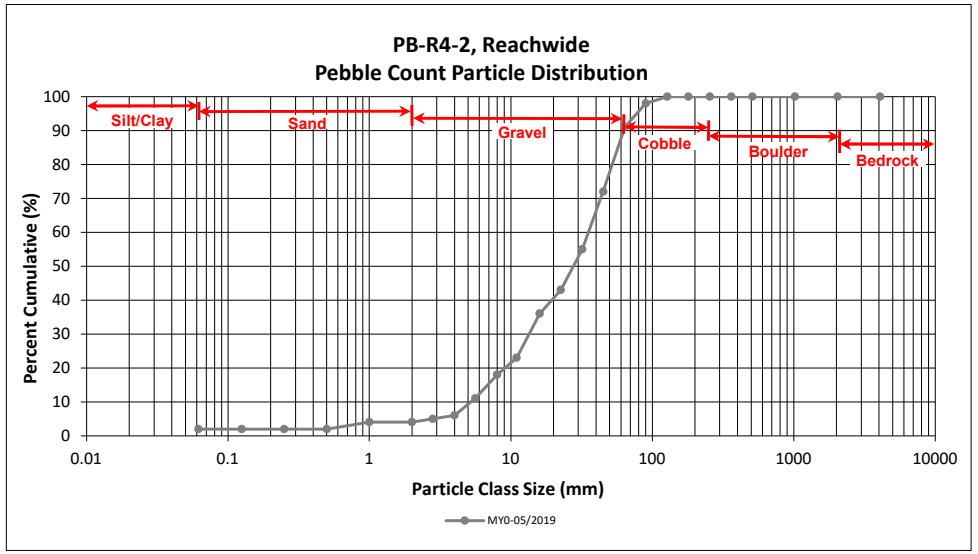
DMS Project No. 100093

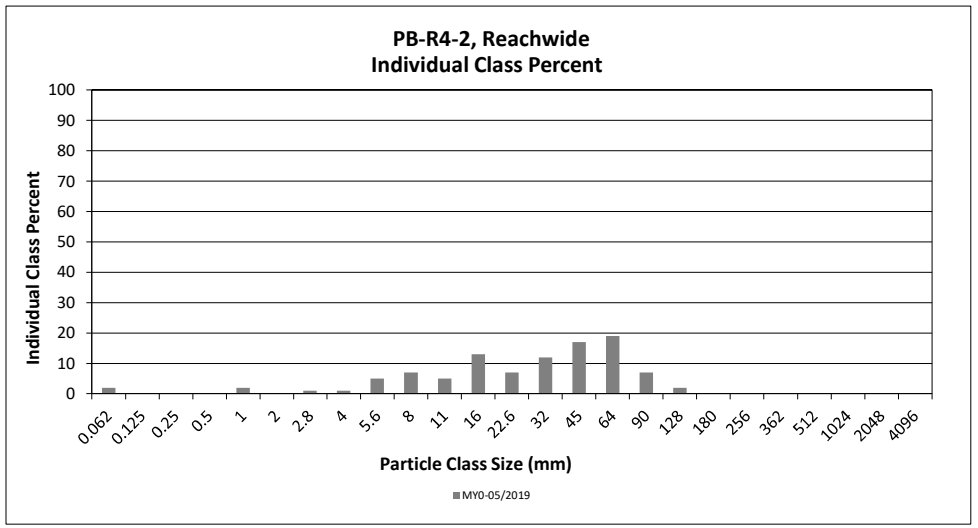
Existing Conditions

PB-R4-2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		2	2	2	2
SAND	Very fine	0.062	0.125					2
	Fine	0.125	0.250					2
	Medium	0.25	0.50					2
	Coarse	0.5	1.0		2	2	2	4
	Very Coarse	1.0	2.0					4
GRAVEL	Very Fine	2.0	2.8		1	1	1	5
	Very Fine	2.8	4.0		1	1	1	6
	Fine	4.0	5.6	4	1	5	5	11
	Fine	5.6	8.0	4	3	7	7	18
	Medium	8.0	11.0	3	2	5	5	23
	Medium	11.0	16.0	7	6	13	13	36
	Coarse	16.0	22.6	4	3	7	7	43
	Coarse	22.6	32	7	5	12	12	55
	Very Coarse	32	45	14	3	17	17	72
	Very Coarse	45	64	13	6	19	19	91
COBBLE	Small	64	90	4	3	7	7	98
	Small	90	128		2	2	2	100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	7.22
D_{35} =	15.55
D_{50} =	27.7
D_{84} =	56.2
D_{95} =	77.8
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

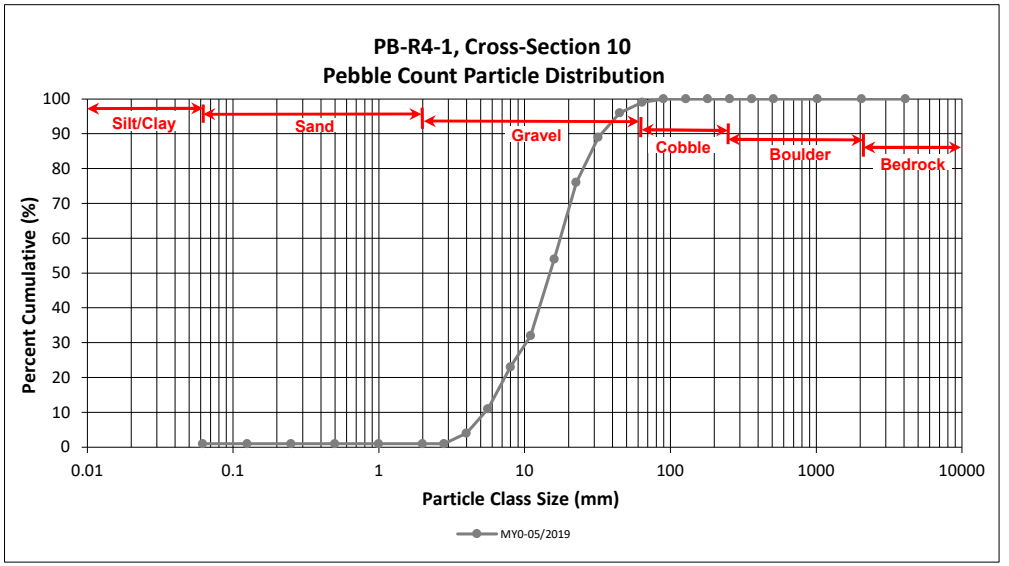
DMS Project No. 100093

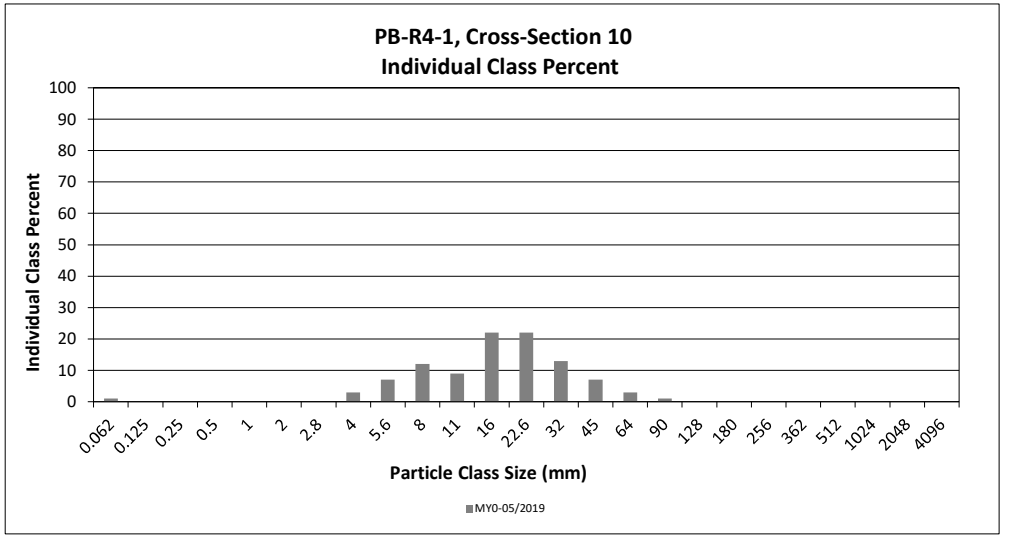
Existing Conditions

PB-R4-1, Cross-Section 10

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50			1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0			1
GRAVEL	Very Fine	2.0	2.8			1
	Very Fine	2.8	4.0	3	3	4
	Fine	4.0	5.6	7	7	11
	Fine	5.6	8.0	12	12	23
	Medium	8.0	11.0	9	9	32
	Medium	11.0	16.0	22	22	54
	Coarse	16.0	22.6	22	22	76
	Coarse	22.6	32	13	13	89
	Very Coarse	32	45	7	7	96
	Very Coarse	45	64	3	3	99
COBBLE	Small	64	90	1	1	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 10	
Channel materials (mm)	
D_{16} =	6.50
D_{35} =	11.58
D_{50} =	14.9
D_{84} =	28.0
D_{95} =	42.9
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

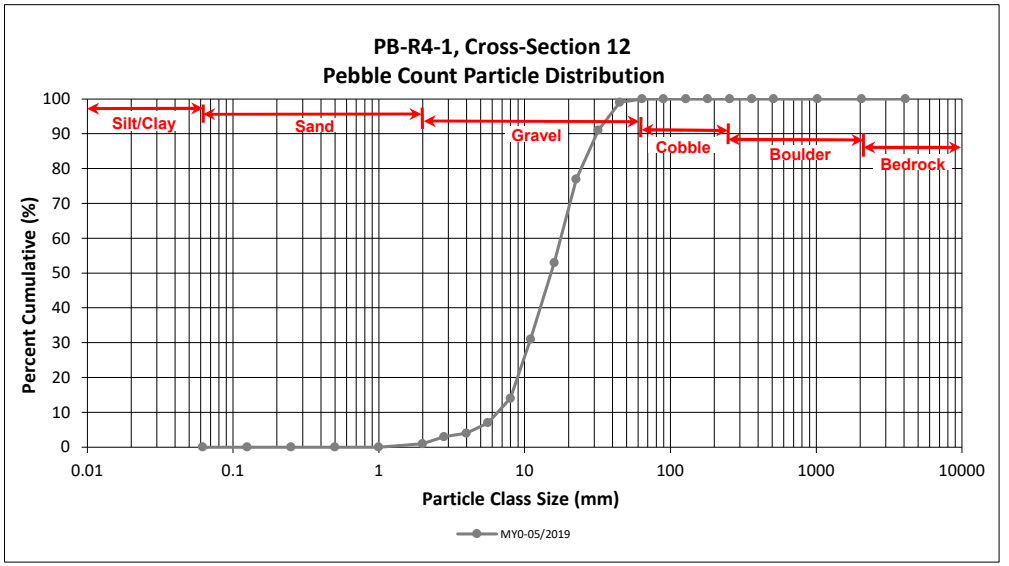
DMS Project No. 100093

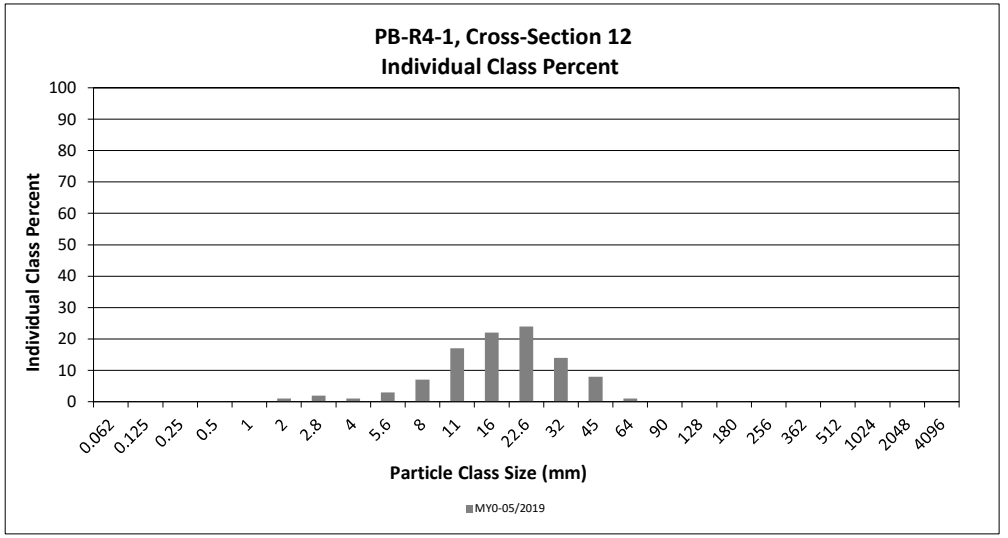
Existing Conditions

PB-R4-1, Cross-Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	1	1	1
GRAVEL	Very Fine	2.0	2.8	2	2	3
	Very Fine	2.8	4.0	1	1	4
	Fine	4.0	5.6	3	3	7
	Fine	5.6	8.0	7	7	14
	Medium	8.0	11.0	17	17	31
	Medium	11.0	16.0	22	22	53
	Coarse	16.0	22.6	24	24	77
	Coarse	22.6	32	14	14	91
	Very Coarse	32	45	8	8	99
	Very Coarse	45	64	1	1	100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 12	
Channel materials (mm)	
D_{16} =	8.31
D_{35} =	11.78
D_{50} =	15.2
D_{84} =	26.9
D_{95} =	37.9
D_{100} =	64.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

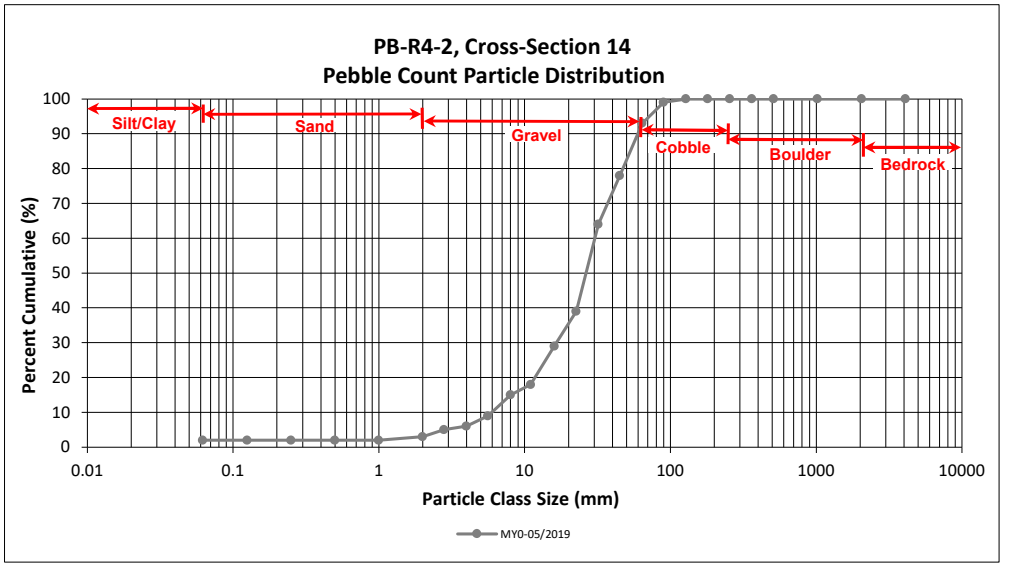
DMS Project No. 100093

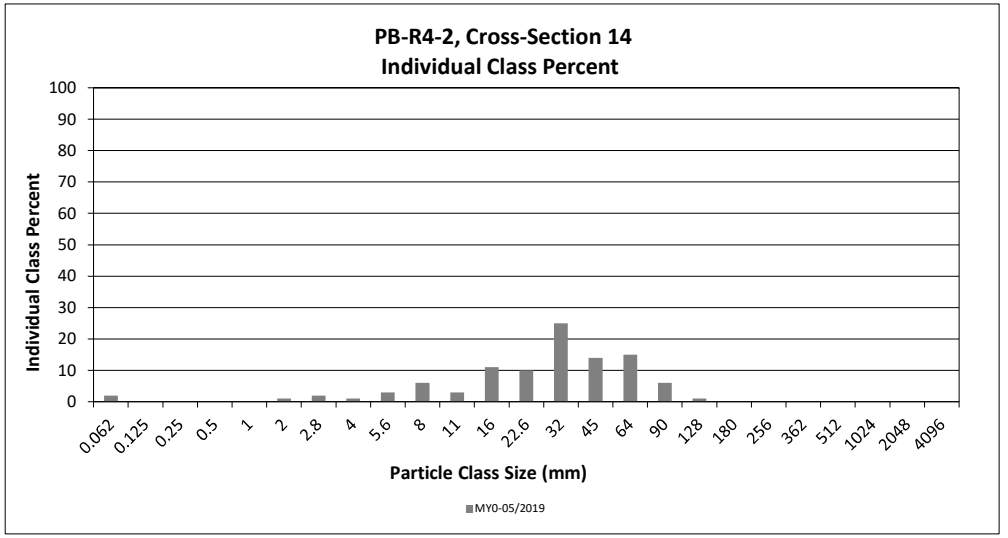
Existing Conditions

PB-R4-2, Cross-Section 14

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	1	1	3
GRAVEL	Very Fine	2.0	2.8	2	2	5
	Very Fine	2.8	4.0	1	1	6
	Fine	4.0	5.6	3	3	9
	Fine	5.6	8.0	6	6	15
	Medium	8.0	11.0	3	3	18
	Medium	11.0	16.0	11	11	29
	Coarse	16.0	22.6	10	10	39
	Coarse	22.6	32	25	25	64
	Very Coarse	32	45	14	14	78
	Very Coarse	45	64	15	15	93
COBBLE	Small	64	90	6	6	99
	Small	90	128	1	1	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 14	
Channel materials (mm)	
D_{16} =	8.90
D_{35} =	19.68
D_{50} =	26.3
D_{84} =	51.8
D_{95} =	71.7
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

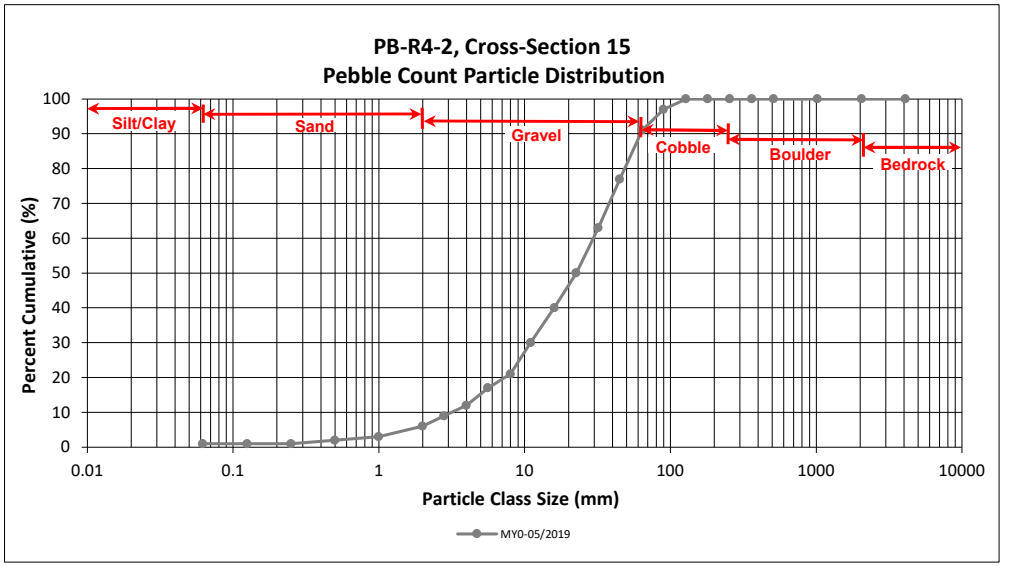
DMS Project No. 100093

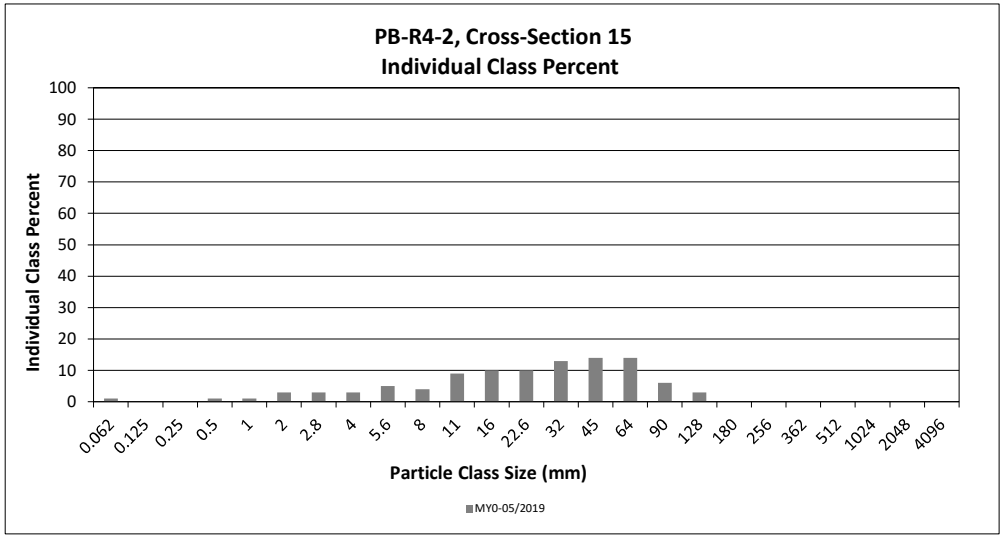
Existing Conditions

PB-R4-2, Cross-Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50	1	1	2
	Coarse	0.5	1.0	1	1	3
	Very Coarse	1.0	2.0	3	3	6
GRAVEL	Very Fine	2.0	2.8	3	3	9
	Very Fine	2.8	4.0	3	3	12
	Fine	4.0	5.6	5	5	17
	Fine	5.6	8.0	4	4	21
	Medium	8.0	11.0	9	9	30
	Medium	11.0	16.0	10	10	40
	Coarse	16.0	22.6	10	10	50
	Coarse	22.6	32	13	13	63
	Very Coarse	32	45	14	14	77
	Very Coarse	45	64	14	14	91
COBBLE	Small	64	90	6	6	97
	Small	90	128	3	3	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 15	
Channel materials (mm)	
D_{16} =	5.24
D_{35} =	13.27
D_{50} =	22.6
D_{84} =	53.7
D_{95} =	80.3
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

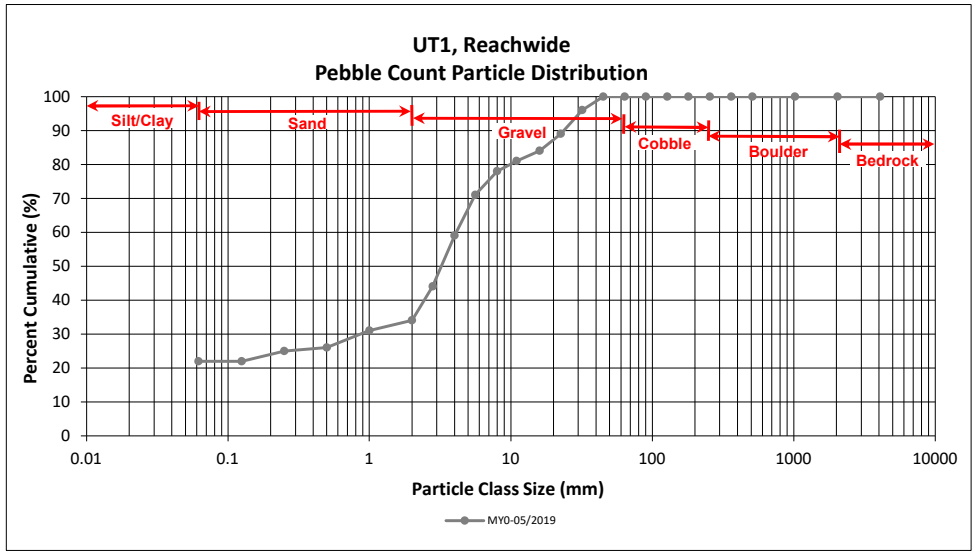
DMS Project No. 100093

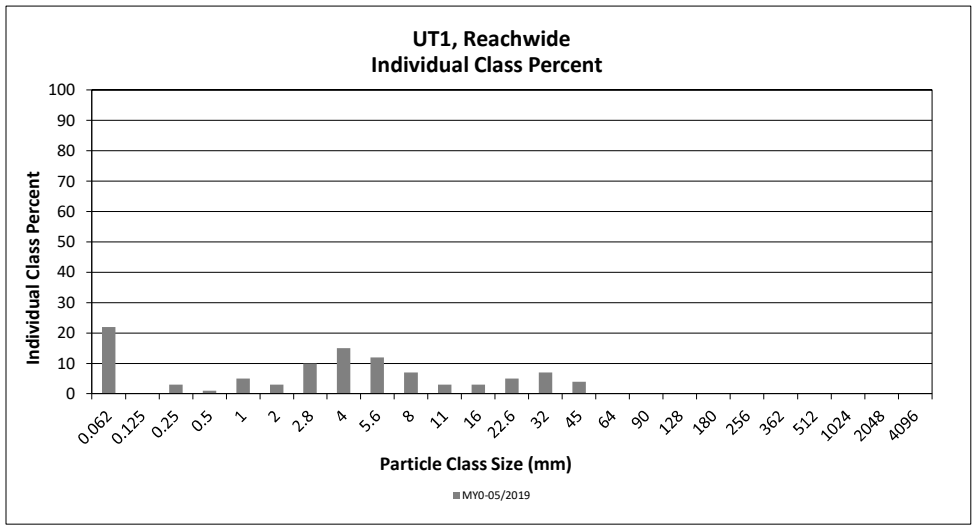
Existing Conditions

UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	8	14	22	22	22
SAND	Very fine	0.062	0.125					22
	Fine	0.125	0.250	1	2	3	3	25
	Medium	0.25	0.50	1		1	1	26
	Coarse	0.5	1.0	3	2	5	5	31
	Very Coarse	1.0	2.0	3		3	3	34
GRAVEL	Very Fine	2.0	2.8	7	3	10	10	44
	Very Fine	2.8	4.0	11	4	15	15	59
	Fine	4.0	5.6	8	4	12	12	71
	Fine	5.6	8.0	6	1	7	7	78
	Medium	8.0	11.0	3		3	3	81
	Medium	11.0	16.0	3		3	3	84
	Coarse	16.0	22.6	5		5	5	89
	Coarse	22.6	32	7		7	7	96
	Very Coarse	32	45	4		4	4	100
	Very Coarse	45	64					100
COBBLE	Small	64	90					100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	2.07
D_{50} =	3.2
D_{84} =	16.0
D_{95} =	30.4
D_{100} =	45.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

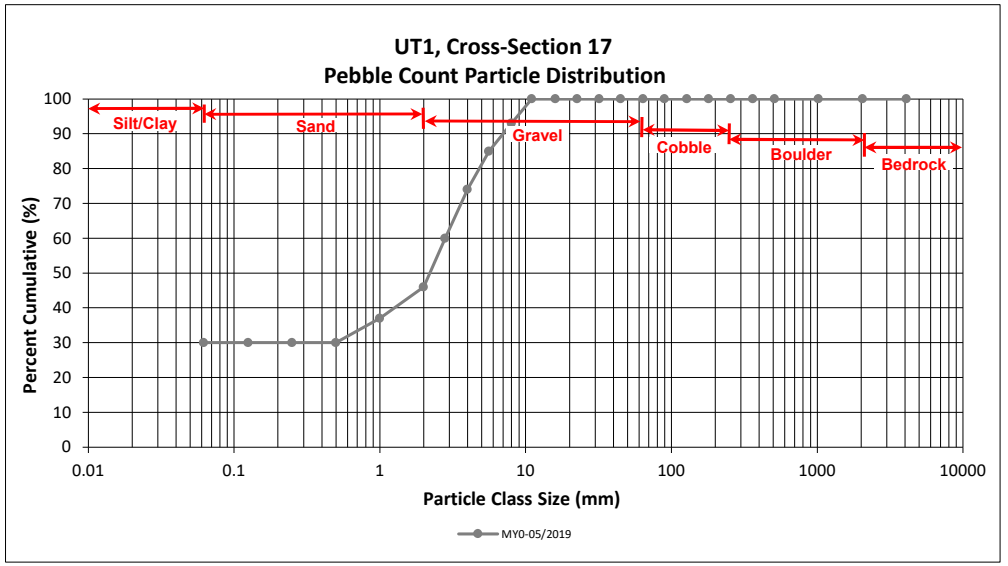
DMS Project No. 100093

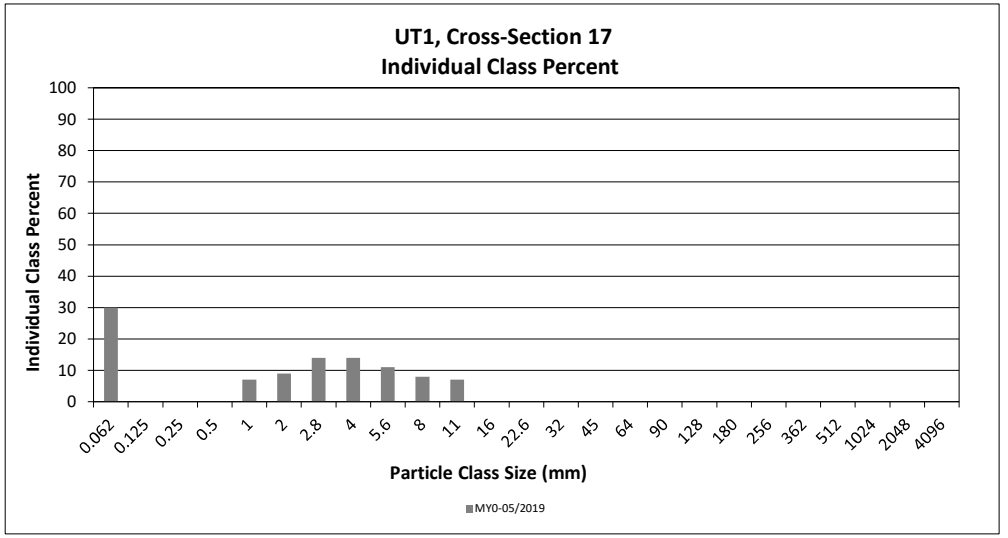
Existing Conditions

UT1, Cross-Section 17

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	30	30	30
SAND	Very fine	0.062	0.125			30
	Fine	0.125	0.250			30
	Medium	0.25	0.50			30
	Coarse	0.5	1.0	7	7	37
	Very Coarse	1.0	2.0	9	9	46
GRAVEL	Very Fine	2.0	2.8	14	14	60
	Very Fine	2.8	4.0	14	14	74
	Fine	4.0	5.6	11	11	85
	Fine	5.6	8.0	8	8	93
	Medium	8.0	11.0	7	7	100
	Medium	11.0	16.0			100
	Coarse	16.0	22.6			100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 17	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.82
D_{50} =	2.2
D_{84} =	5.4
D_{95} =	8.8
D_{100} =	11.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

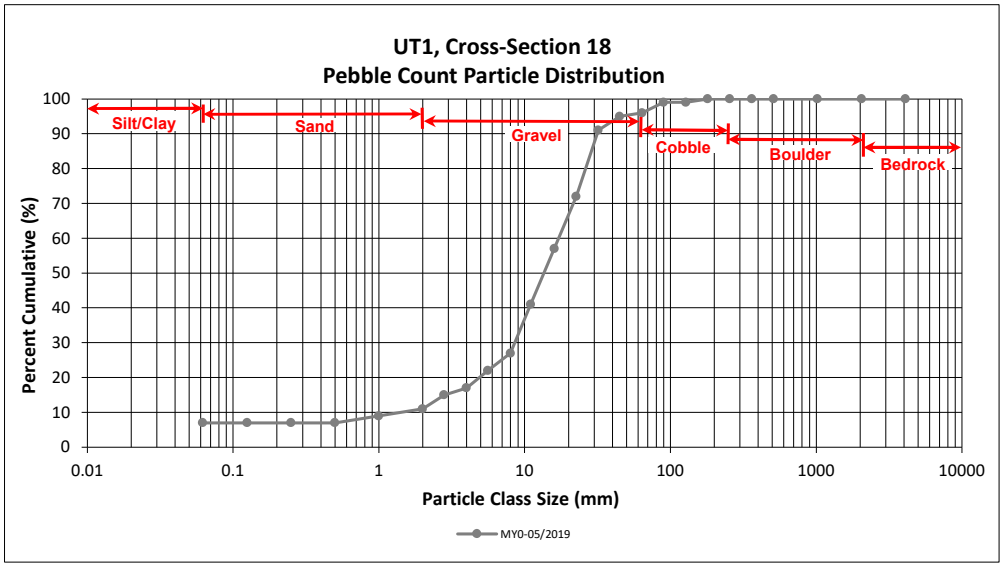
DMS Project No. 100093

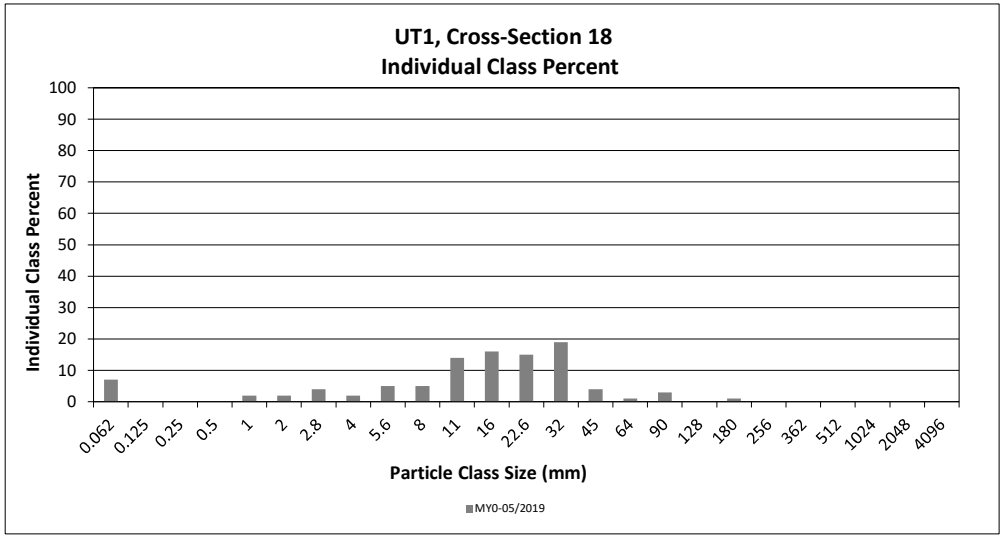
Existing Conditions

UT1, Cross-Section 18

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	7	7
SAND	Very fine	0.062	0.125			7
	Fine	0.125	0.250			7
	Medium	0.25	0.50			7
	Coarse	0.5	1.0	2	2	9
	Very Coarse	1.0	2.0	2	2	11
GRAVEL	Very Fine	2.0	2.8	4	4	15
	Very Fine	2.8	4.0	2	2	17
	Fine	4.0	5.6	5	5	22
	Fine	5.6	8.0	5	5	27
	Medium	8.0	11.0	14	14	41
	Medium	11.0	16.0	16	16	57
	Coarse	16.0	22.6	15	15	72
	Coarse	22.6	32	19	19	91
	Very Coarse	32	45	4	4	95
	Very Coarse	45	64	1	1	96
COBBLE	Small	64	90	3	3	99
	Small	90	128			99
	Large	128	180	1	1	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 18	
Channel materials (mm)	
D_{16} =	3.35
D_{35} =	9.60
D_{50} =	13.6
D_{84} =	28.2
D_{95} =	45.0
D_{100} =	180.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

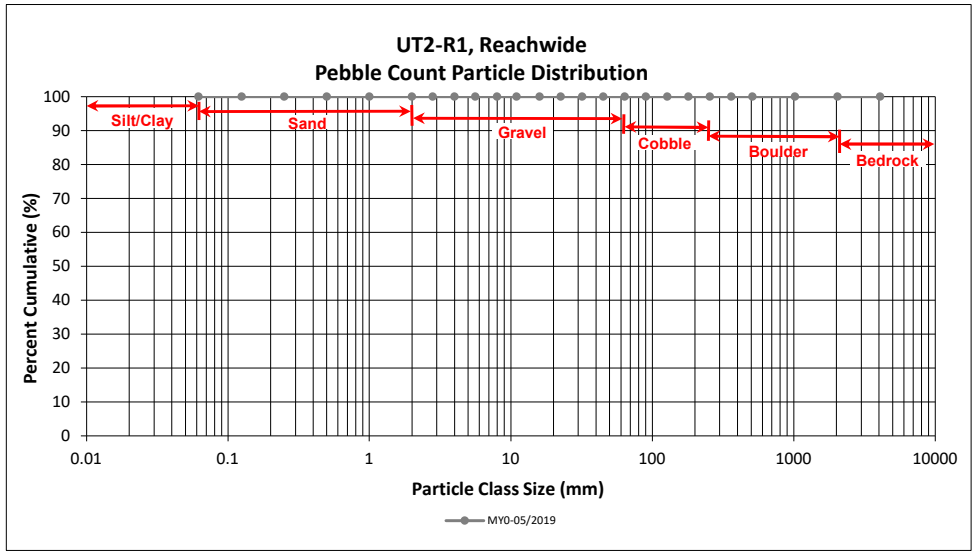
DMS Project No. 100093

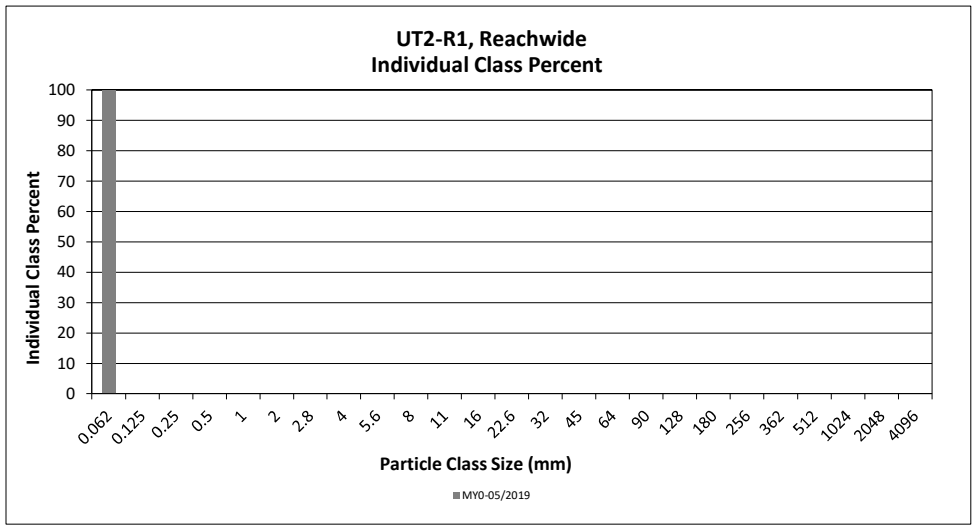
Existing Conditions

UT2-R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	60	40	100	100	100
SAND	Very fine	0.062	0.125					100
	Fine	0.125	0.250					100
	Medium	0.25	0.50					100
	Coarse	0.5	1.0					100
	Very Coarse	1.0	2.0					100
GRAVEL	Very Fine	2.0	2.8					100
	Very Fine	2.8	4.0					100
	Fine	4.0	5.6					100
	Fine	5.6	8.0					100
	Medium	8.0	11.0					100
	Medium	11.0	16.0					100
	Coarse	16.0	22.6					100
	Coarse	22.6	32					100
	Very Coarse	32	45					100
	Very Coarse	45	64					100
COBBLE	Small	64	90					100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	#N/A
D_{95} =	#N/A
D_{100} =	0.1





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

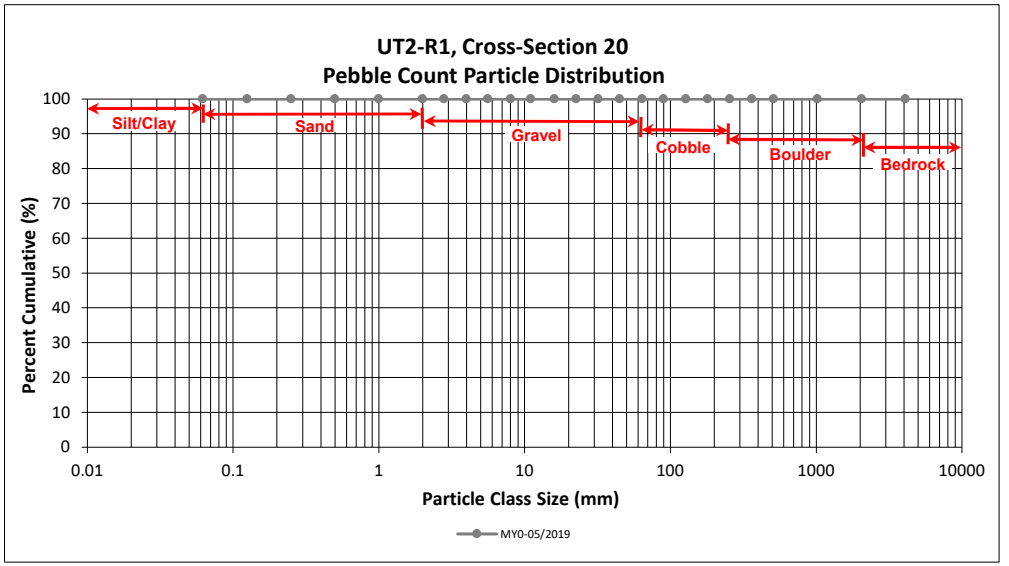
DMS Project No. 100093

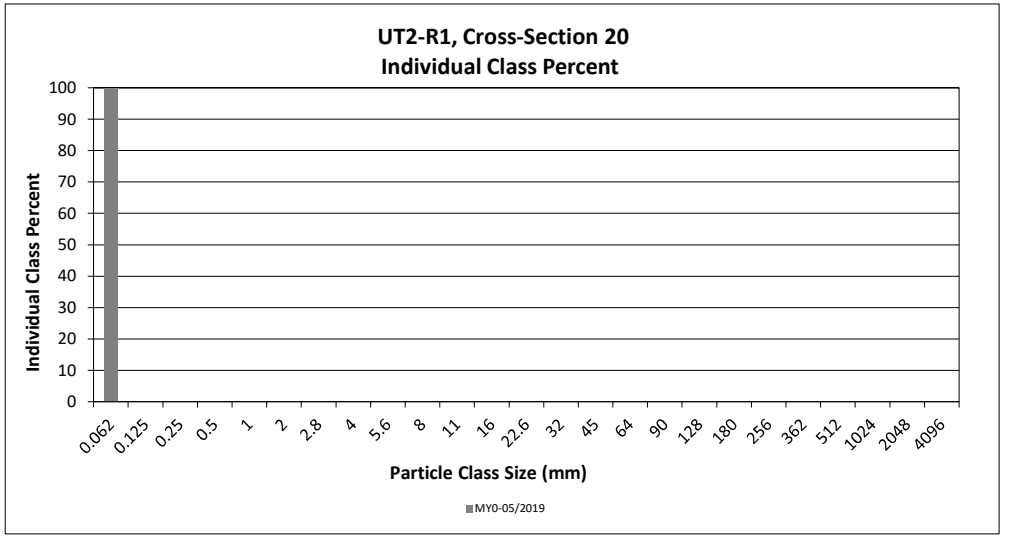
Existing Conditions

UT2-R1, Cross-Section 20

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	100	100	100
SAND	Very fine	0.062	0.125			100
	Fine	0.125	0.250			100
	Medium	0.25	0.50			100
	Coarse	0.5	1.0			100
	Very Coarse	1.0	2.0			100
GRAVEL	Very Fine	2.0	2.8			100
	Very Fine	2.8	4.0			100
	Fine	4.0	5.6			100
	Fine	5.6	8.0			100
	Medium	8.0	11.0			100
	Medium	11.0	16.0			100
	Coarse	16.0	22.6			100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 20	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	Silt/Clay
D_{84} =	#N/A
D_{95} =	#N/A
D_{100} =	0.1





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

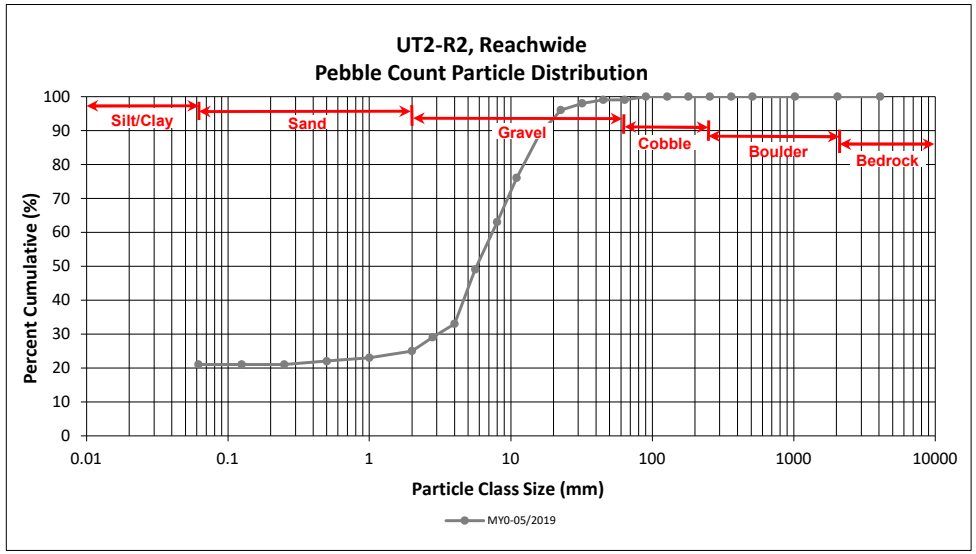
DMS Project No. 100093

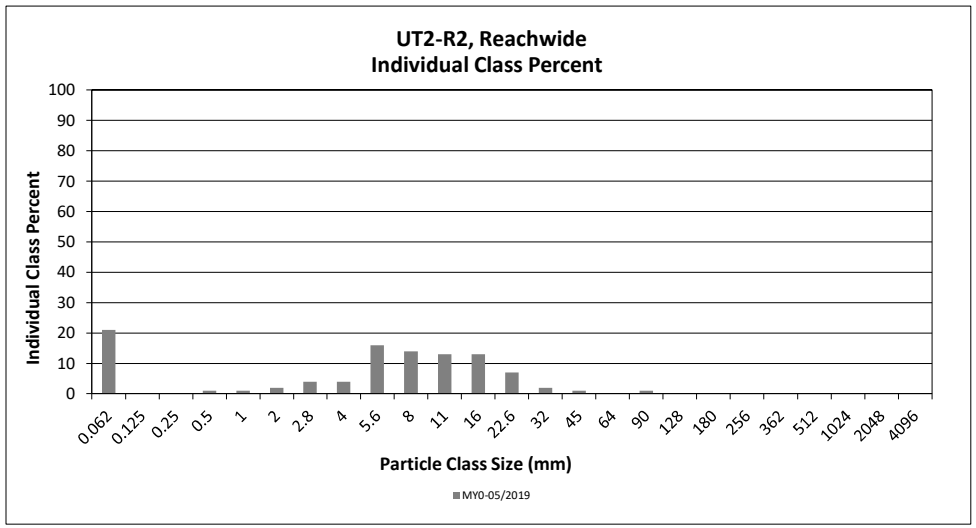
Existing Conditions

UT2-R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	11	10	21	21	21
SAND	Very fine	0.062	0.125					21
	Fine	0.125	0.250					21
	Medium	0.25	0.50		1	1	1	22
	Coarse	0.5	1.0		1	1	1	23
	Very Coarse	1.0	2.0	2		2	2	25
GRAVEL	Very Fine	2.0	2.8	4		4	4	29
	Very Fine	2.8	4.0	2	2	4	4	33
	Fine	4.0	5.6	12	4	16	16	49
	Fine	5.6	8.0	9	5	14	14	63
	Medium	8.0	11.0	6	7	13	13	76
	Medium	11.0	16.0	8	5	13	13	89
	Coarse	16.0	22.6	6	1	7	7	96
	Coarse	22.6	32		2	2	2	98
	Very Coarse	32	45		1	1	1	99
	Very Coarse	45	64					99
COBBLE	Small	64	90		1	1	1	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	4.17
D_{50} =	5.7
D_{84} =	13.9
D_{95} =	21.5
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

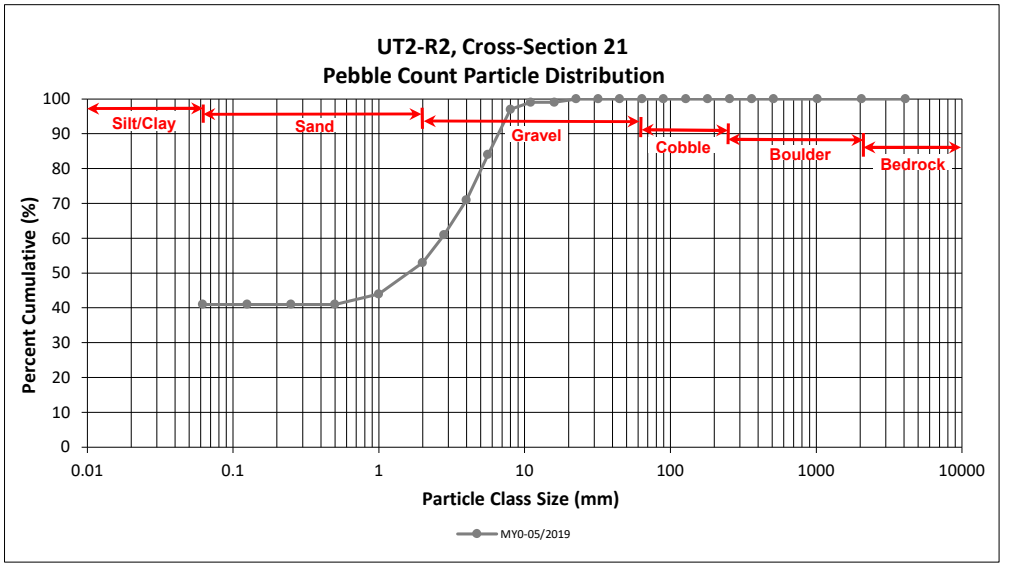
DMS Project No. 100093

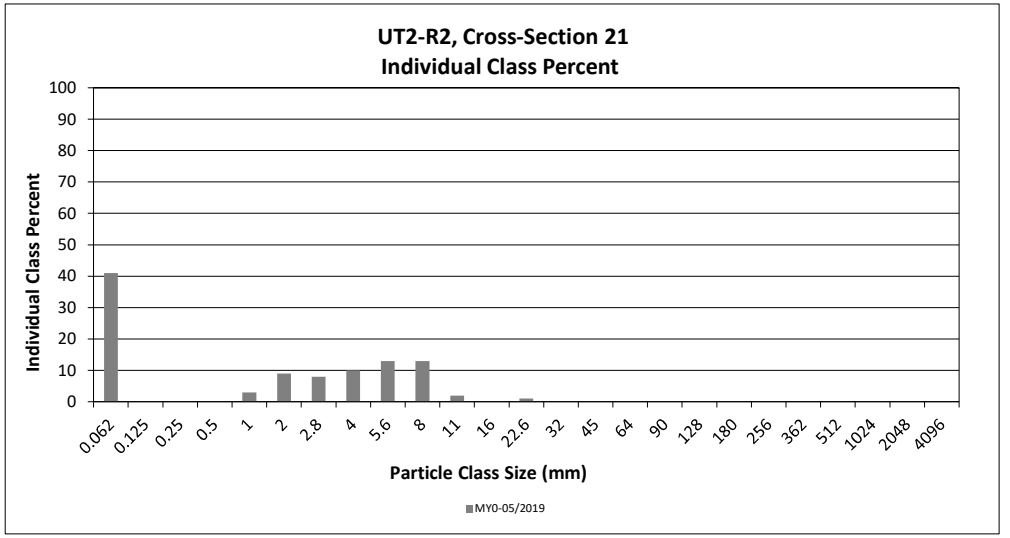
Existing Conditions

UT2-R2, Cross-Section 21

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	41	41	41
SAND	Very fine	0.062	0.125			41
	Fine	0.125	0.250			41
	Medium	0.25	0.50			41
	Coarse	0.5	1.0	3	3	44
	Very Coarse	1.0	2.0	9	9	53
GRAVEL	Very Fine	2.0	2.8	8	8	61
	Very Fine	2.8	4.0	10	10	71
	Fine	4.0	5.6	13	13	84
	Fine	5.6	8.0	13	13	97
	Medium	8.0	11.0	2	2	99
	Medium	11.0	16.0			99
	Coarse	16.0	22.6	1	1	100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 21	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	1.6
D_{84} =	5.6
D_{95} =	7.6
D_{100} =	22.6





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

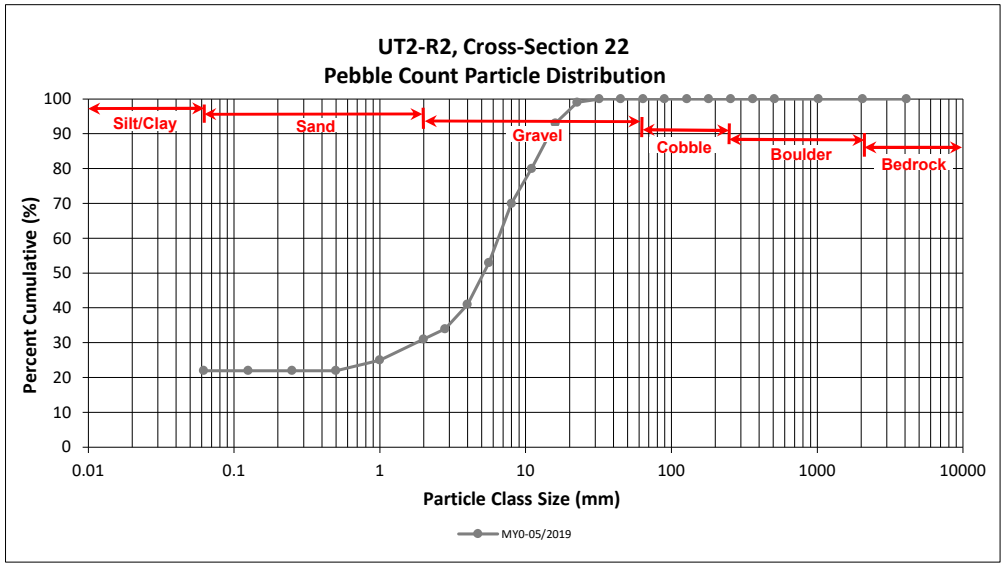
DMS Project No. 100093

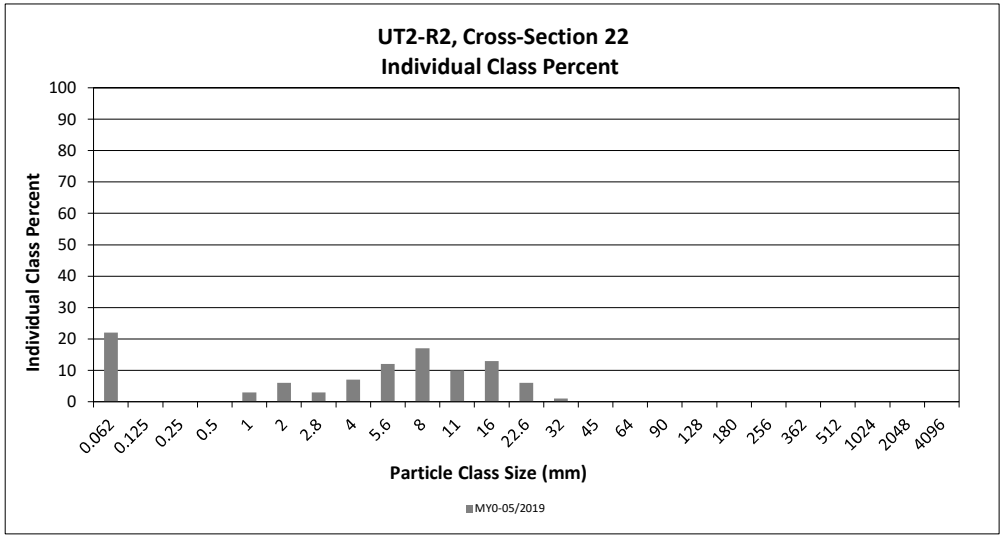
Existing Conditions

UT2-R2, Cross-Section 22

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	22	22	22
SAND	Very fine	0.062	0.125			22
	Fine	0.125	0.250			22
	Medium	0.25	0.50			22
	Coarse	0.5	1.0	3	3	25
	Very Coarse	1.0	2.0	6	6	31
GRAVEL	Very Fine	2.0	2.8	3	3	34
	Very Fine	2.8	4.0	7	7	41
	Fine	4.0	5.6	12	12	53
	Fine	5.6	8.0	17	17	70
	Medium	8.0	11.0	10	10	80
	Medium	11.0	16.0	13	13	93
	Coarse	16.0	22.6	6	6	99
	Coarse	22.6	32	1	1	100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 22	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	2.95
D_{50} =	5.1
D_{84} =	12.3
D_{95} =	18.0
D_{100} =	32.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

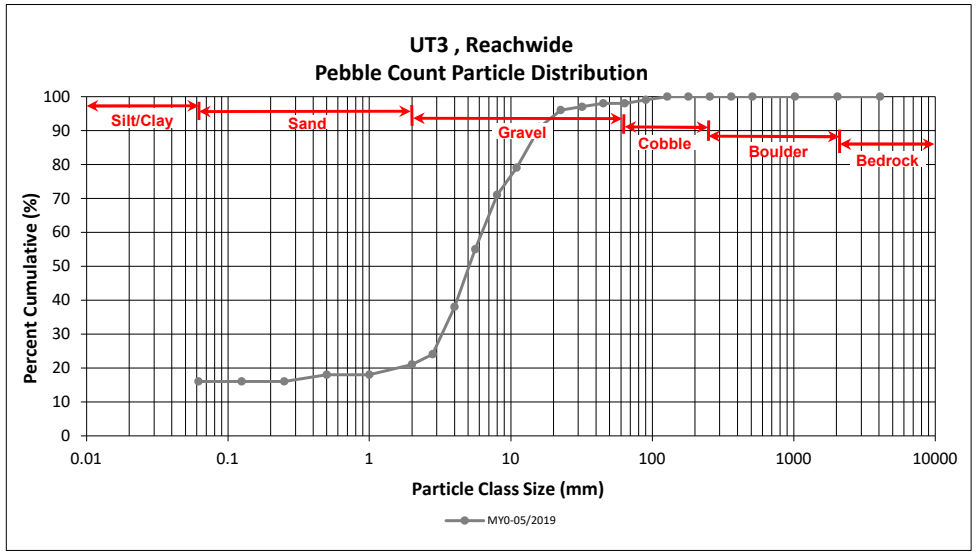
DMS Project No. 100093

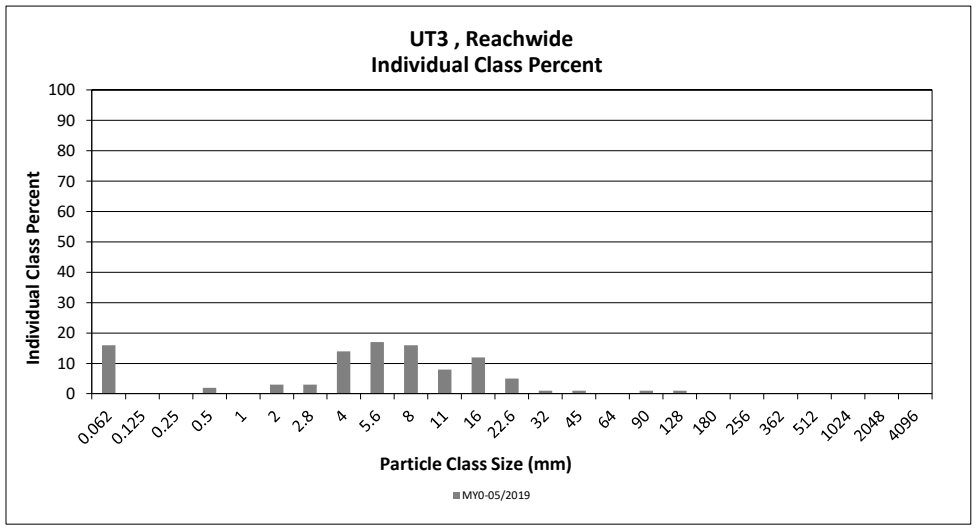
Existing Conditions

UT3 , Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	13	3	16	16	16
SAND	Very fine	0.062	0.125					16
	Fine	0.125	0.250					16
	Medium	0.25	0.50	2		2	2	18
	Coarse	0.5	1.0					18
	Very Coarse	1.0	2.0	1	2	3	3	21
GRAVEL	Very Fine	2.0	2.8	1	2	3	3	24
	Very Fine	2.8	4.0	8	6	14	14	38
	Fine	4.0	5.6	8	9	17	17	55
	Fine	5.6	8.0	12	4	16	16	71
	Medium	8.0	11.0	1	7	8	8	79
	Medium	11.0	16.0	2	10	12	12	91
	Coarse	16.0	22.6	1	4	5	5	96
	Coarse	22.6	32		1	1	1	97
	Very Coarse	32	45		1	1	1	98
	Very Coarse	45	64					98
COBBLE	Small	64	90		1	1	1	99
	Small	90	128	1		1	1	100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	3.71
D_{50} =	5.1
D_{84} =	12.9
D_{95} =	21.1
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

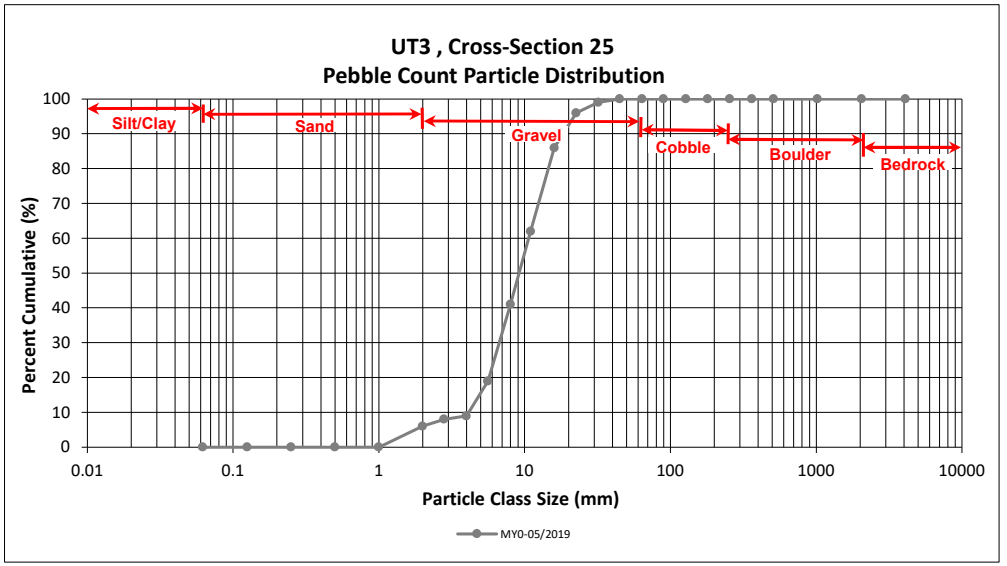
DMS Project No. 100093

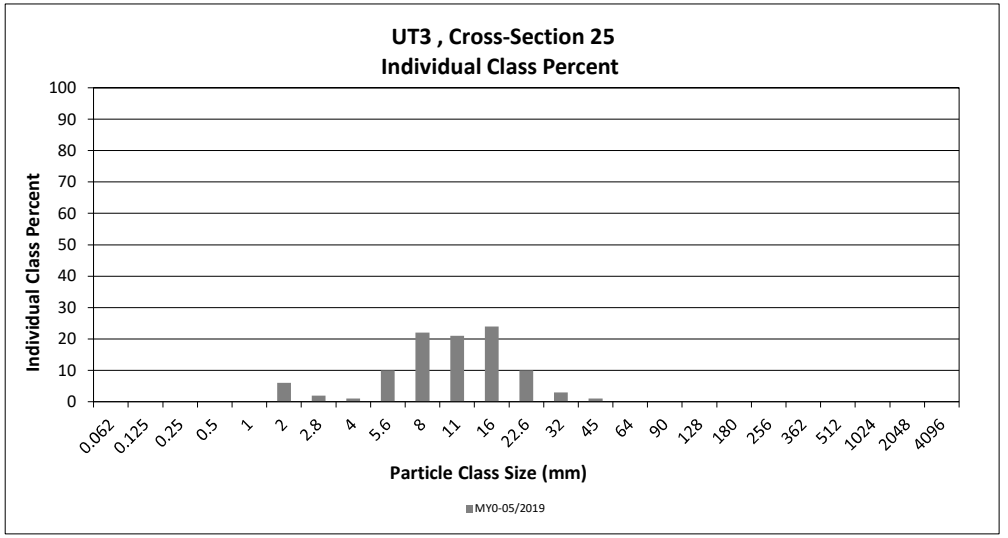
Existing Conditions

UT3 , Cross-Section 25

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	6	6	6
GRAVEL	Very Fine	2.0	2.8	2	2	8
	Very Fine	2.8	4.0	1	1	9
	Fine	4.0	5.6	10	10	19
	Fine	5.6	8.0	22	22	41
	Medium	8.0	11.0	21	21	62
	Medium	11.0	16.0	24	24	86
	Coarse	16.0	22.6	10	10	96
	Coarse	22.6	32	3	3	99
	Very Coarse	32	45	1	1	100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 25	
Channel materials (mm)	
D_{16} =	5.06
D_{35} =	7.26
D_{50} =	9.2
D_{84} =	15.5
D_{95} =	21.8
D_{100} =	45.0





Reachwide and Cross-Section Pebble Count Plots

Perry Hill

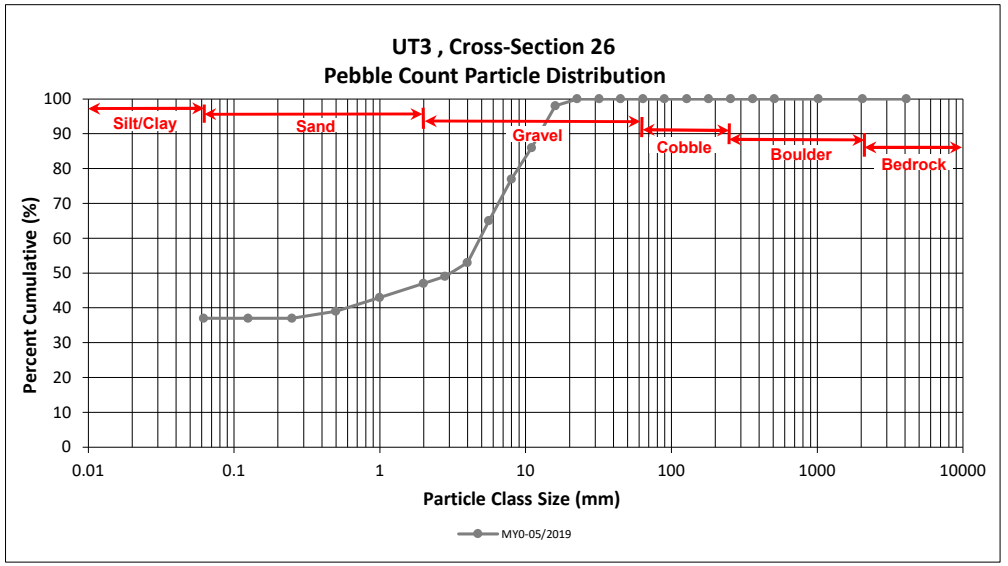
DMS Project No. 100093

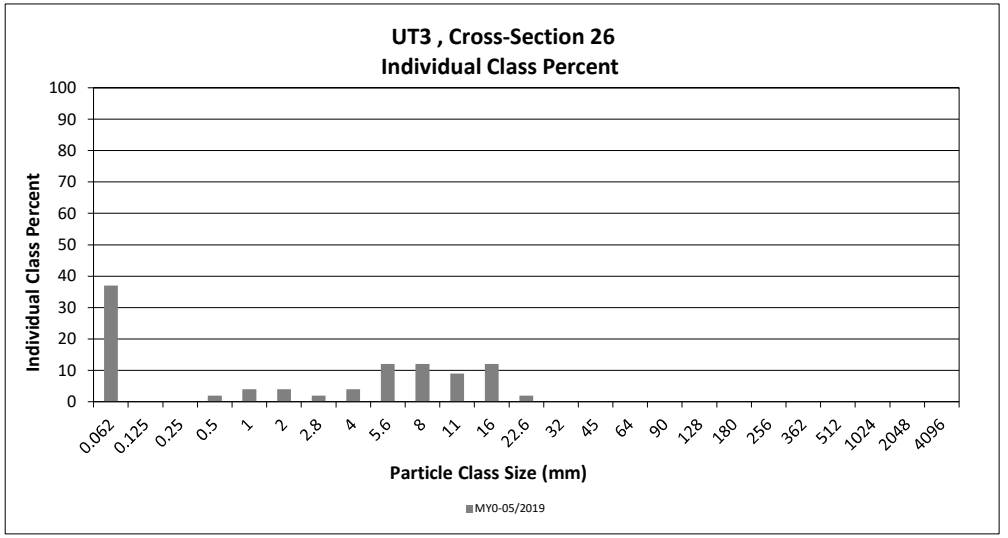
Existing Conditions

UT3 , Cross-Section 26

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	37	37	37
SAND	Very fine	0.062	0.125			37
	Fine	0.125	0.250			37
	Medium	0.25	0.50	2	2	39
	Coarse	0.5	1.0	4	4	43
	Very Coarse	1.0	2.0	4	4	47
GRAVEL	Very Fine	2.0	2.8	2	2	49
	Very Fine	2.8	4.0	4	4	53
	Fine	4.0	5.6	12	12	65
	Fine	5.6	8.0	12	12	77
	Medium	8.0	11.0	9	9	86
	Medium	11.0	16.0	12	12	98
	Coarse	16.0	22.6	2	2	100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 26	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	3.1
D_{84} =	10.2
D_{95} =	14.6
D_{100} =	22.6





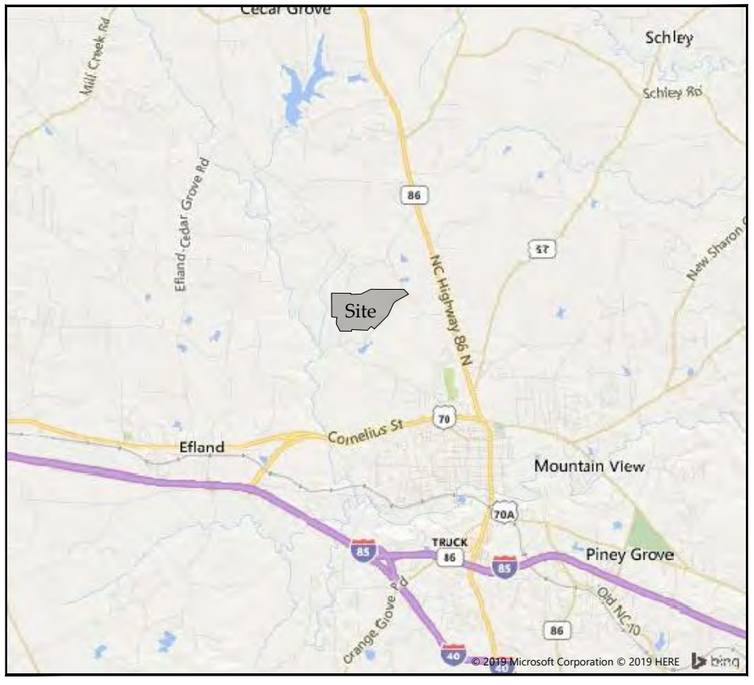
Appendix 8

August 3, 2020

Perry Hill Mitigation Site

Orange County, North Carolina
for
NCDEQ
Division of Mitigation Services

Orange County, NC



Vicinity Map
Not to Scale

Site Coordinates	
Latitude	Longitude
36° 06' 25.81"N	79° 07' 46.66"W

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

Environmental Quality

90% Plans
July 23, 2020

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
497 Bramson Ct., Suite 104
Mount Pleasant, SC 29464
Geoff Smith PE
843-277-6221

Surveying:
IPW Construction Group
P.O. Box 40968
Charleston, SC 29423
M. Hart Weatherford, PE, PLS, CFM
843-308-0524 x228

Owner:
NCDEQ
Division of Mitigation Services
217 West Jones St. Suite 3000A
Raleigh, NC 27603
Jeff Schaffer
919-707-8976

DMS Project No. 100093

Neuse River Basin HUC 03020201

USACE Action ID: SAW-2019-00125

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221

NORTH CAROLINA PROFESSIONAL GEOLOGIST SEAL 048920 JEFFREY L. SMITH 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Title Sheet

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CK

Sheet 0.1

X:\Shared\Projects\005-02180 Perry Hill Gadd\Plans\02180-Cover and Notes.dwg

August 3, 2020

General Construction Notes for All Reaches

1. All erosion and sediment control practices shall comply with the 2013 North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Contractor shall enter and exit the Site from Frank Perry Road using the existing driveway at the northeast side of the Site, as indicated on the Plans.
3. No material from the off-line proposed stream channel excavation may be backfilled into the adjacent existing stream channel until the newly-constructed proposed stream section is completed, stabilized, and the stream flow has been diverted into it, not even if that section of old/ existing stream is being pumped.
4. Contractor shall disturb only as much channel bank as can be stabilized with temporary seeding, mulch, and erosion control matting by the end of each work day.
5. Contractor will install pump-around systems to divert flow while working in live, flowing channels. Contractor shall not remove pump-around systems and advance to the next work area until the current work area is completed and stabilized. If flow is not sufficient at the time of construction to cause sedimentation to downstream waters, pump-around operations will not be required. In these cases, rock silt check dams will be installed near the downstream extent of the active work zone. Contractor shall take measures necessary to ensure that storm flows do not damage work areas or create sedimentation of aquatic habitat.
6. Locations for staging, stockpile areas and stream crossings have been provided on the Plans. Additional or alternative staging and/or stockpile areas and stream crossings may be utilized by the Contractor provided that all practices comply with the NC Erosion and Sediment Control Planning and Design Manual and are approved by Engineer prior to implementation.
7. Clearing and grubbing activities shall not extend more than 150 linear feet ahead of in-stream work.
8. When crossing an active section of new or old stream channel, a timber mat shall be installed according to the details and specifications.
9. All graded areas with slopes steeper than 3:1 will be stabilized within seven (7) working days. All other areas will be stabilized within (14) working days.
10. Vegetation located on site to be used as transplant material (juncus, small trees, and sod mats) shall not be disturbed until Contractor is prepared to install transplants.
11. Various types of constructed riffles and cascades are specified on the Plans. Contractor will build the specific types of constructed riffles at locations shown on the Plans. Changes in type and location must be approved by the Engineer prior to installation.
12. Topsoil will be harvested to the extent that it is encountered in depths sufficient to warrant the effort.
13. Fertilizer and soil amendments are discussed in the permanent seeding specification. Lime and fertilizer will be applied to assist with grass establishment in some or all disturbed areas. The limits of applications will be determined by the Engineer in the field.
14. Contractor is to make every effort to avoid damaging or removing existing trees.
15. Under no circumstances will the Contractor exceed the limits of disturbance as shown on the Plans.

Initial Site Preparation

1. Erosion and Sediment Control (E&SC) permit and a Certificate of Coverage (COC) must be obtained before any land disturbing activities occur. The COC can be obtained by filling out the electronic Notice of Intent (3-NOI) form at deq.nc.gov/NCG01. Please note, the e-NOI form may only be filled out once the Plans have been approved. A copy of the E&SC permit, the COC, and a hard copy of the Plans must be kept on site, preferably in a permits box, and accessible during inspection.
2. The Contractor shall coordinate with the Engineer to setup a meeting with NCDEQ Division of Energy, Mineral and Land Resources regional (Raleigh) office, 919-791-4200, to notify them of the start date and schedule a pre-construction meeting at least 48 hours prior to project activation.
3. Contact North Carolina "One Call" Center (1.800.632.4949) before any land disturbance.
4. Mobilize equipment and materials to the Site.
5. Identify and establish construction entrance, staging and stockpile areas, temporary haul roads, erosion and sediment control practices and stream crossings as indicated on the Plans for work areas.
6. Set up temporary facilities, locate equipment within staging areas and stockpile materials needed for the initial stages of construction within stockpile area(s).
7. All haul roads shall be monitored for sediment loss daily. In the event of sediment loss, silt fence or other acceptable sediment and erosion control practices shall be installed. Silt fence outlets shall be located at points of low elevation or a minimum spacing of 150 ft.
8. Install and maintain an on-site rain gauge and log book to record the rainfall amounts and dates. Complete the self-inspection as required by NCDEQ permit. Rainfall records, completed self-inspection forms and permits should be stored in an on-site permit box.
9. Maintain an approved copy of the E&SC plan with placard and approval letter and a copy of the NPDES permit with a minimum of 30 days of self-inspection reports on site until project closure by NCDEQ. Complete the self-inspection as required by NCDEQ permit. Rainfall records, completed self-inspection forms and permits should be updated in accordance with regulatory requirements and maintained on site.

Stream Construction

1. Detailed construction sequencing shall be determined by the Contractor prior to land disturbance. The Contractor shall provide a schedule to the Engineer prior to commencement or construction activities.
2. Install temporary livestock fencing, as necessary, to secure project area prior to construction. Conservation easement fencing may be installed prior to construction to reduce or eliminate the need for temporary fencing.
3. Perform any necessary clearing and grubbing in phases as work progresses in accordance with the Plans and General Notes. Bank vegetation and vegetation immediately adjacent to live channels shall be left undisturbed as long as possible. Remove all non-native and invasive vegetation prior to beginning the channel construction.
4. All stream construction, relocation and in-stream enhancement activities shall be completed from upstream to downstream. No downstream disturbance shall be permitted prior to the completion of upstream restoration activities. Where in-stream construction occurs at the confluence of two tributaries, construction of both upstream tributaries shall be completed prior to extending work zone downstream of the confluence.
5. Construction of all channels are to be done in the dry. A pump-around system is required when working in the live stream. Install impervious dikes at upstream and downstream ends of pump-around locations. The pump-around operation shall be performed between these dike locations.
6. Where feasible, more than one offline section may be constructed concurrently. Offline sections shall be tied online sequentially.
7. As work progresses, remove and stockpile the top three (3) inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for on-site replacement prior to floodplain seeding.
8. Perform excavation and grading of the channel and floodplain according to the Plans.
9. Install in-stream structures (riffles, sills, vanes, etc.) and bank revetments such as brush toe and boulder toe after channel grading is completed according to details and specifications. Various types of constructed riffles are specified on the plans. Contractor shall build the specific types of constructed riffles at locations shown on the Plans. Changes in constructed riffle type must be approved by the Engineer.
10. Install permanent stream crossings according to Plans and Specifications.
11. Install coir fiber matting according to Plans and Specifications.
12. Prepare floodplain for seeding by applying stockpiled topsoil to the floodplain between bankfull elevation and the grading limits, ripping and raking/smoothing.
13. Seed (with specified temporary and permanent seed mix) and straw mulch banks and floodplain areas according to the Plans and Specifications.
14. Backfill abandoned channel sections with stockpiled soil according to the grades shown on the Plans. Non-native and invasive vegetation (e.g. Chinese privet) shall be removed from the existing channel prior to backfilling.
15. Once disturbed areas and exposed slopes are stabilized, remove pump-around system, if used, and progress to the next downstream work zone.
16. Once all phases of channel and floodplain construction are complete, fence lines shall be staked according to fencing plan. Install fence outside of conservation easement according to Plans and Specifications.
17. All haul roads and other areas of compacted soil must be thoroughly ripped or disked. Seed with specified temporary and permanent seed mix and mulch. Any areas within the conservation easement that have not been graded shall be treated according to the planting plan.
18. Install bare root plants on floodplain and live stakes and herbaceous plugs along the stream banks according to the Plans and Specifications.

Construction Demobilization

1. Following final site acceptance by Engineer, remove temporary stream crossings, stockpile areas, and erosion and sediment control devices.
2. The Contractor shall ensure that the Site is free of trash and leftover materials prior to demobilization of equipment from the Site.
3. Complete the removal of any additional stockpiled material from the Site.
4. Demobilize grading equipment from the Site.
5. All areas, including but not limited to pasture areas, roads, and entrances outside the conservation easement shall be returned to pre-project conditions or better.
6. Seed, mulch, and stabilize staging areas, stockpile areas, haul roads, and construction entrances. Permanent Seeding Outside Easement mixture as specified on the plans is to be applied to areas of disturbance outside of the conservation easement.
7. Demobilize all equipment, offices, buildings and other facilities from the Site.
8. When the project is complete, the permittee shall contact DEMLR to close out the E&SC Plan. After DEMLR informs the permittee of the project close out, via inspection report, the permittee shall visit deq.nc.gov/NCG01 to submit an electronic Notice of Termination (e-NOT). A $100 annual general permit fee will be charged until the e-NOT has been filled out.

Existing Features

- Existing Thalweg
- Existing Top of Bank (TB)
- Existing Property Line
- Existing Major Contour (100)
- Existing Minor Contour
- Existing Overhead Electric (OHE)
- Existing Overhead Utility Easement (OUE)
- Existing Right-of-Way (R/W)
- Existing Fence
- Existing Wetland
- Existing Bedrock
- Existing Farm Road
- Existing Road
- Existing Debris Pile
- Existing Tree
- Existing Treeline

Proposed Features

- Proposed Thalweg Alignment (10+00)
- Proposed Bankfull
- Proposed Major Contour (100)
- Proposed Minor Contour
- Proposed Conservation Easement (CE)
- Proposed Internal Crossing of Conservation Easement (CE-IX)
- Proposed Temporary Construction Easement (TCE)
- Proposed Limits of Disturbance (LOD)
- Proposed Tree Protection/Safety Fence (SAF)
- Proposed Silt Fence ([X])
- Proposed Woven Wire Fencing
- Proposed High Tensile Fencing
- Proposed Culvert
- Proposed Bank Grading
- Proposed Road over Culvert
- Proposed Ford Crossing
- Proposed Conservation Easement Buffer (CE-B)
- Proposed Riprap Protection

Proposed Structures

- Proposed Various Constructed Riffles Per Plans — See Sheet 6.1
- Proposed Brush Toe — See Detail 3, Sheet 6.2
- Proposed Boulder Toe — See Detail 4, Sheet 6.2
- Proposed Vegetated Soil Lift — See Detail 1, Sheet 6.5
- Proposed Log Sill — See Detail 1&2, Sheet 6.2
- Proposed Rock Sill — See Detail 2, Sheet 6.3
- Proposed Channel Plug — See Detail 4, Sheet 6.8
- Proposed Floodplain Sill — See Detail 4, Sheet 6.4
- Proposed Lunker Log — See Detail 3, Sheet 6.3

Erosion Control Features

- Proposed Construction Entrance — See Detail 1, Sheet 6.10
- Proposed Pump Around — See Detail 3, Sheet 6.9
- Proposed Silt Fence Gravel Outlet — See Detail 2, Sheet 6.10
- Proposed Temporary Stream Crossing - Timber Mat — See Detail 1, Sheet 6.7
- Proposed Haul Road
- Proposed Stockpile/Staging Area
- Proposed Erosion Control Matting — See Detail 1, Sheet 6.9
- Proposed Fiber Roll — See Detail 4, Sheet 6.10
- Proposed 2" Tube Steel Gate — See Detail 3, Sheet 6.8
- Proposed Temporary Rock Check Dam — See Detail 3, Sheet 6.10
- Proposed Temporary Cattle Exclusion Fence — See Detail 2, Sheet 6.8

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. HUNDLEY 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

General Notes and Legend

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 0.2

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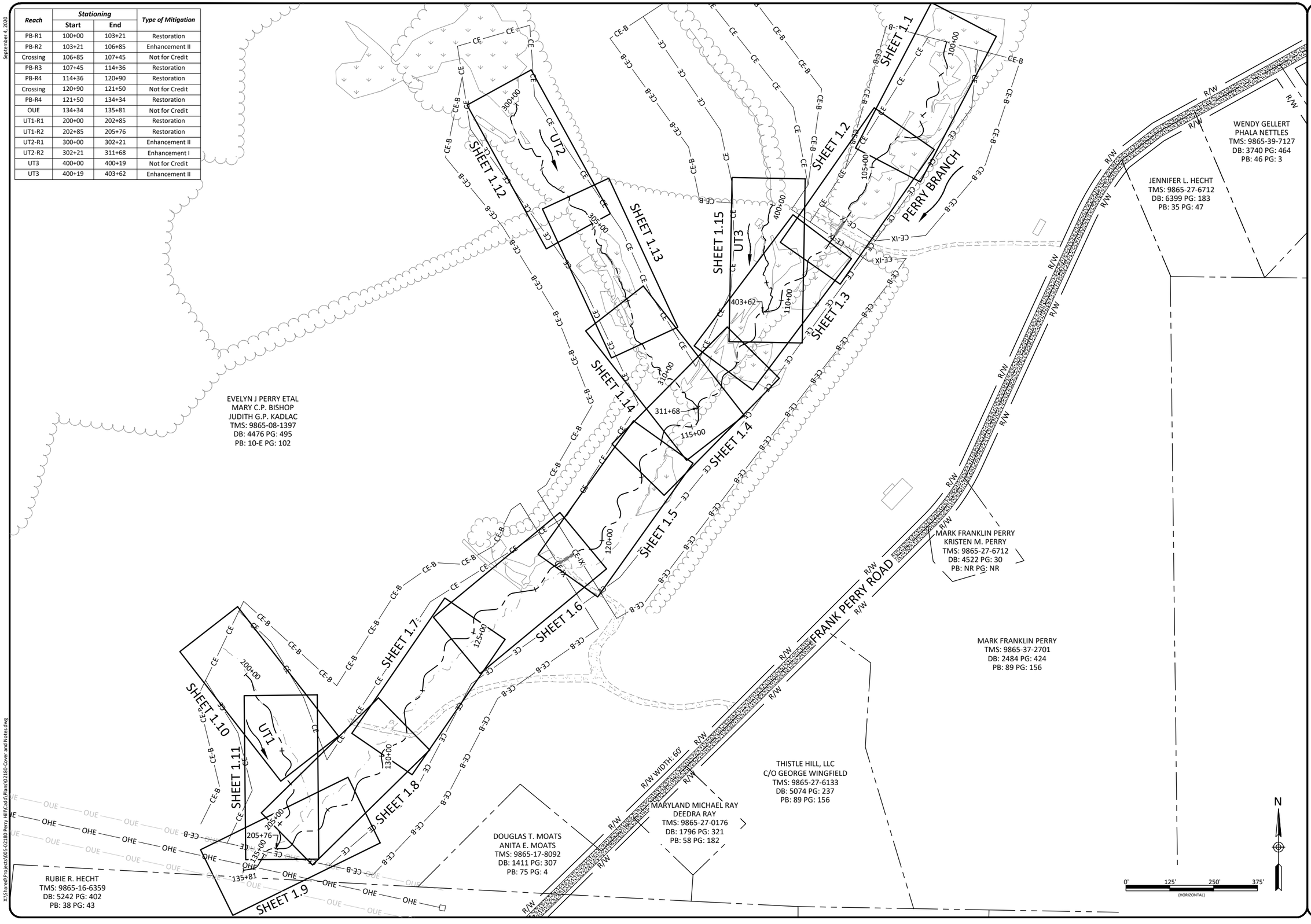
September 4, 2020

Reach	Stationing		Type of Mitigation
	Start	End	
PB-R1	100+00	103+21	Restoration
PB-R2	103+21	106+85	Enhancement II
Crossing	106+85	107+45	Not for Credit
PB-R3	107+45	114+36	Restoration
PB-R4	114+36	120+90	Restoration
Crossing	120+90	121+50	Not for Credit
PB-R4	121+50	134+34	Restoration
OUE	134+34	135+81	Not for Credit
UT1-R1	200+00	202+85	Restoration
UT1-R2	202+85	205+76	Restoration
UT2-R1	300+00	302+21	Enhancement II
UT2-R2	302+21	311+68	Enhancement I
UT3	400+00	400+19	Not for Credit
UT3	400+19	403+62	Enhancement II



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Perry Hill Mitigation Site
Orange County, North Carolina

Project Overview

Revisions:

Date:	08.21.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 0.3

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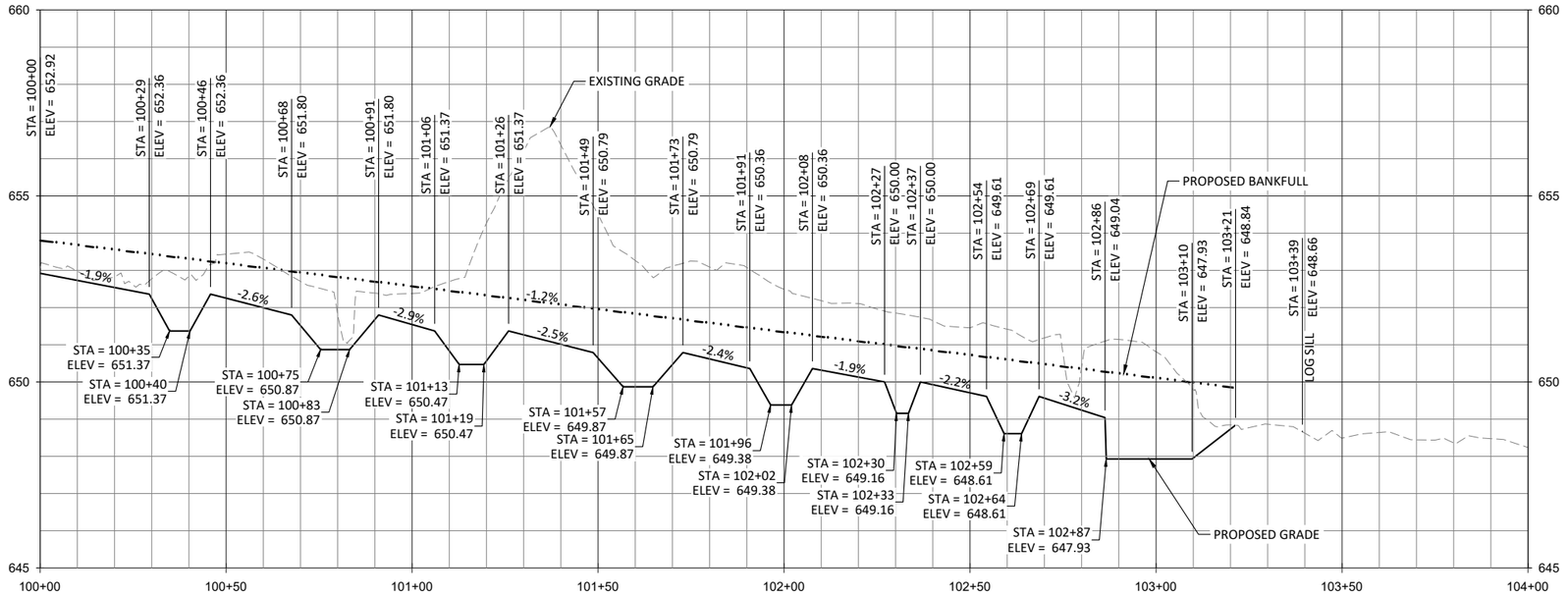
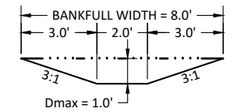
August 3, 2020

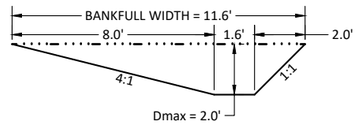


Typical Sections

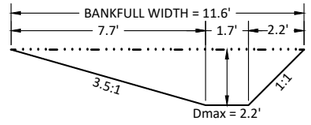
Perry Branch - Reach 1
Riffle Section

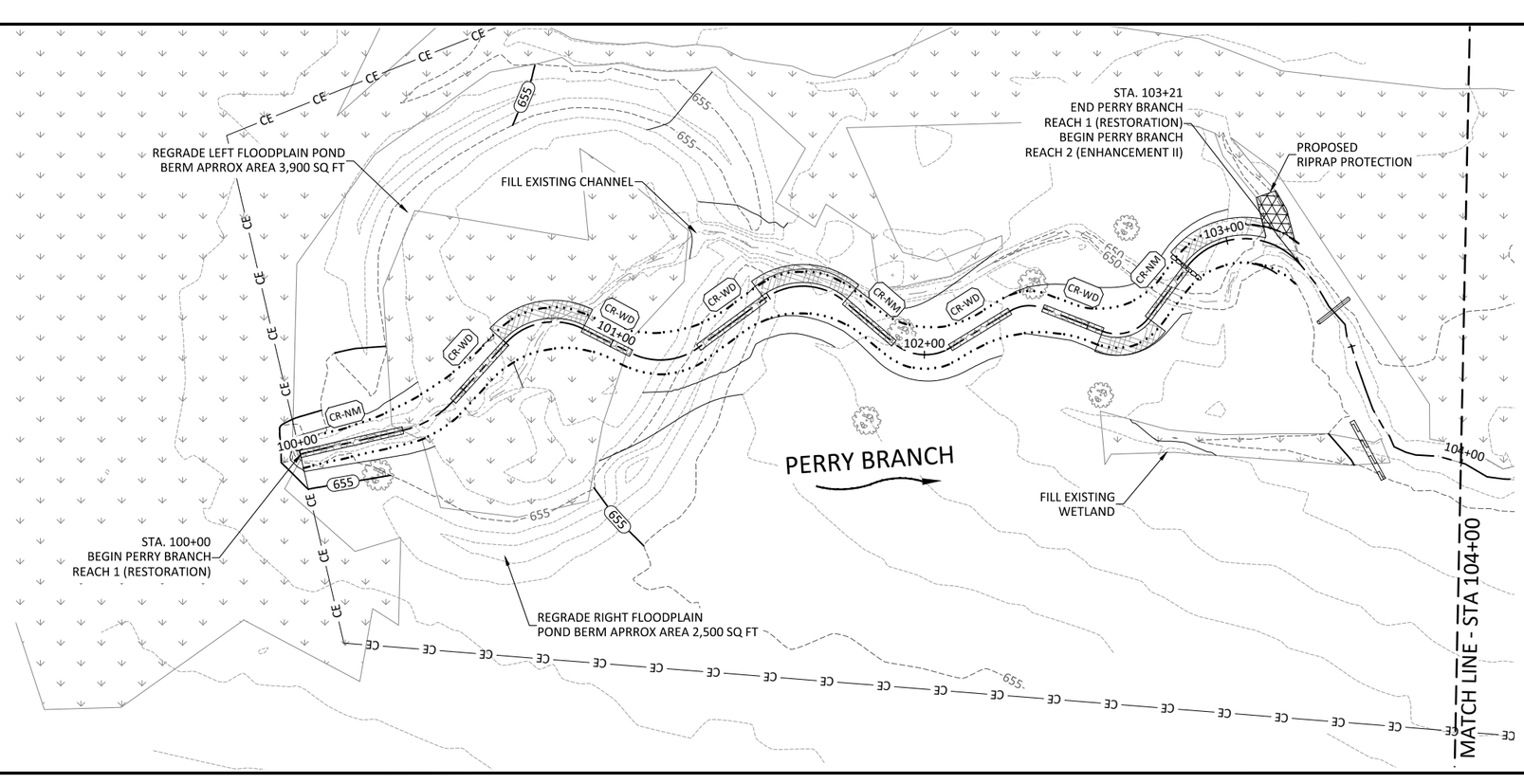


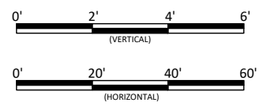
Perry Branch - Reach 1
Pool Section

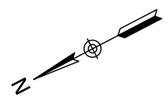


Perry Branch - Reach 1
Pool with Structure Section









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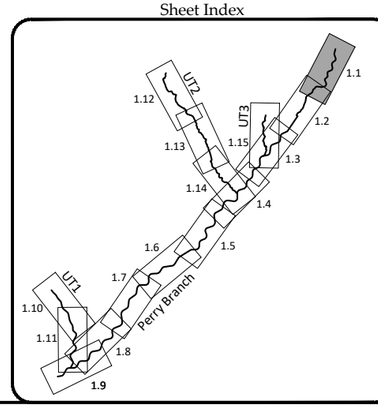

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. SMITH 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 1
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 1.1

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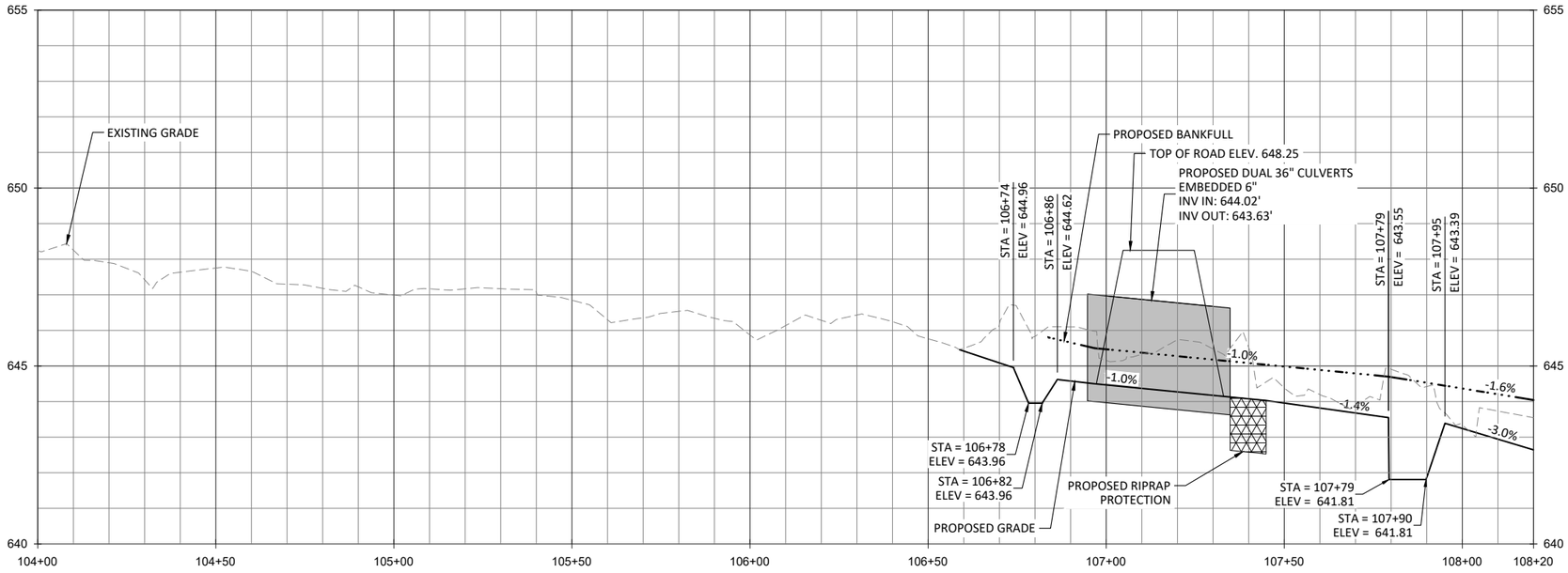
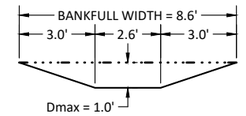
August 3, 2020

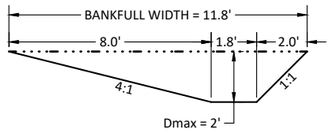


Typical Sections

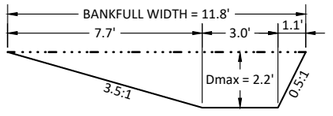
Perry Branch - Reach 2
Riffle Section

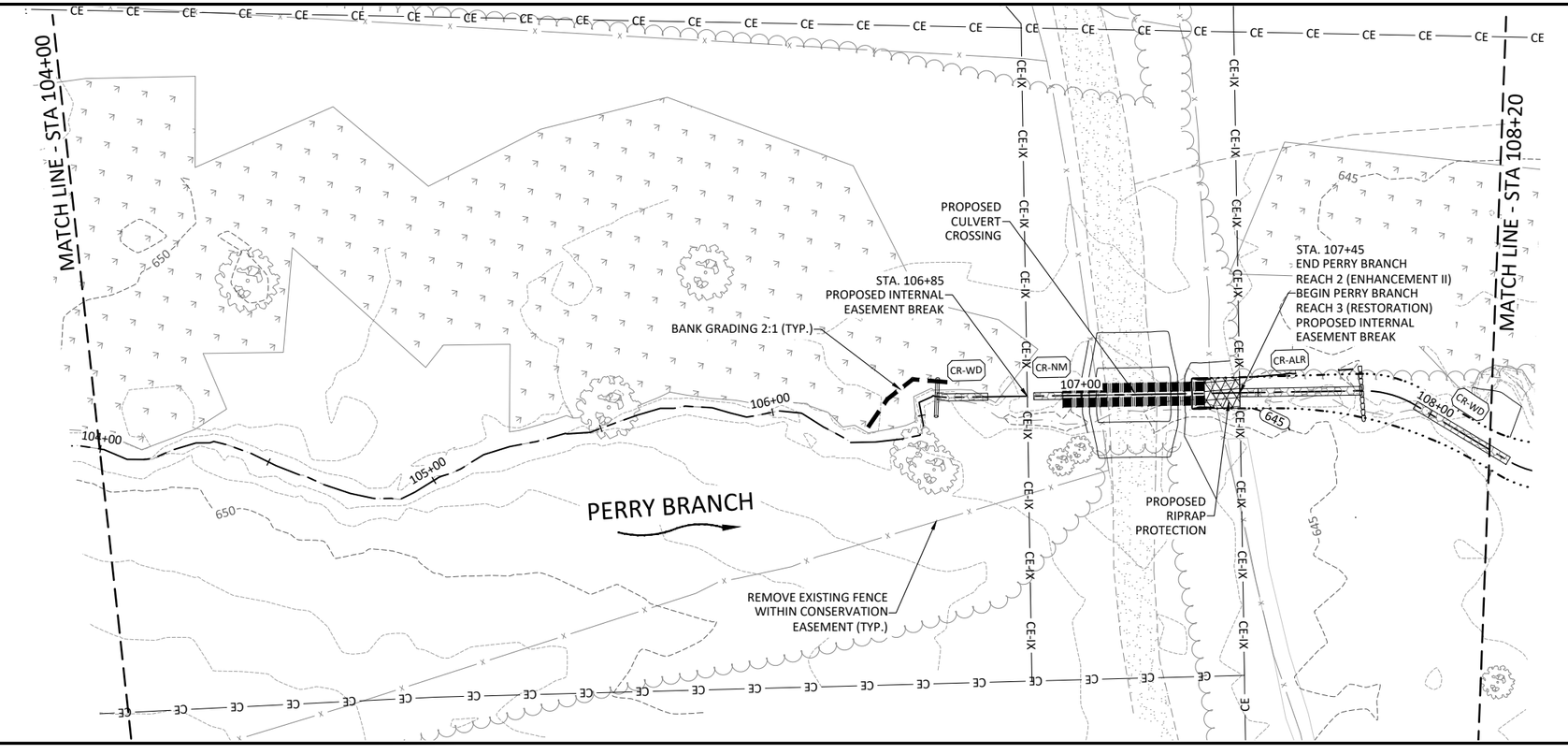


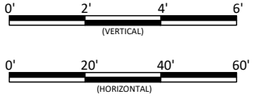
Perry Branch - Reach 2
Pool Section



Perry Branch - Reach 2
Pool with Structure Section







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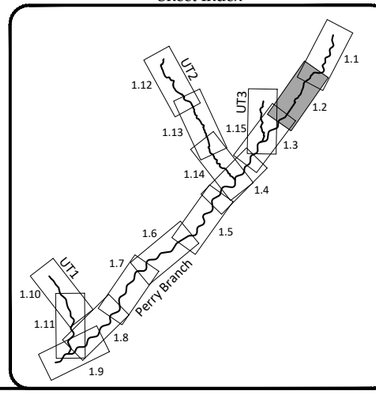

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. CRISP 7/23/2020

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 2
Stream Plan and Profile

Revisions:

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Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CK

Sheet 1.2

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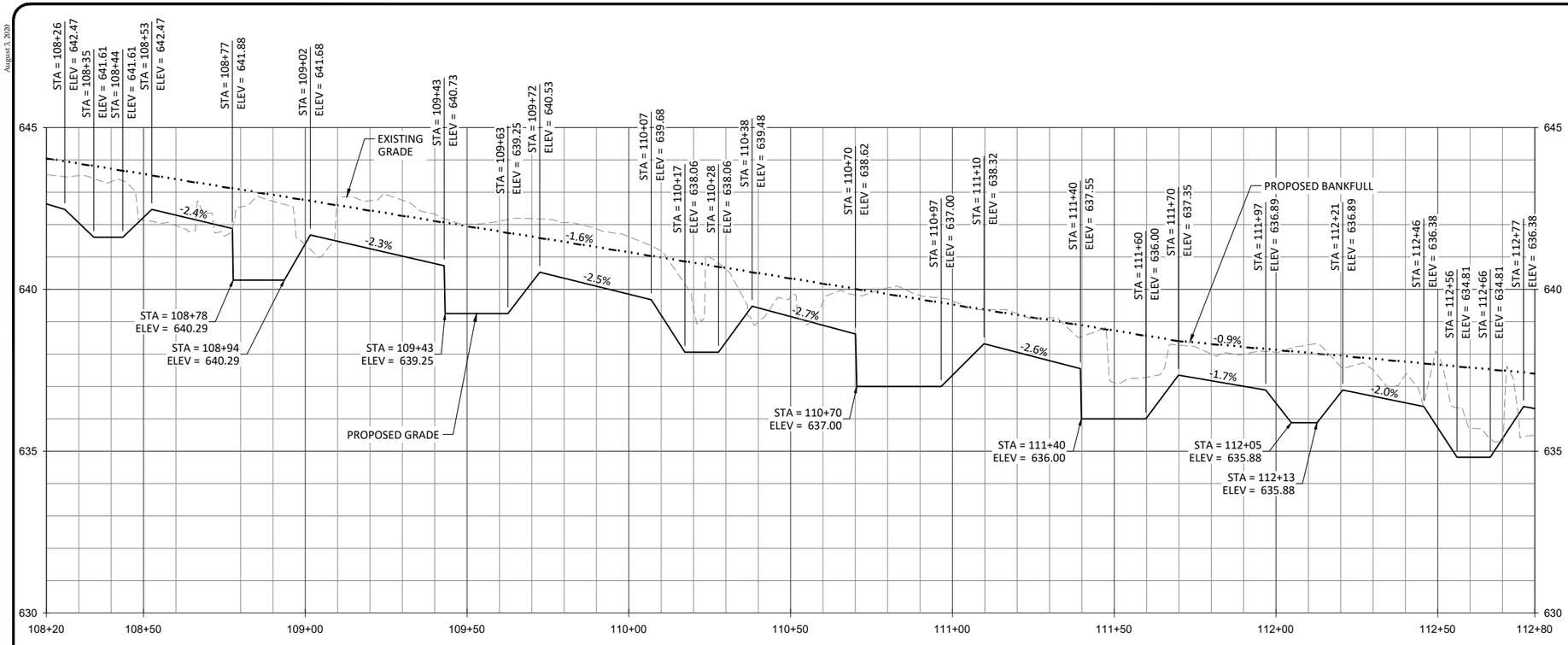
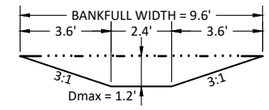
August 3, 2020

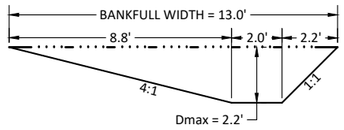


Typical Sections

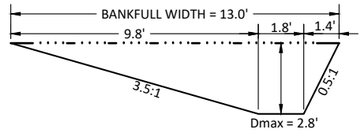
Perry Branch - Reach 3
Riffle Section

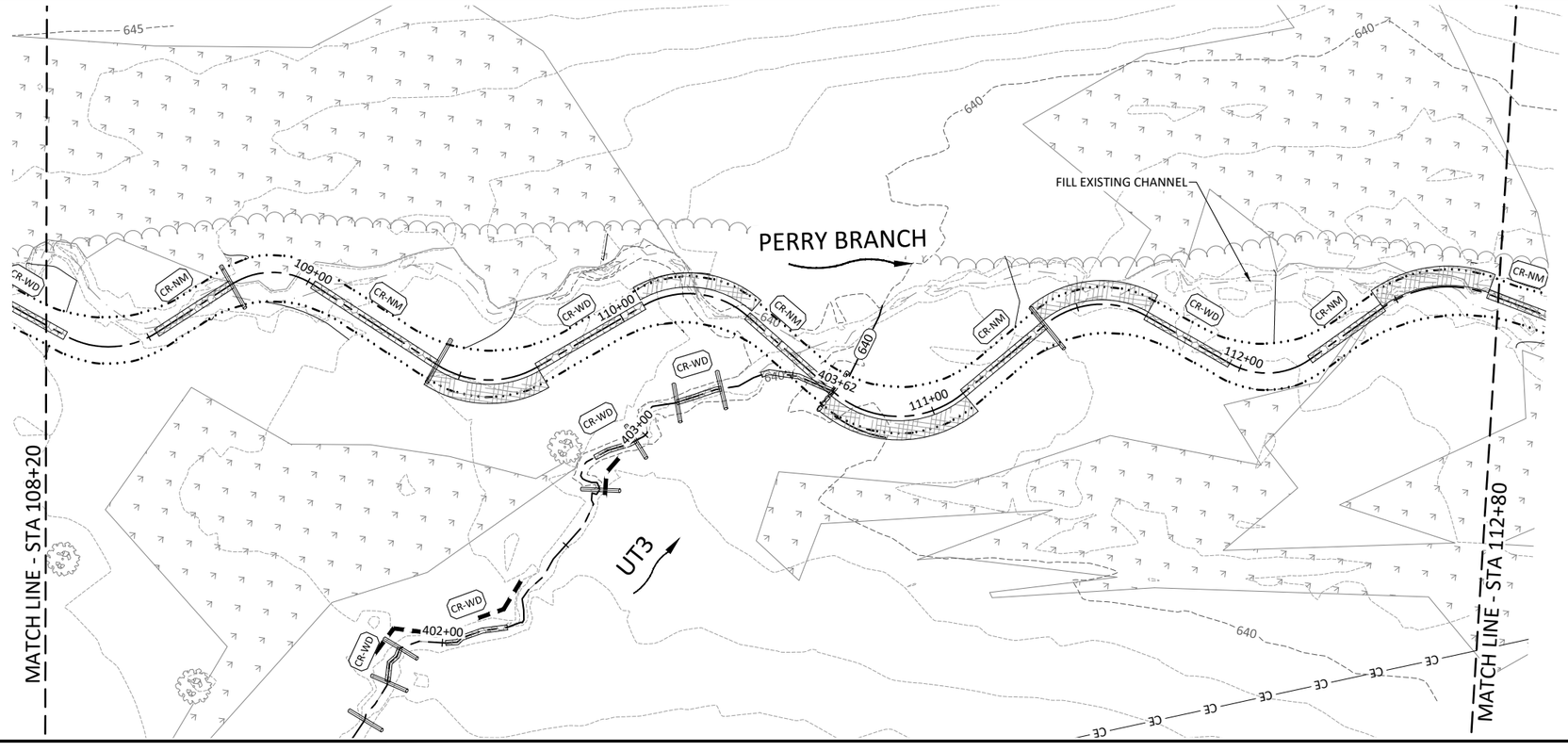


Perry Branch - Reach 3
Pool Section



Perry Branch - Reach 3
Pool with Structure Section





0' 2' 4' 6'
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

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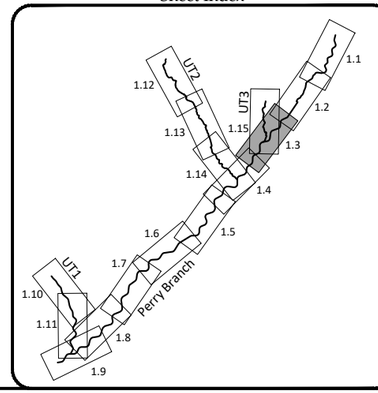
Sheet Index



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. CRUMPLER 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 3
Stream Plan and Profile

Revisions:	
Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 1.3

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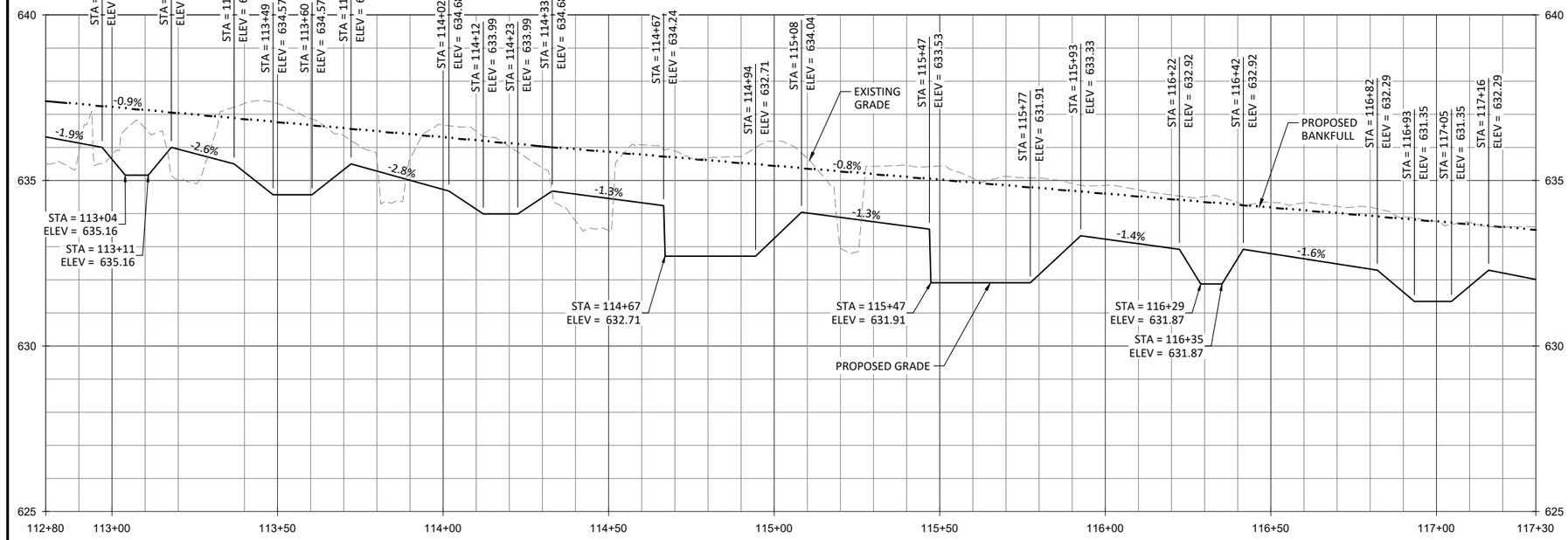
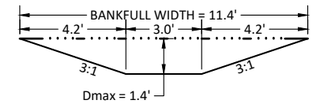
August 3, 2020



Typical Sections

Perry Branch - Reach 4
Riffle Section



Perry Branch - Reach 4
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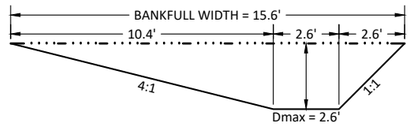
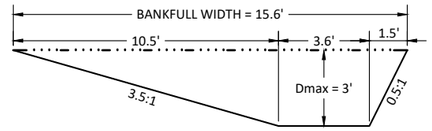
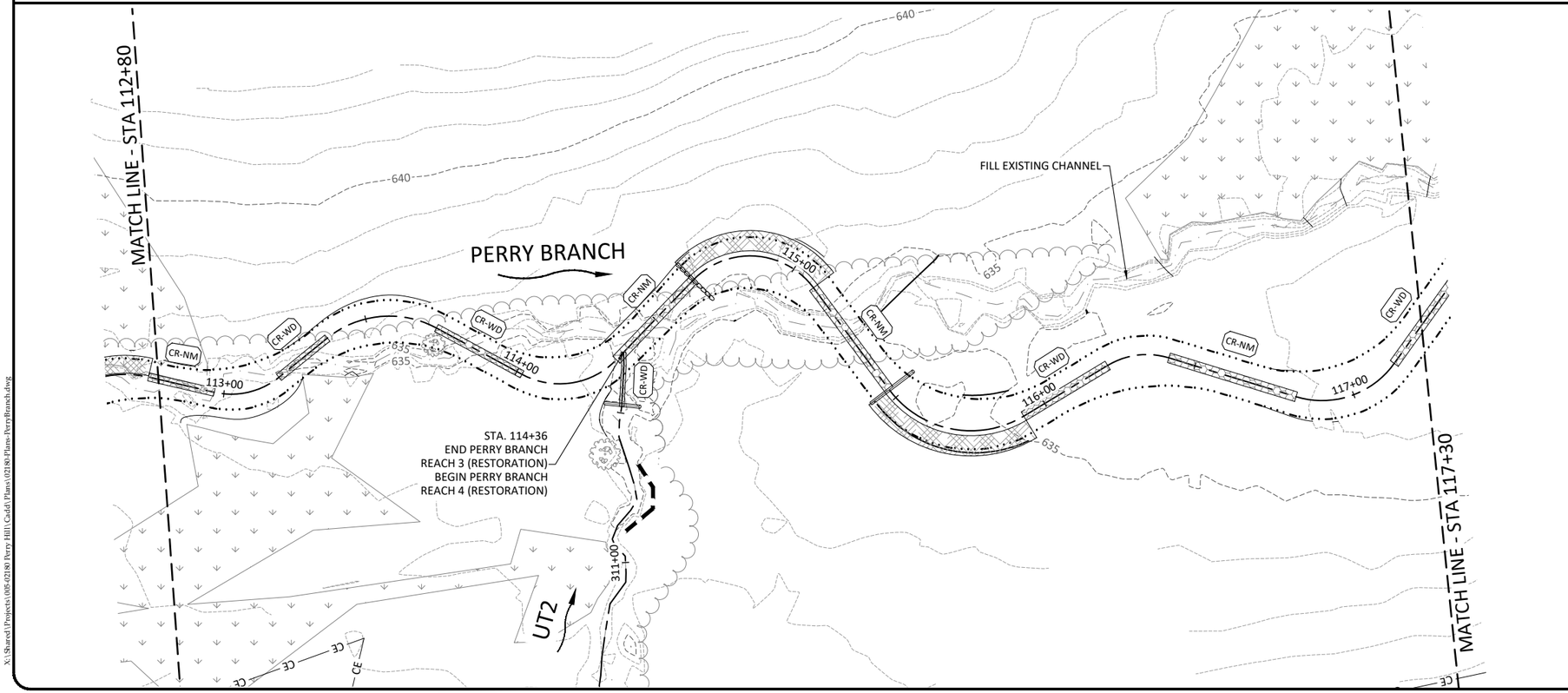
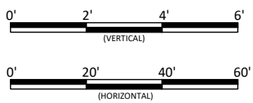
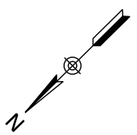


Perry Branch - Reach 4
Pool with Structure Section









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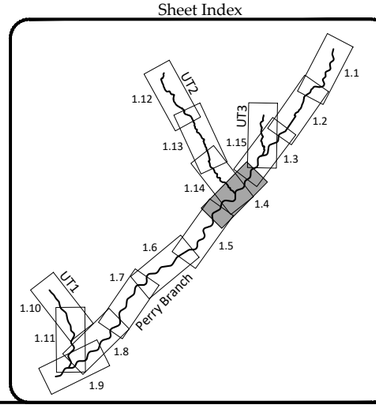

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. CARR 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 3 & 4
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 1.4

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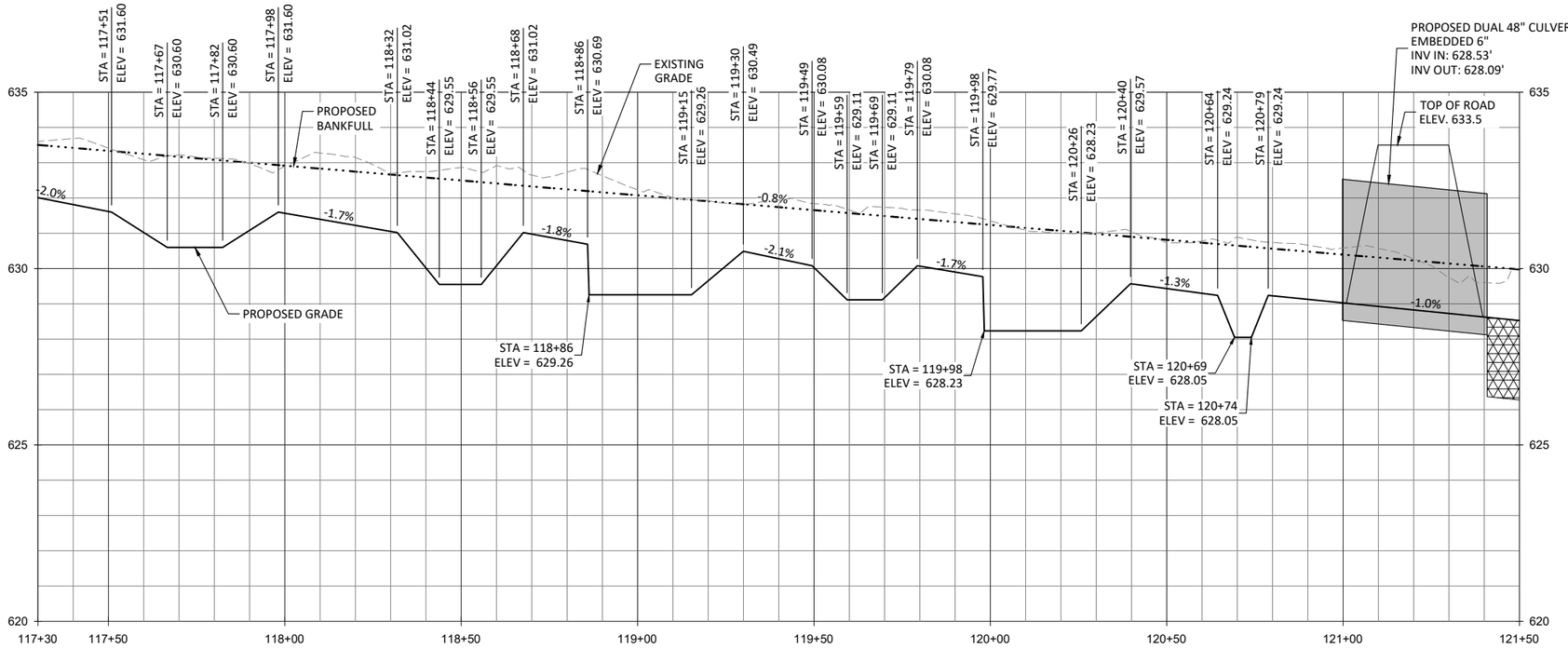
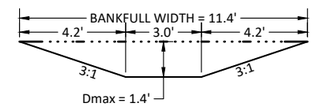
August 3, 2020

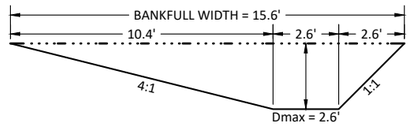


Typical Sections

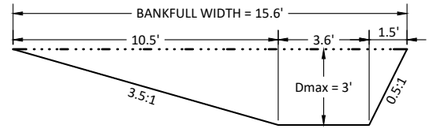
Perry Branch - Reach 4
Riffle Section

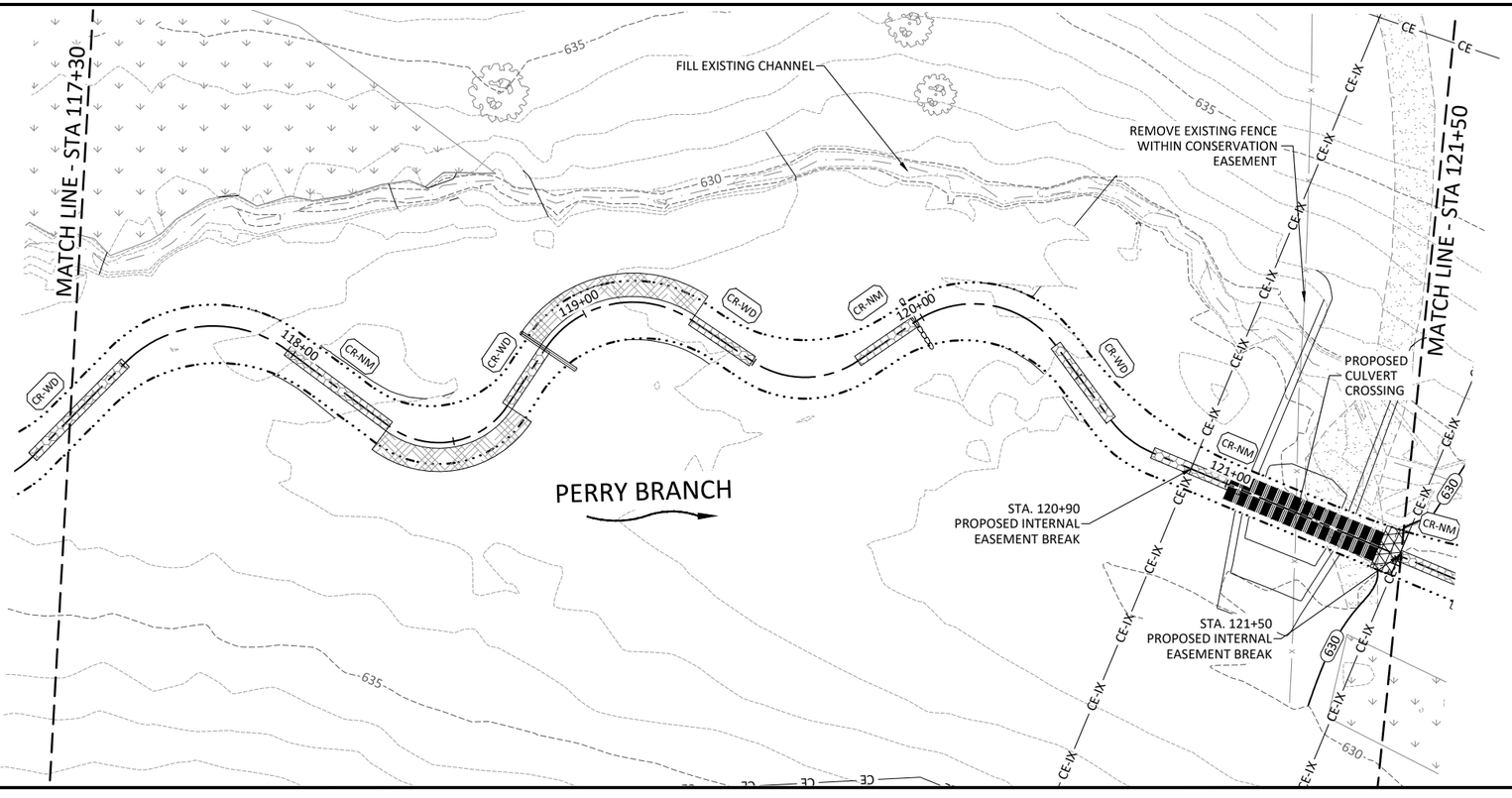


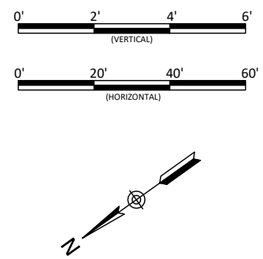
Perry Branch - Reach 4
Pool Section



Perry Branch - Reach 4
Pool with Structure Section







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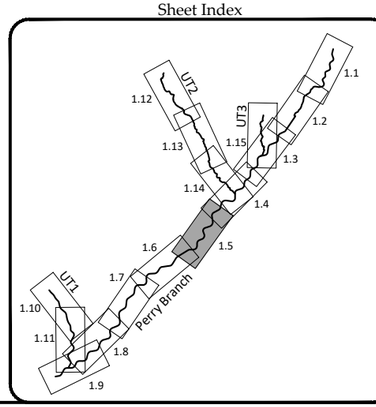

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. KEY 7/24/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CK

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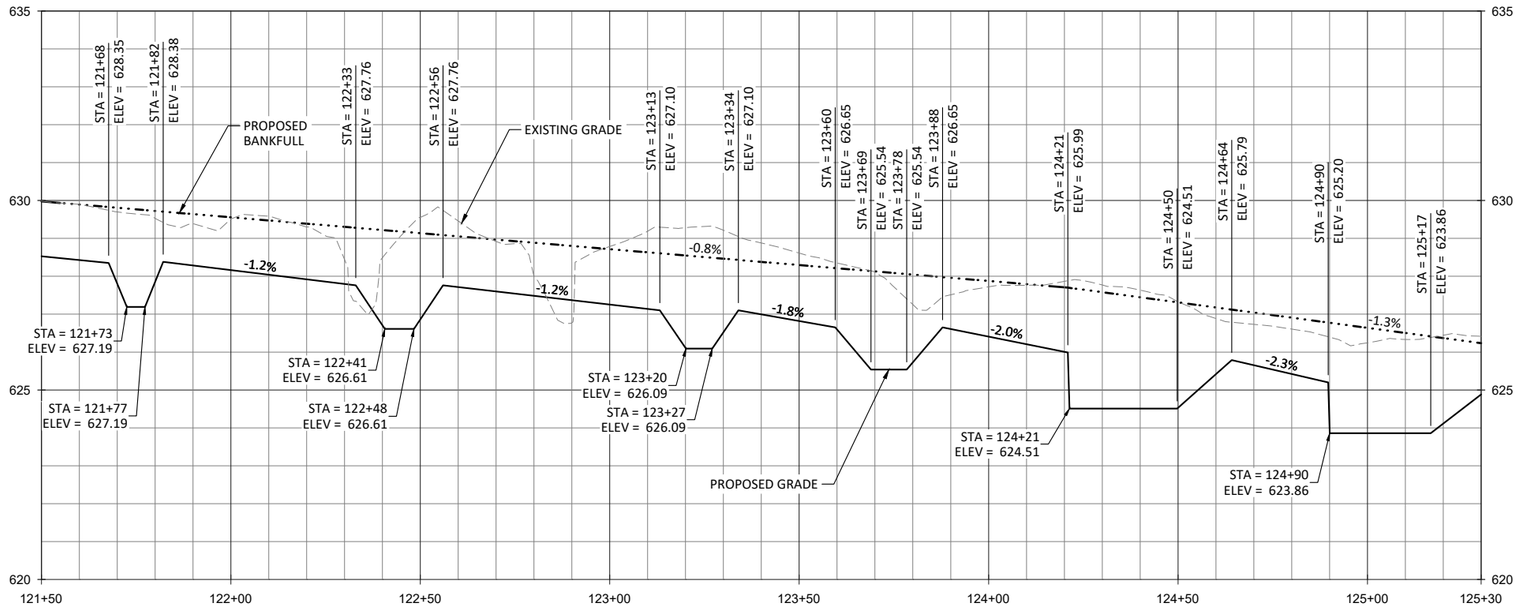
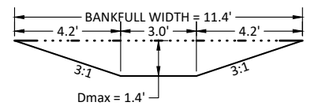
August 3, 2020

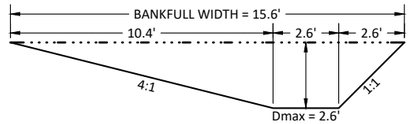


Typical Sections

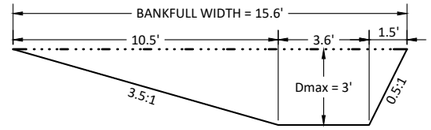
Perry Branch - Reach 4
Riffle Section

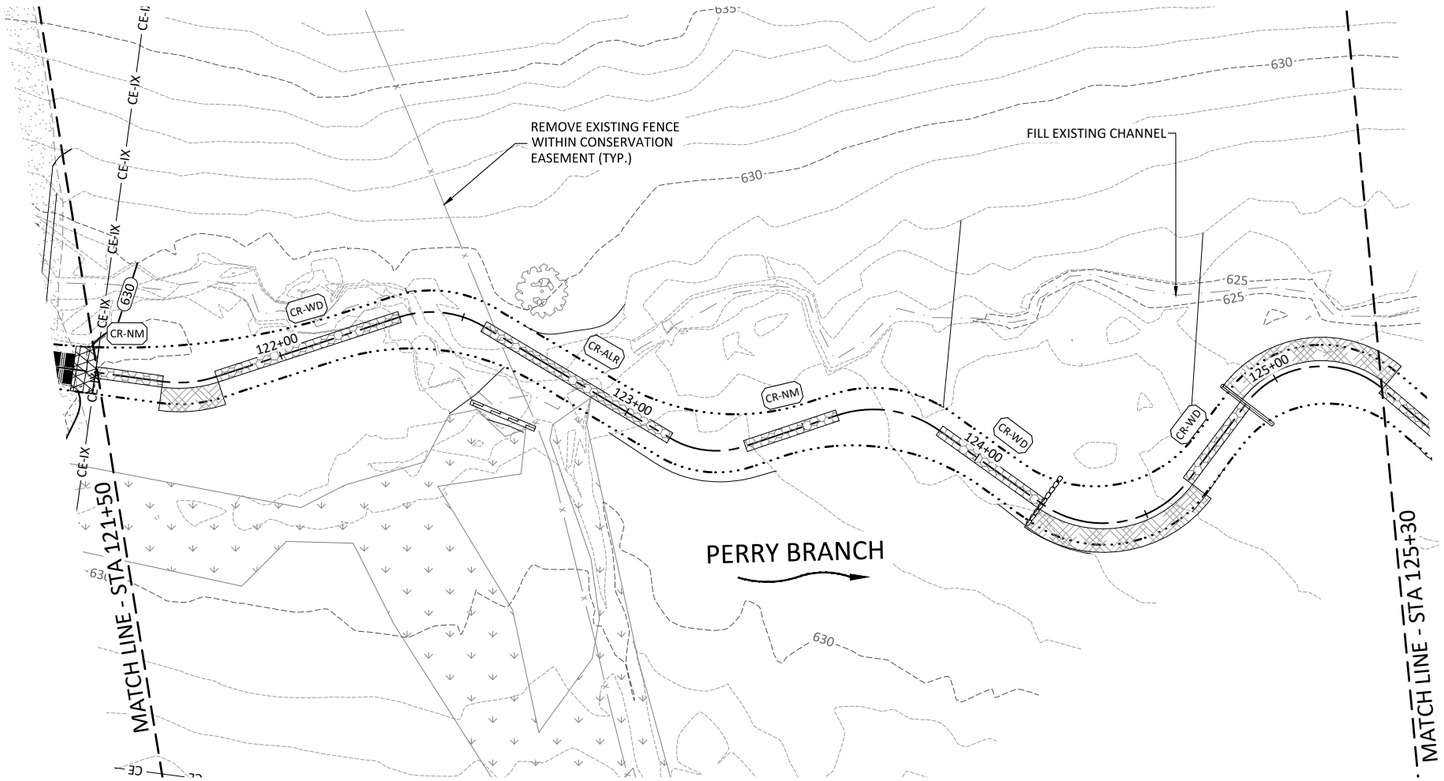


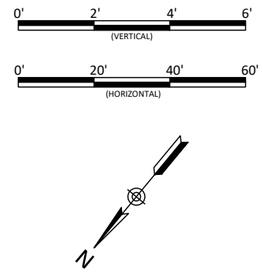
Perry Branch - Reach 4
Pool Section



Perry Branch - Reach 4
Pool with Structure Section







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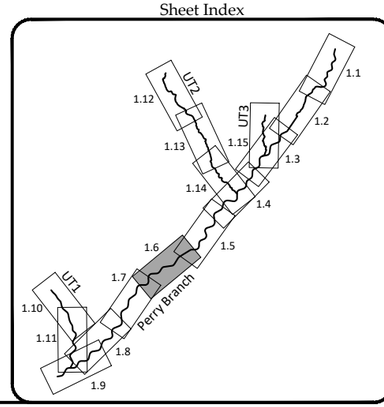

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. CRAWFORD 7/23/2020

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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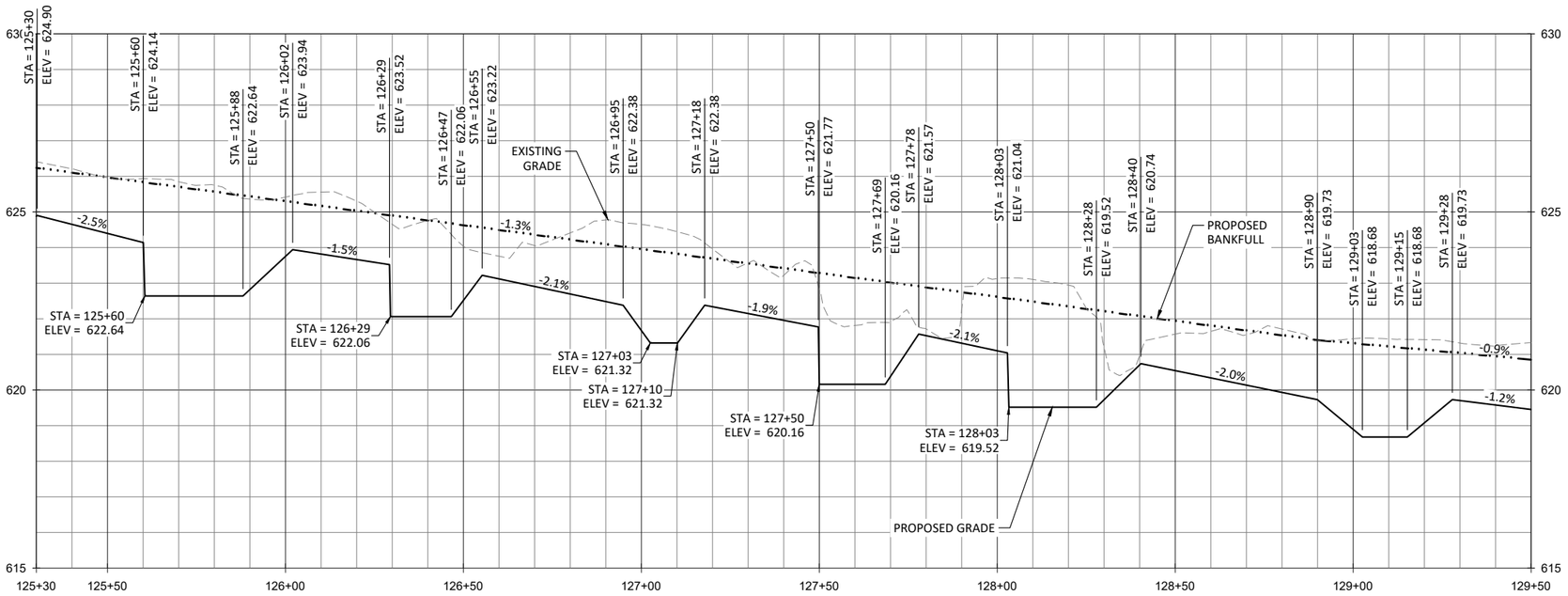
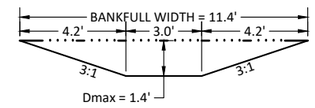
August 3, 2020

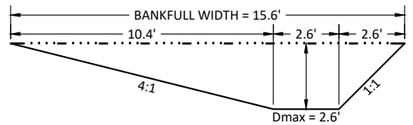


Typical Sections

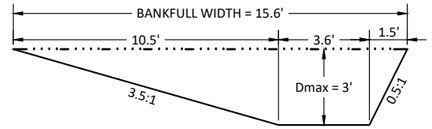
Perry Branch - Reach 4
Riffle Section

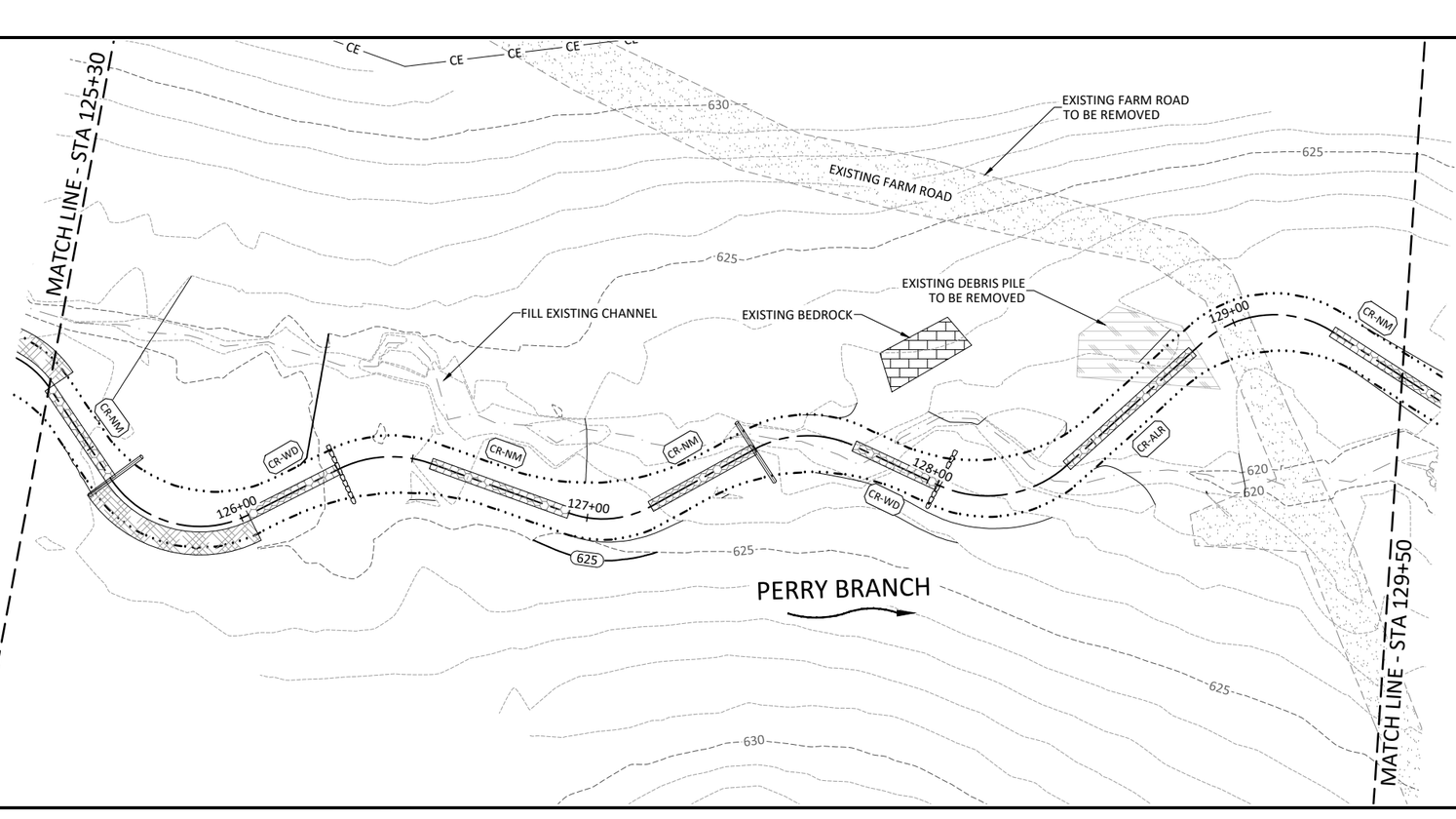


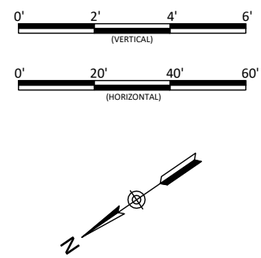
Perry Branch - Reach 4
Pool Section



Perry Branch - Reach 4
Pool with Structure Section







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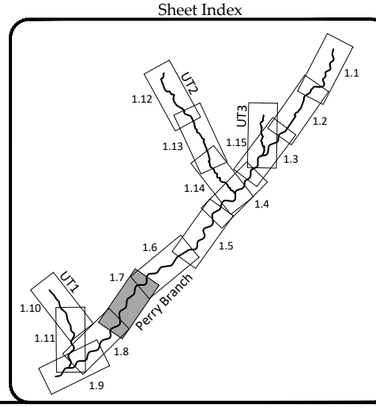

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. CRAWFORD 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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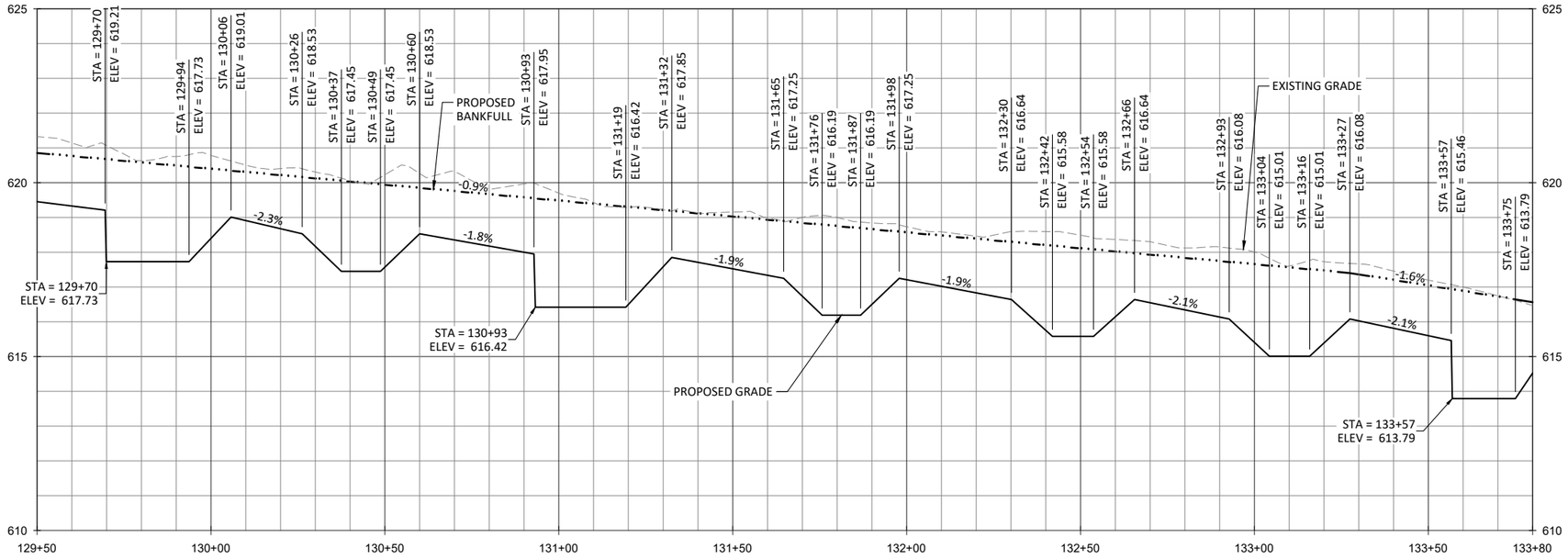
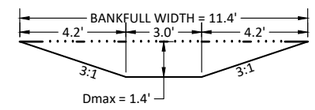
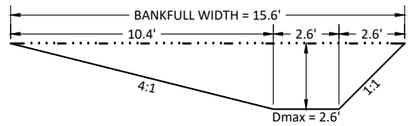


Typical Sections

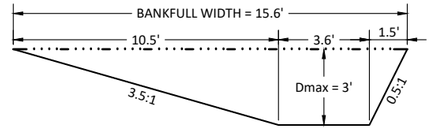
Perry Branch - Reach 4
Riffle Section

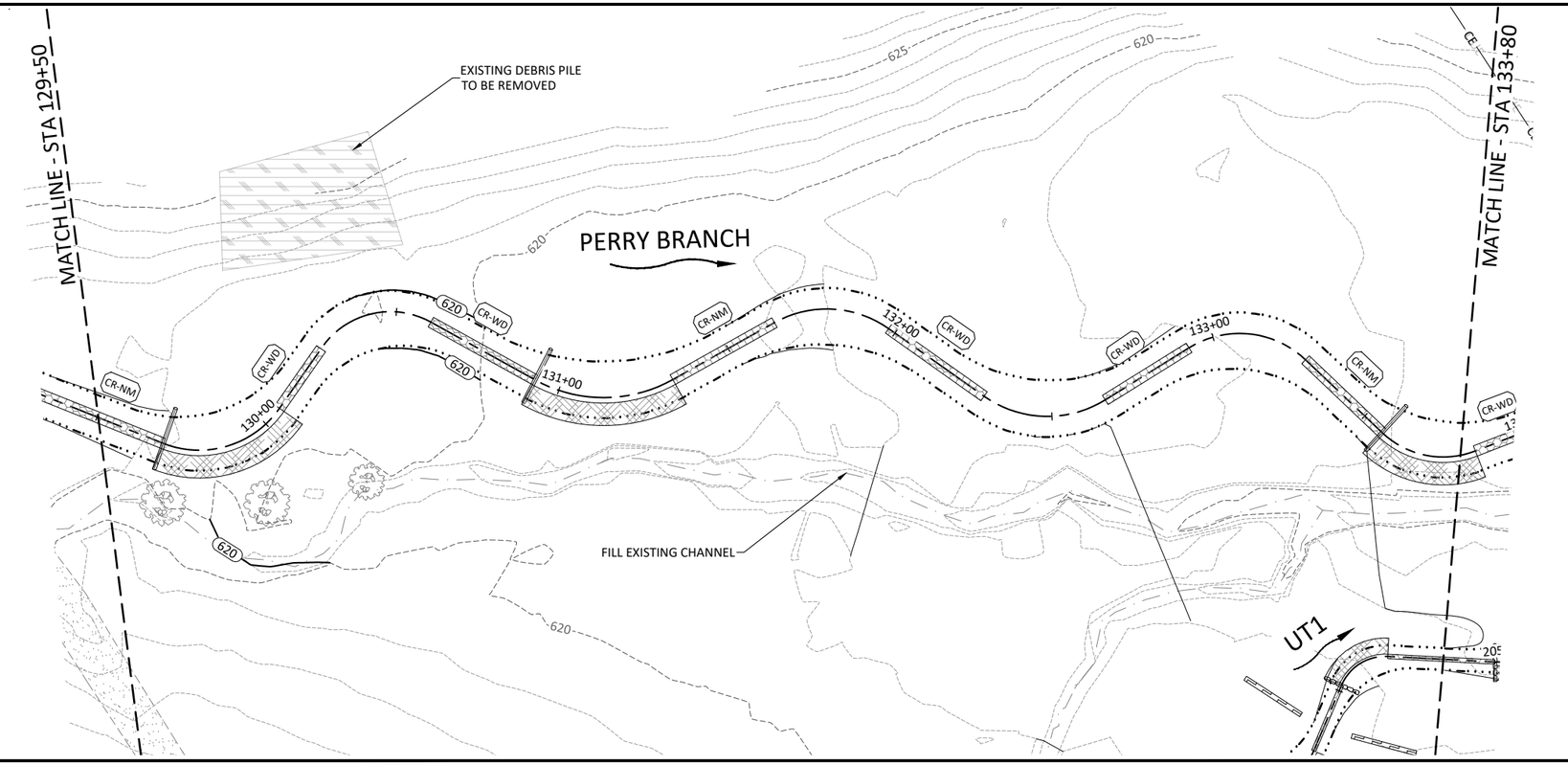


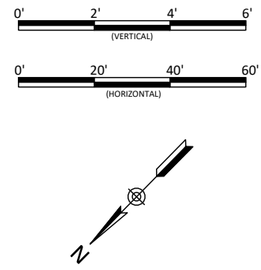
Perry Branch - Reach 4
Pool Section



Perry Branch - Reach 4
Pool with Structure Section







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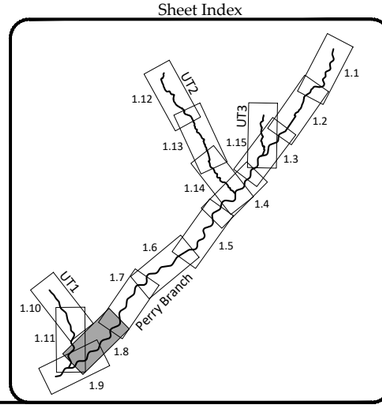

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. CRAWFORD 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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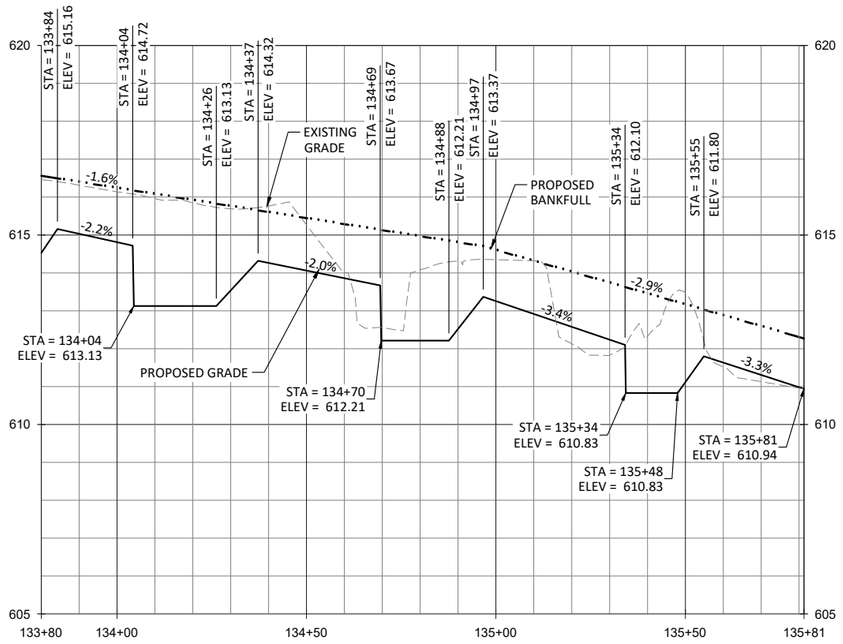
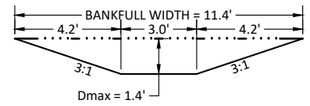
August 3, 2020

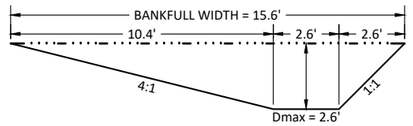


Typical Sections

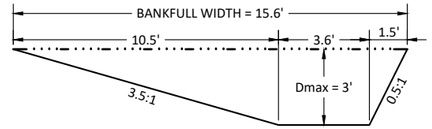
Perry Branch - Reach 4
Riffle Section

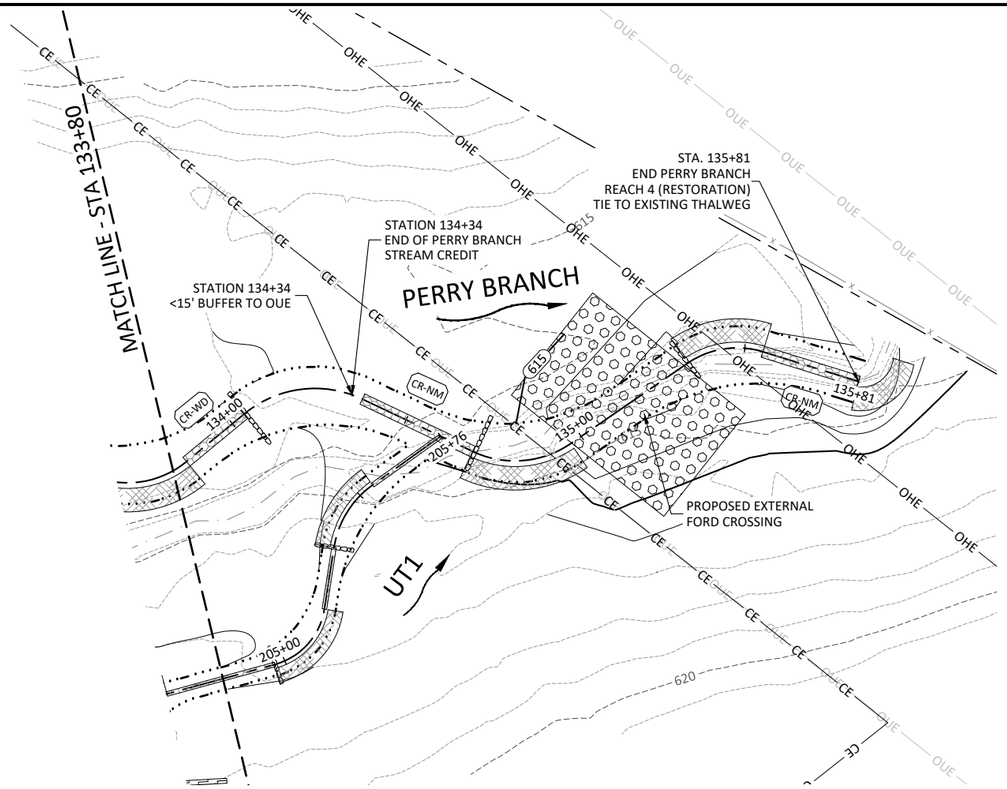


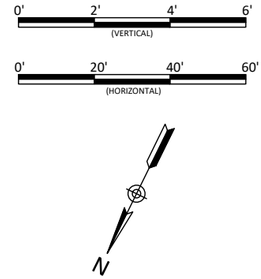
Perry Branch - Reach 4
Pool Section



Perry Branch - Reach 4
Pool with Structure Section







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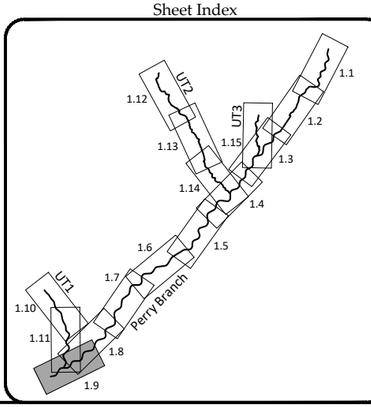

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. CRAWFORD 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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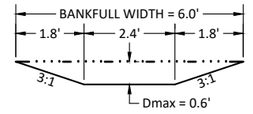
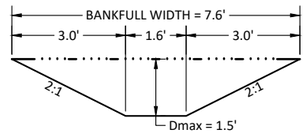
August 3, 2020

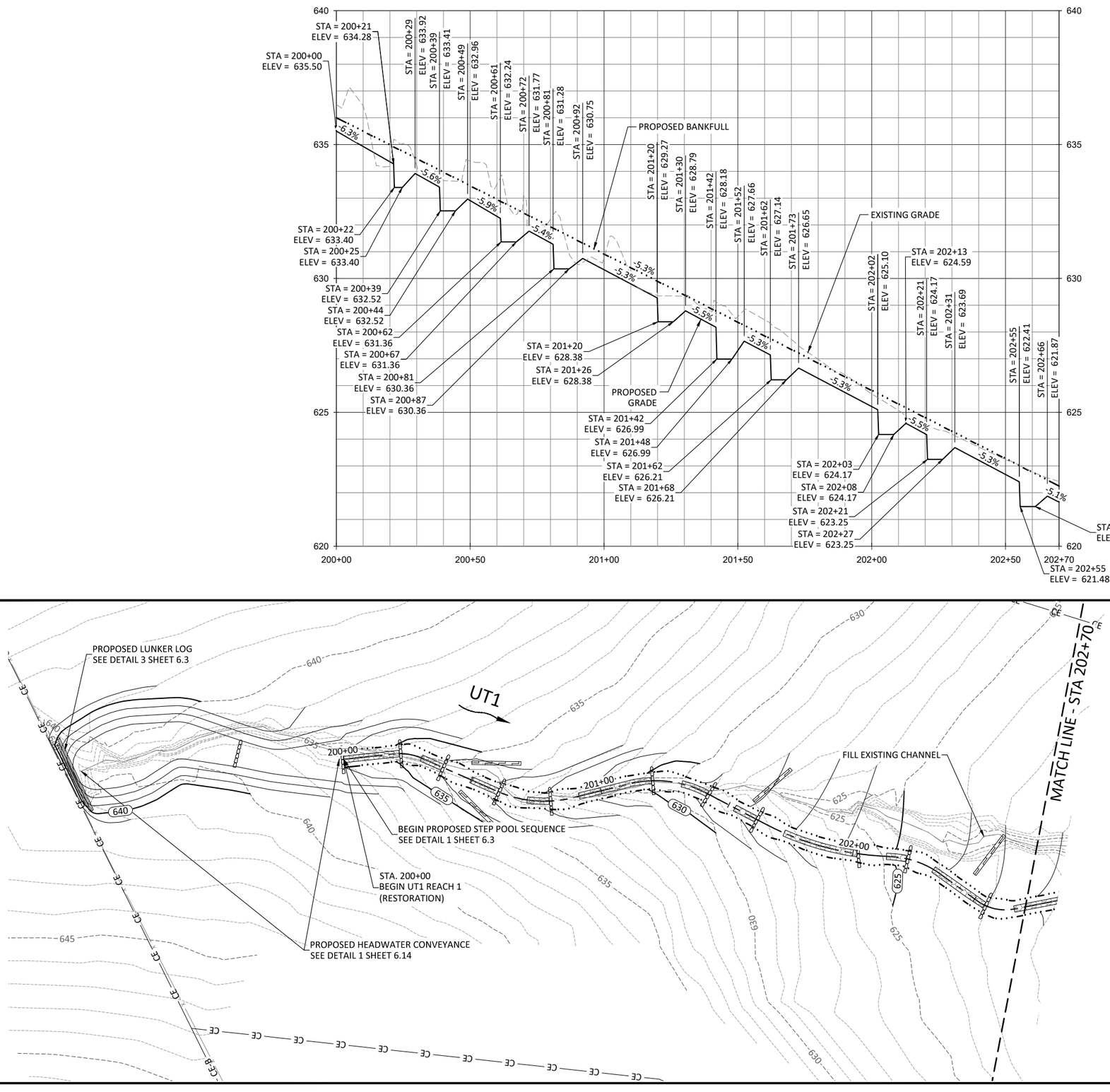
Typical Sections

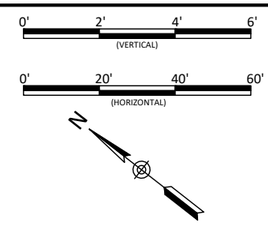
UT1 Reach 1
Riffle Section



UT1 Reach 1
Pool with Structure Section







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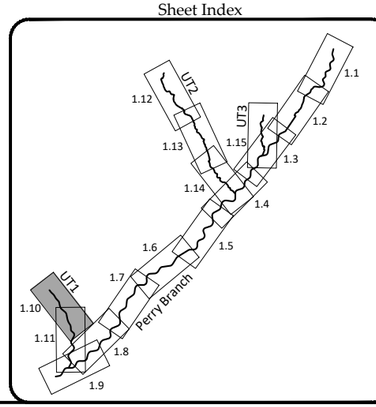

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. CARTER 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT1 Reach 1
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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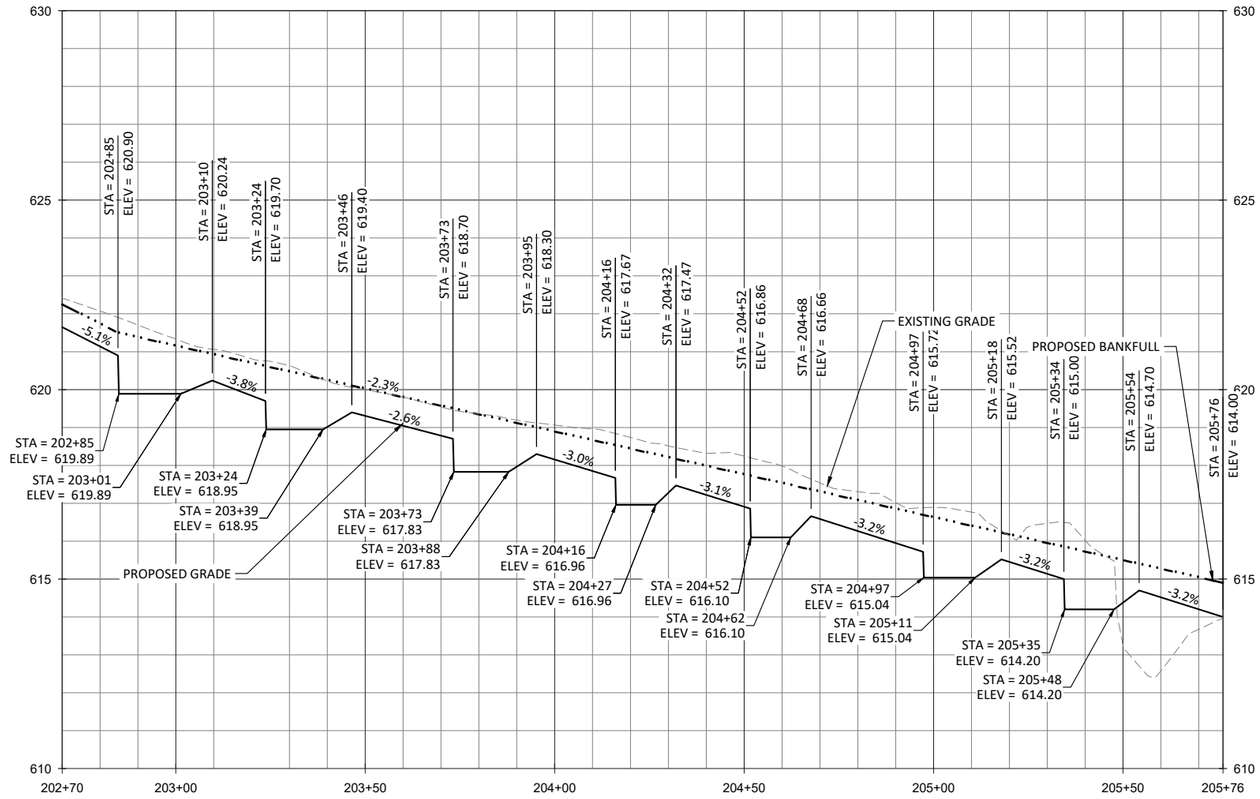
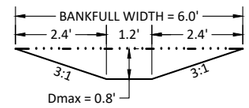
August 3, 2020

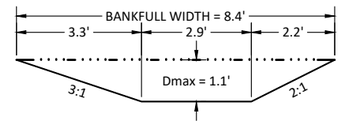


Typical Sections

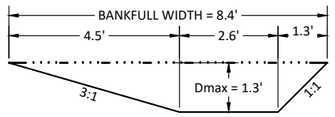
UT1 Reach 2
Riffle Section

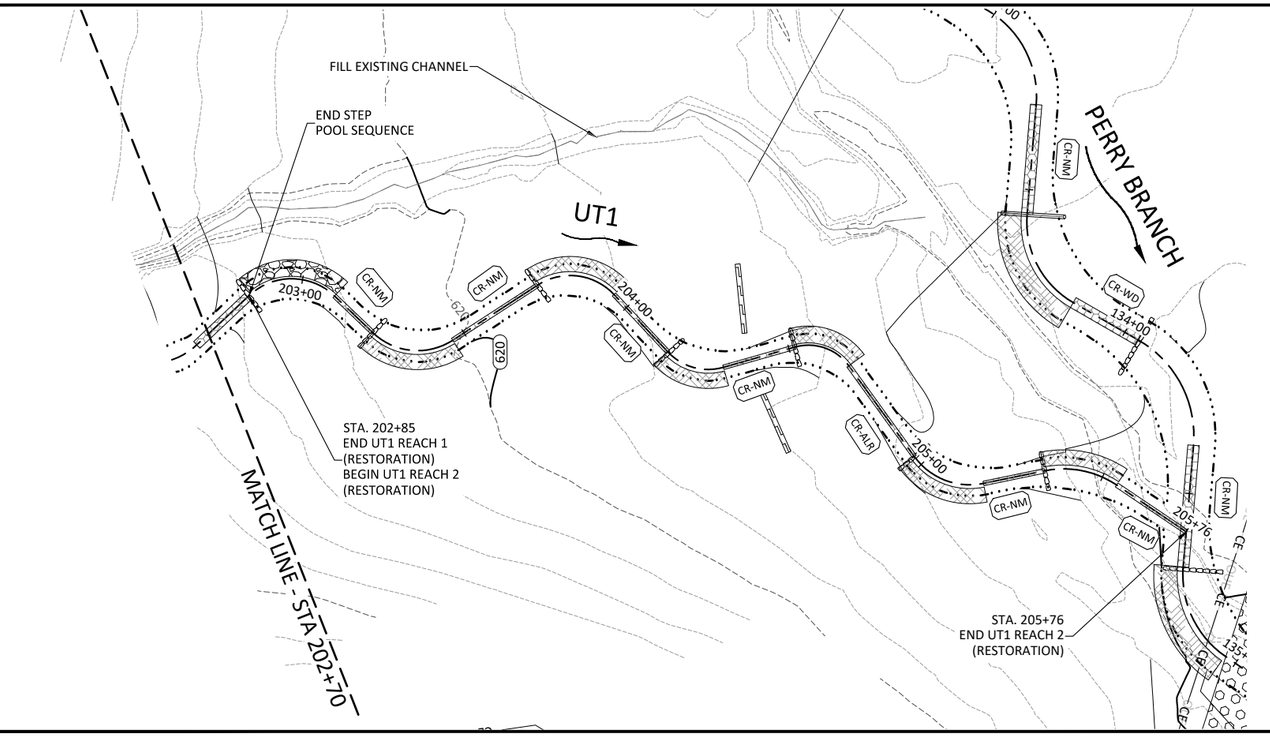


UT1 Reach 2
Pool Section



UT1 Reach 2
Pool with Structure Section





0' 2' 4' 6'
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

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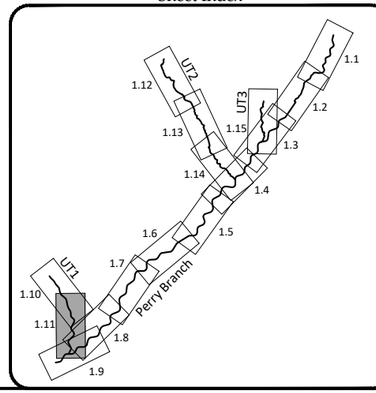

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. CRAWFORD 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT1 Reach 2
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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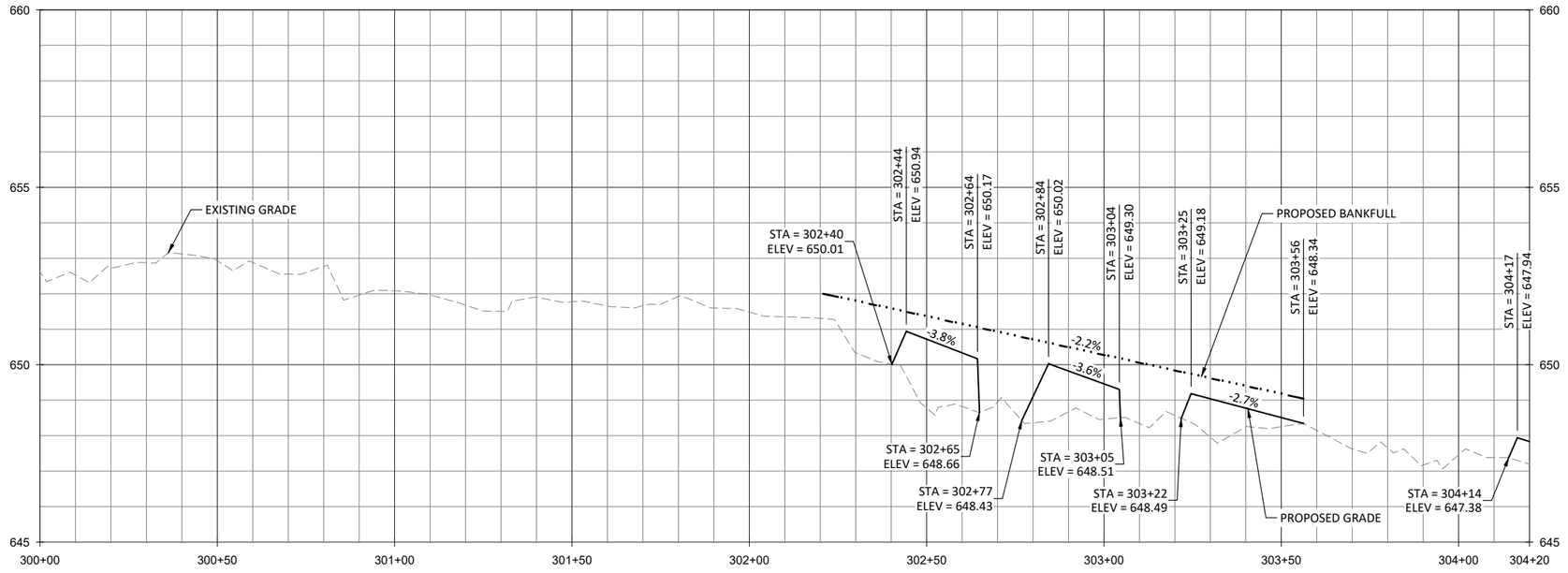
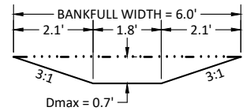
August 3, 2020

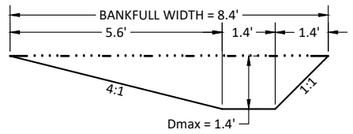


Typical Sections

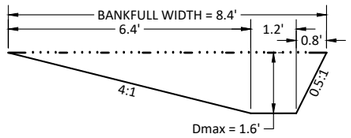
UT2 Reach 2
Riffle Section

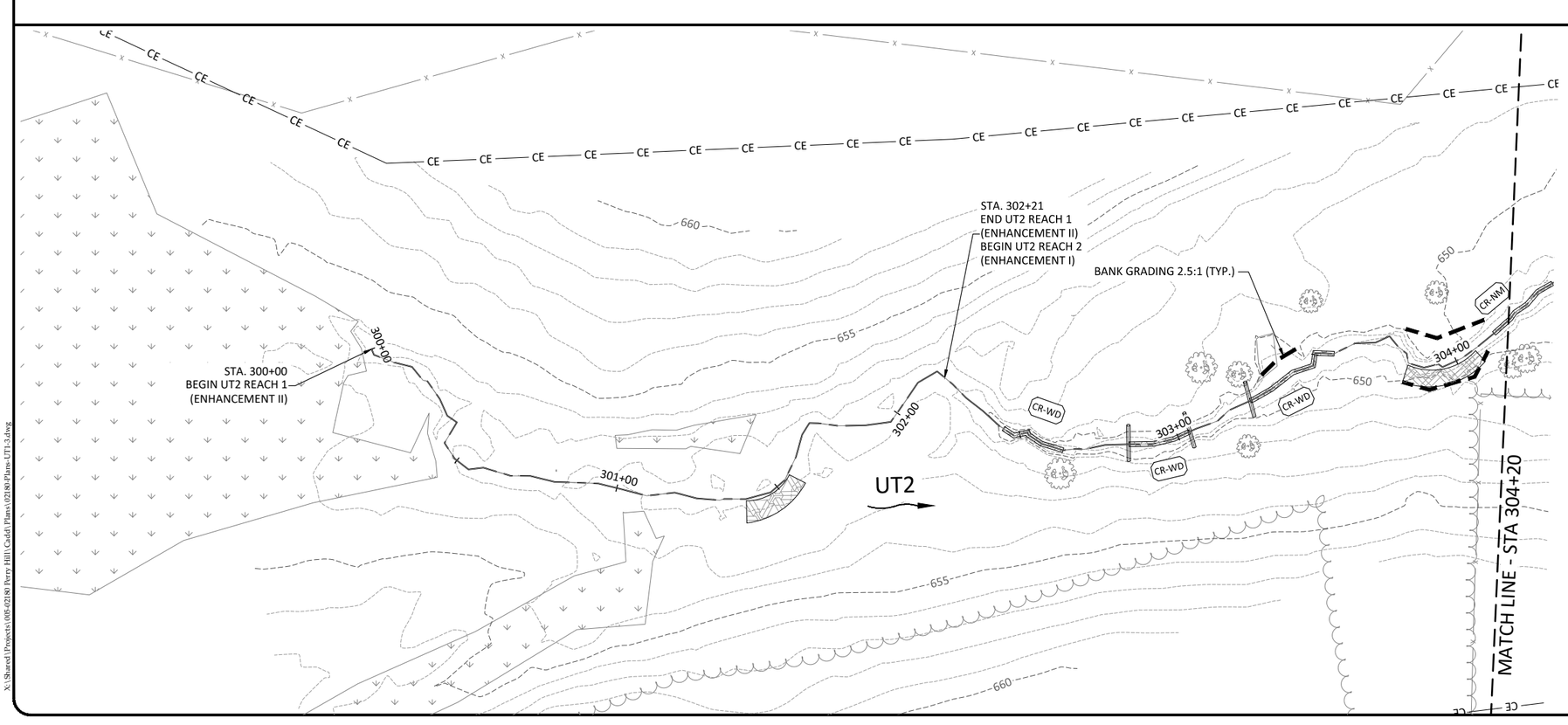


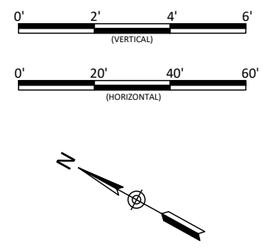
UT2 Reach 2
Pool Section



UT2 Reach 2
Pool with Structure Section







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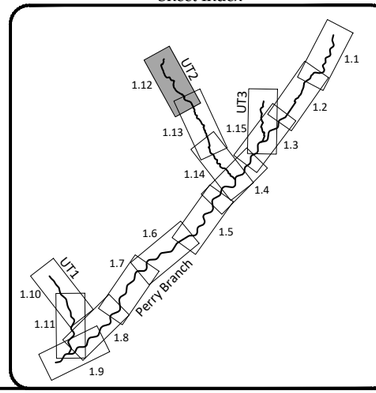

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NORTH CAROLINA PROFESSIONAL GEOLOGIST SEAL 048920 JEFFREY L. CARTER 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT2 Reach 1 & 2
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CK

Sheet 1.12

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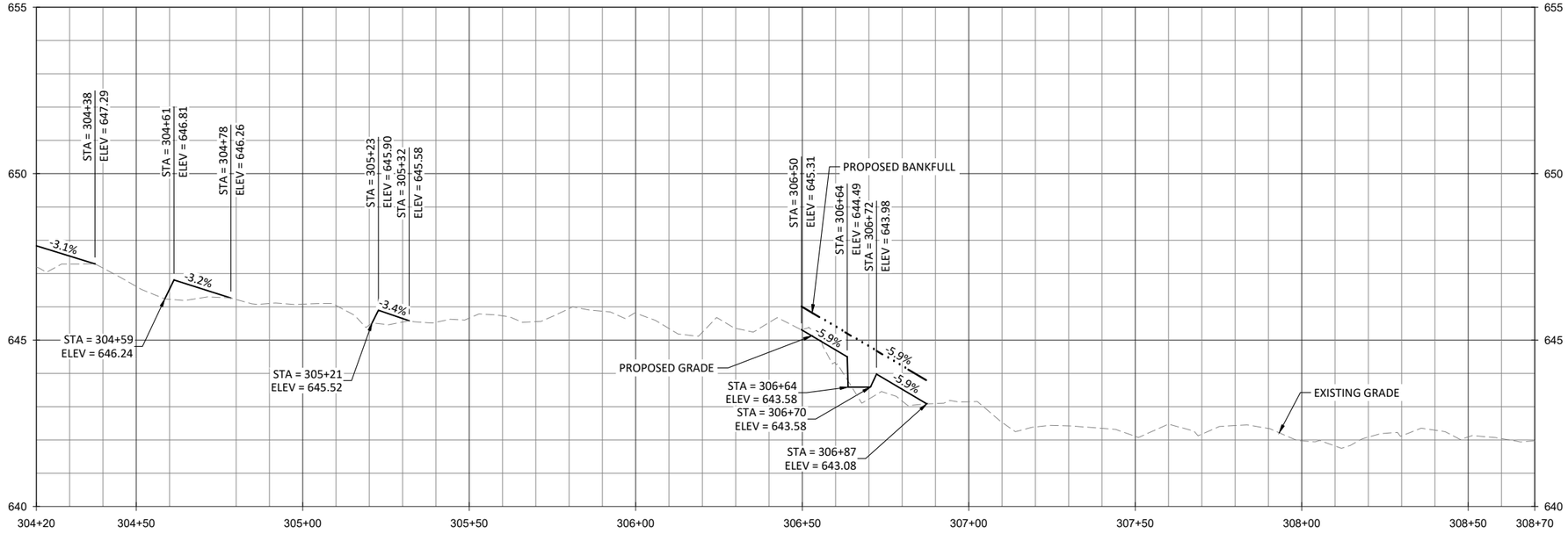
August 3, 2020



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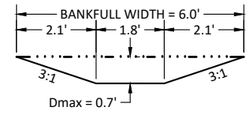
Riffle Section



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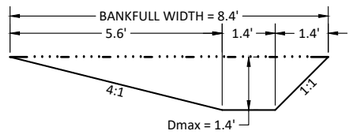
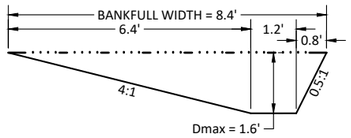
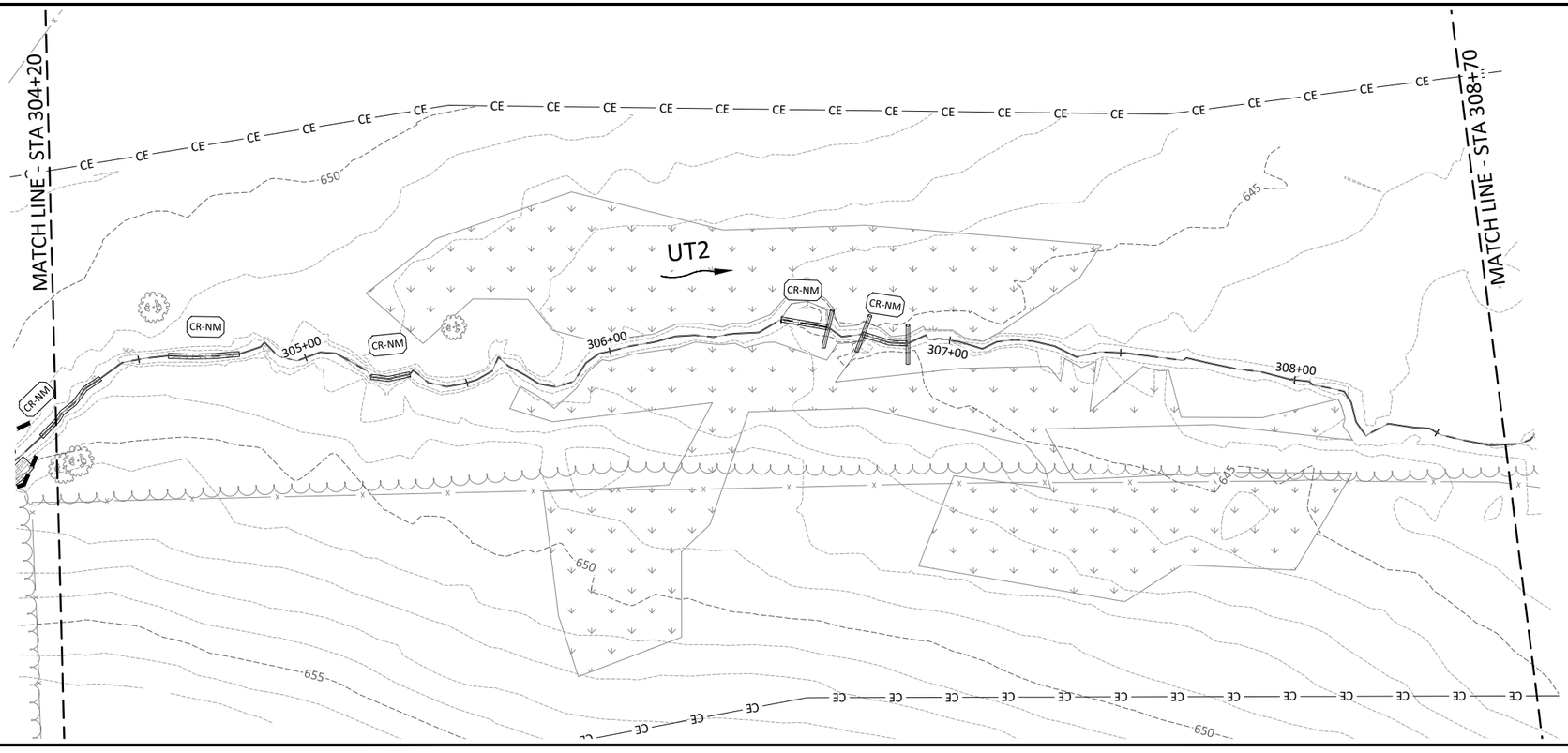
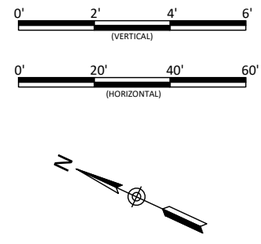


UT2 Reach 2
Pool with Structure Section







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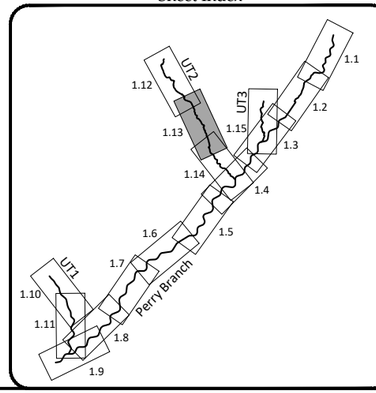

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NORTH CAROLINA PROFESSIONAL GEOLOGIST SEAL 048920 JEFFREY L. CARTER 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT2 Reach 2
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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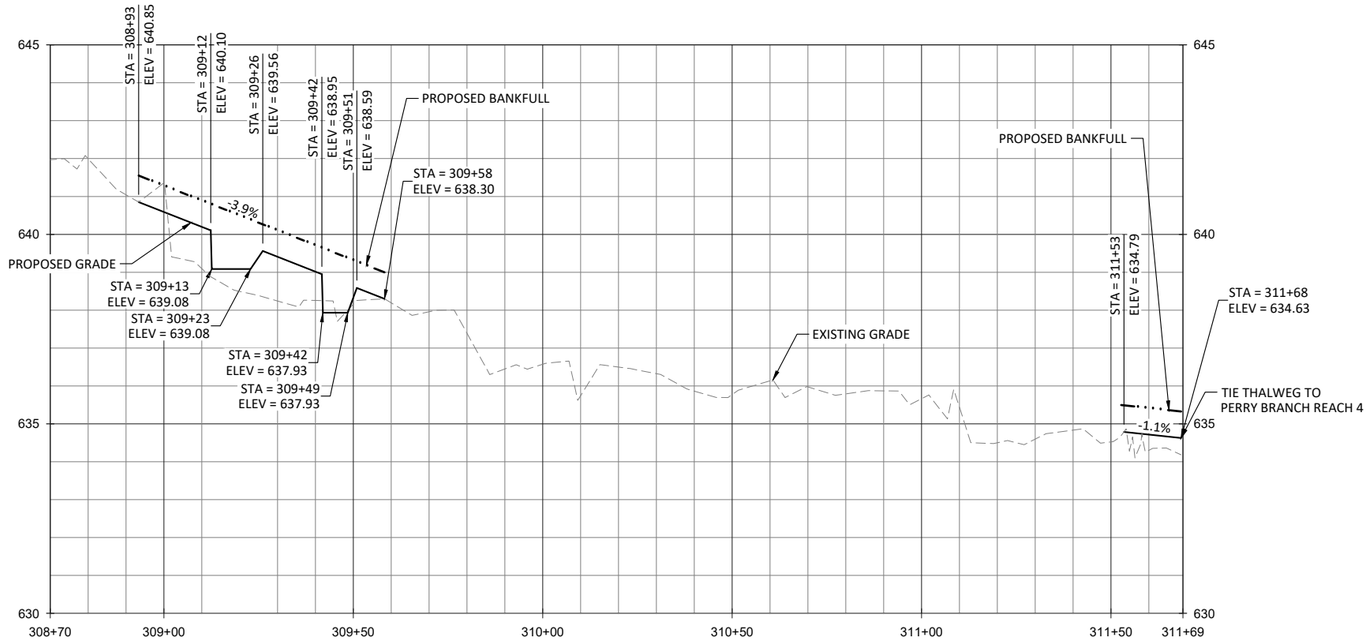
August 3, 2020



Typical Sections

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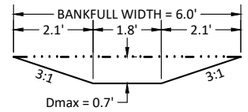
Riffle Section



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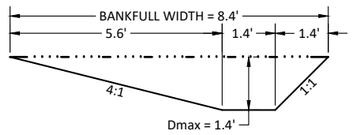
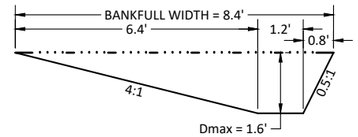
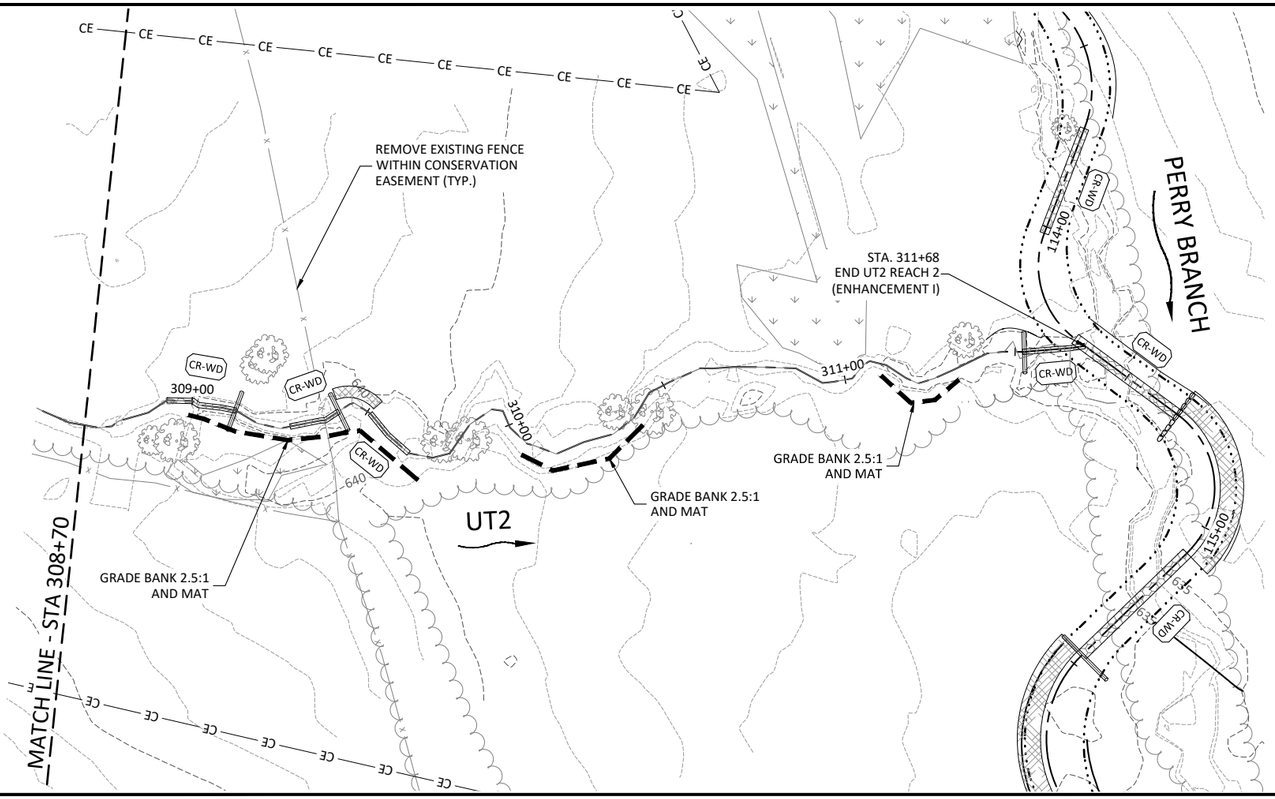
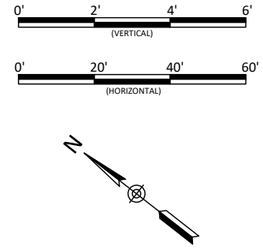
Pool Section



UT2 Reach 2
Pool with Structure Section







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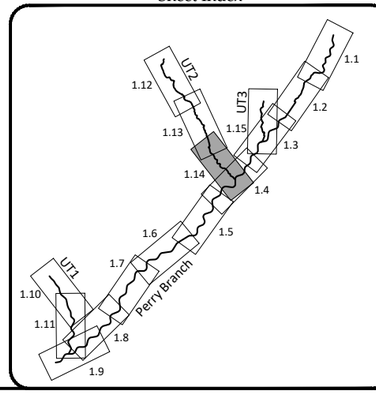

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Perry Hill Mitigation Site
Orange County, North Carolina

UT2 Reach 2
Stream Plan and Profile

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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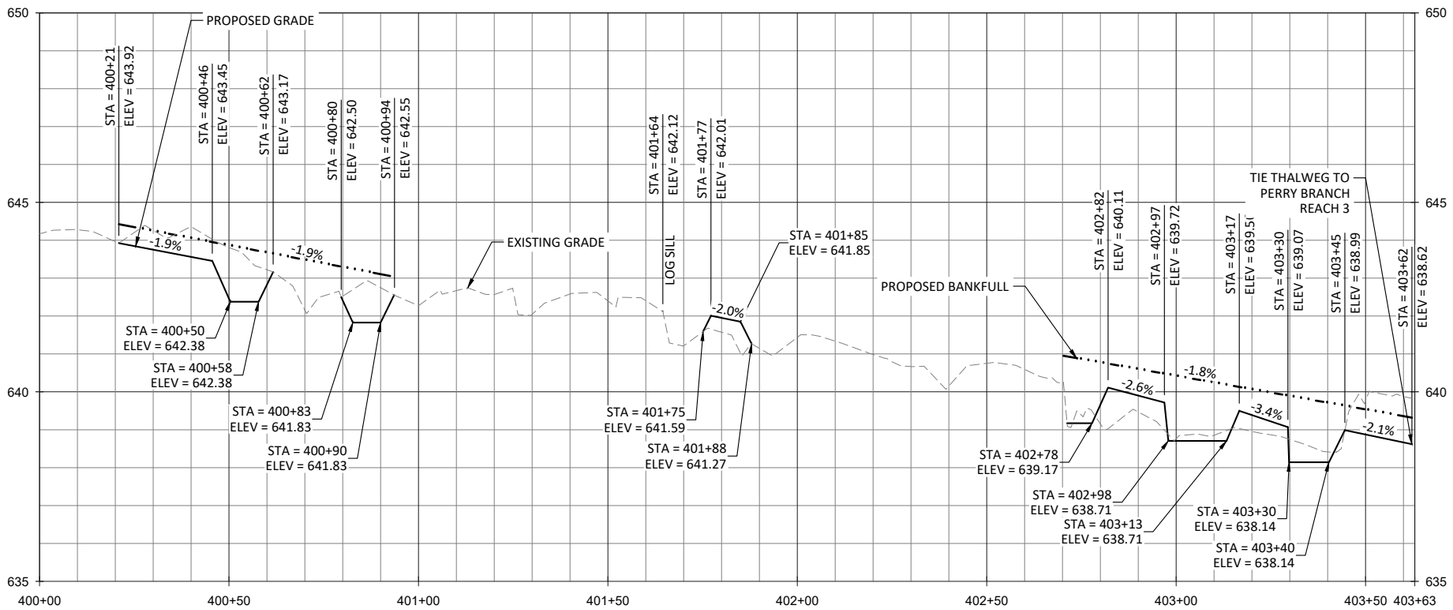
September 4, 2020



Typical Sections

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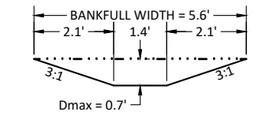
Riffle Section



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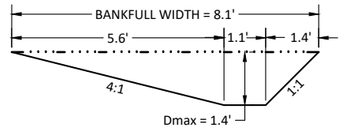
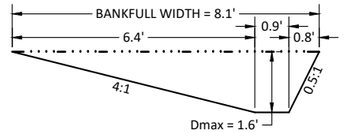
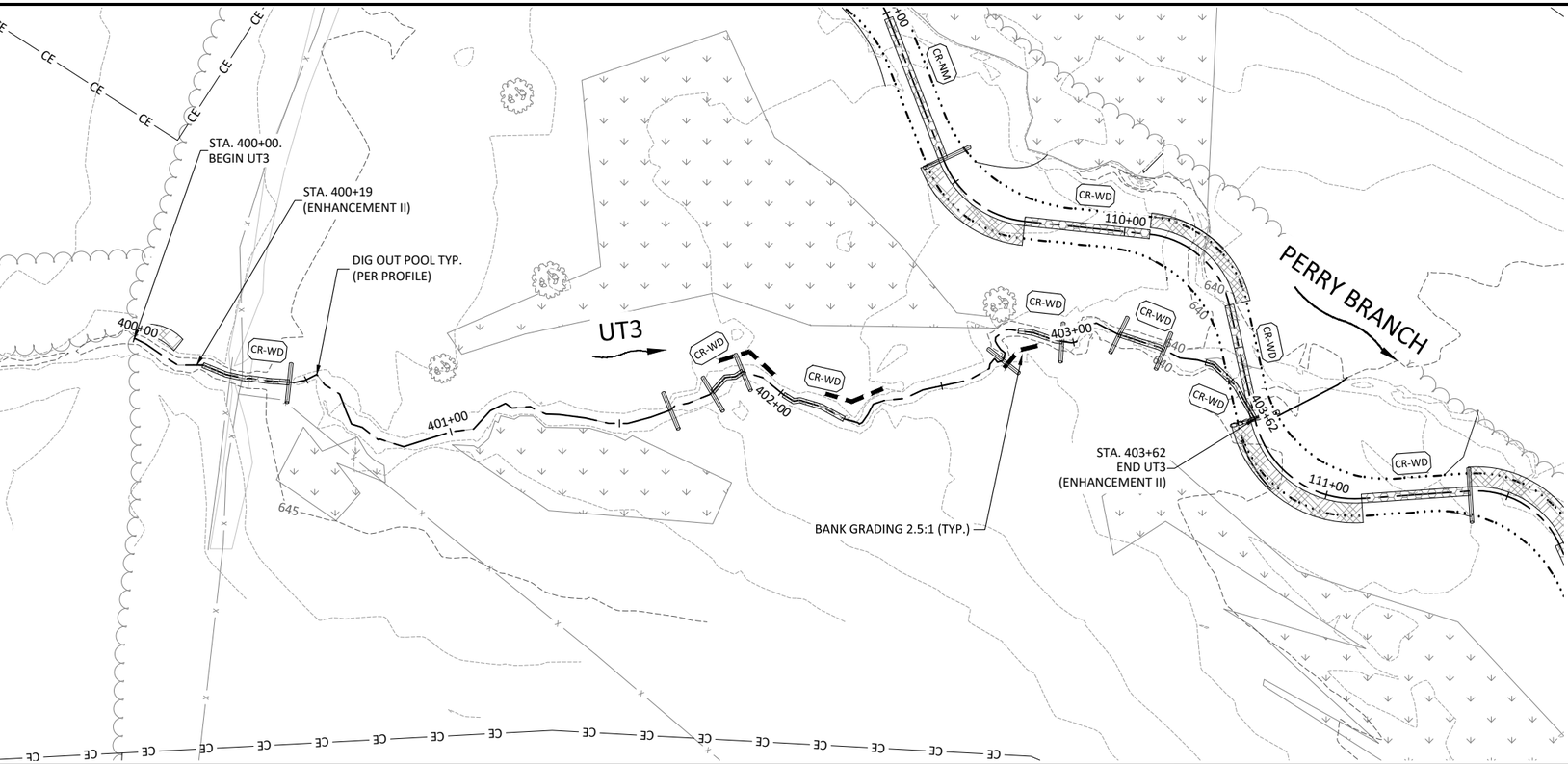
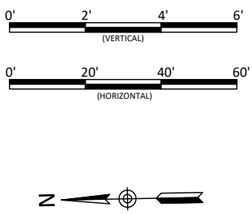
Pool Section



UT3
Pool with Structure Section







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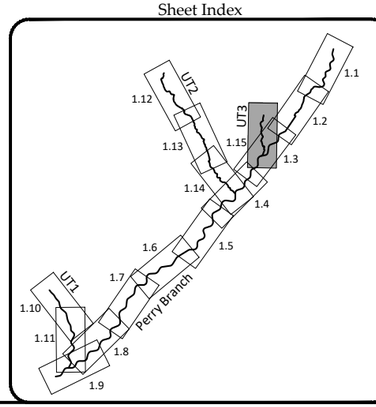

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Perry Hill Mitigation Site
Orange County, North Carolina

UT3
Stream Plan and Profile

Revisions:

Date:	08.21.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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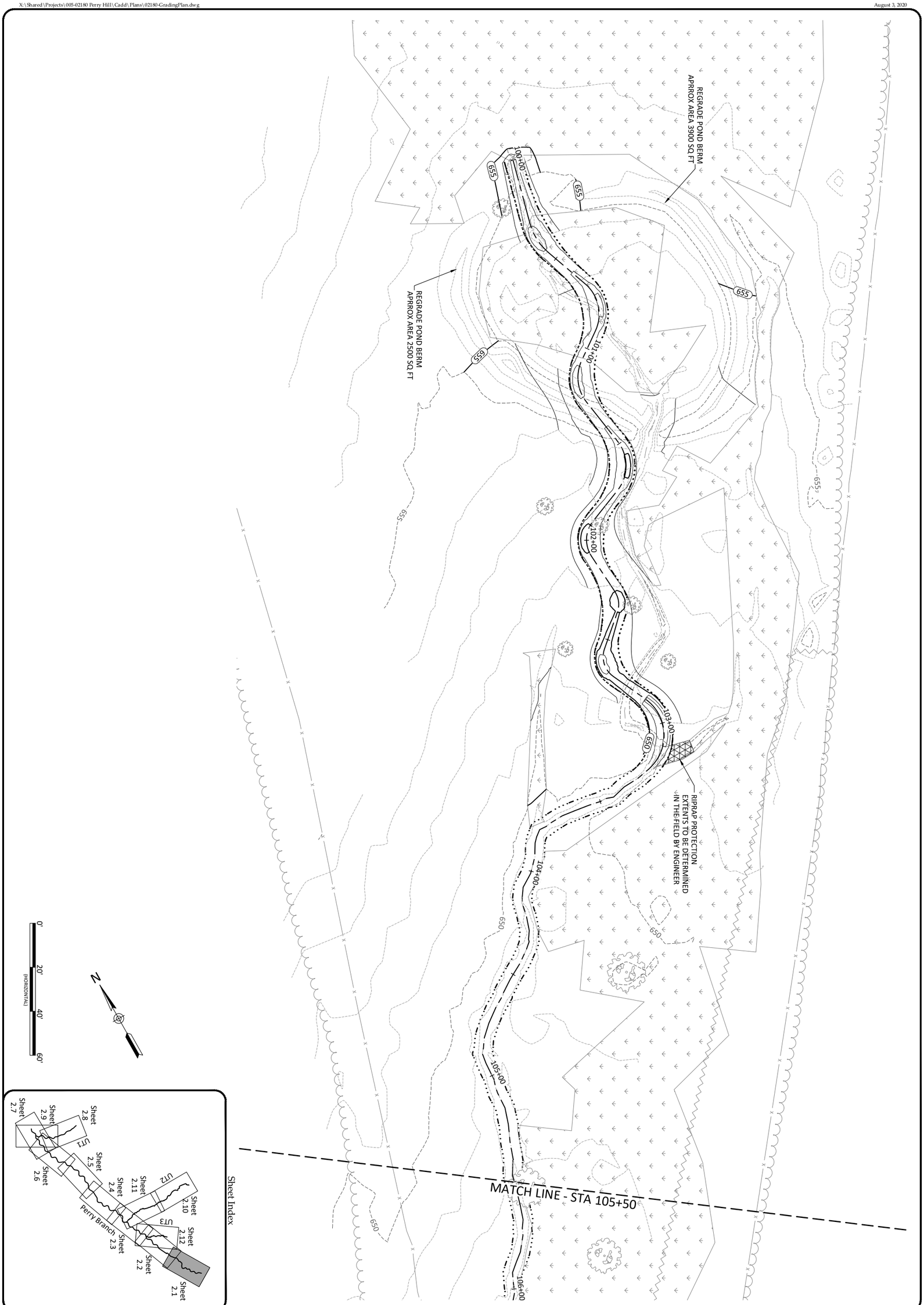
X:\Shared\Projects\005-02180 Perry Hill\Cadd\Plans\02180-GradingPlan.dwg August 3, 2020



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL SEAL 047920 ENGINEER GEOFFREY L. SMITH
7/23/20

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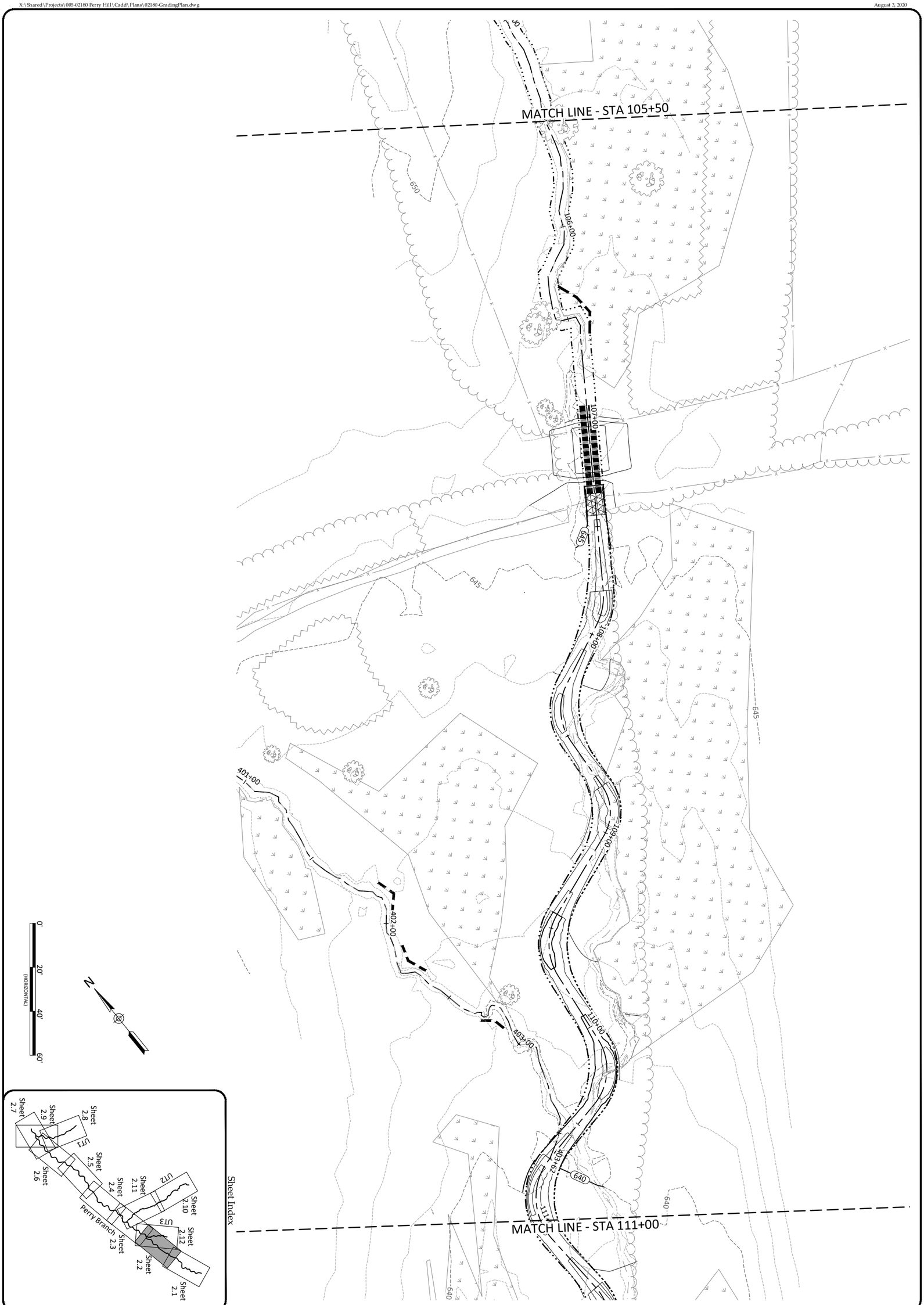
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

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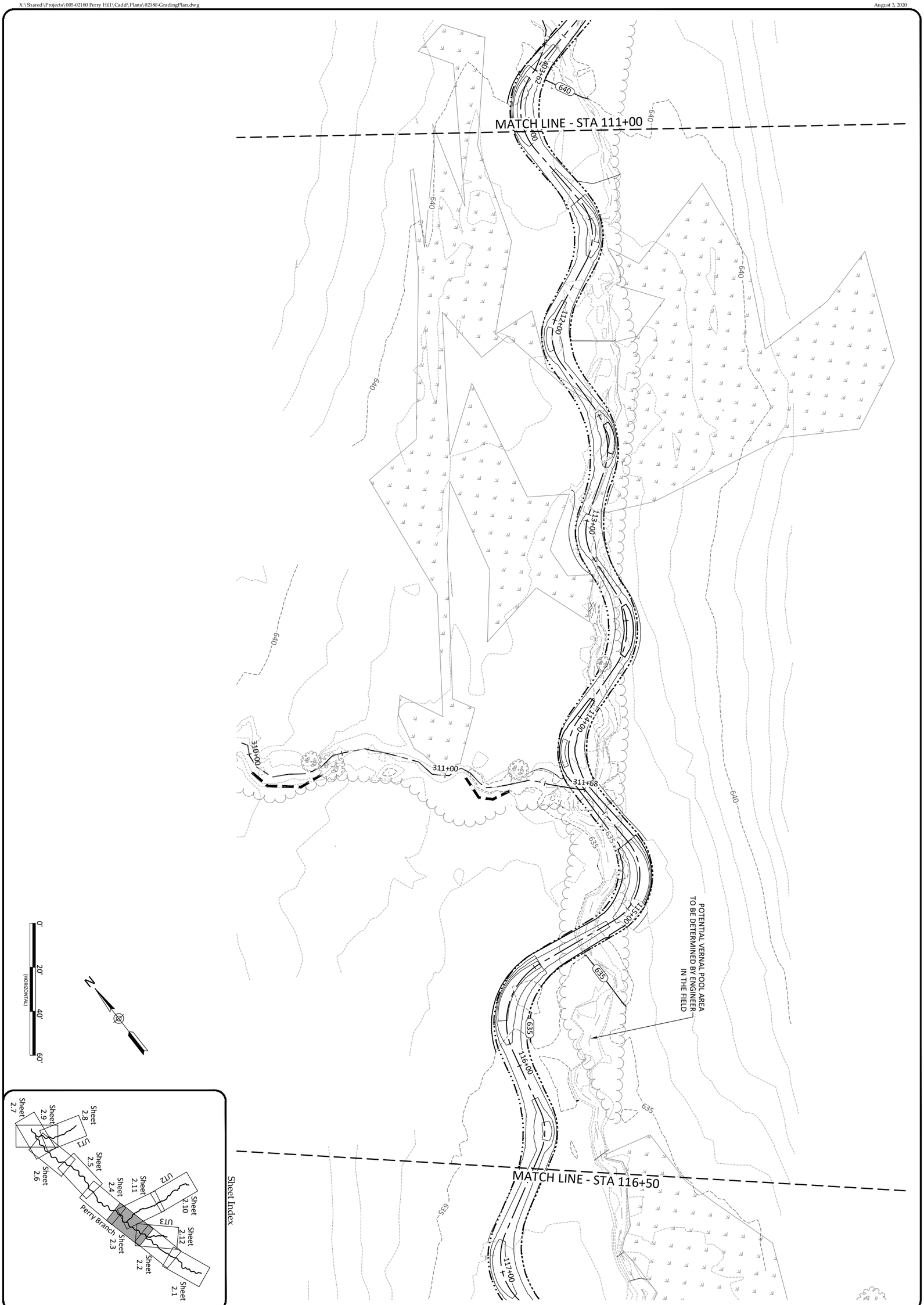
Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL SEAL 042920 ENGINEER GREGORY L. SMITH
7/23/20

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

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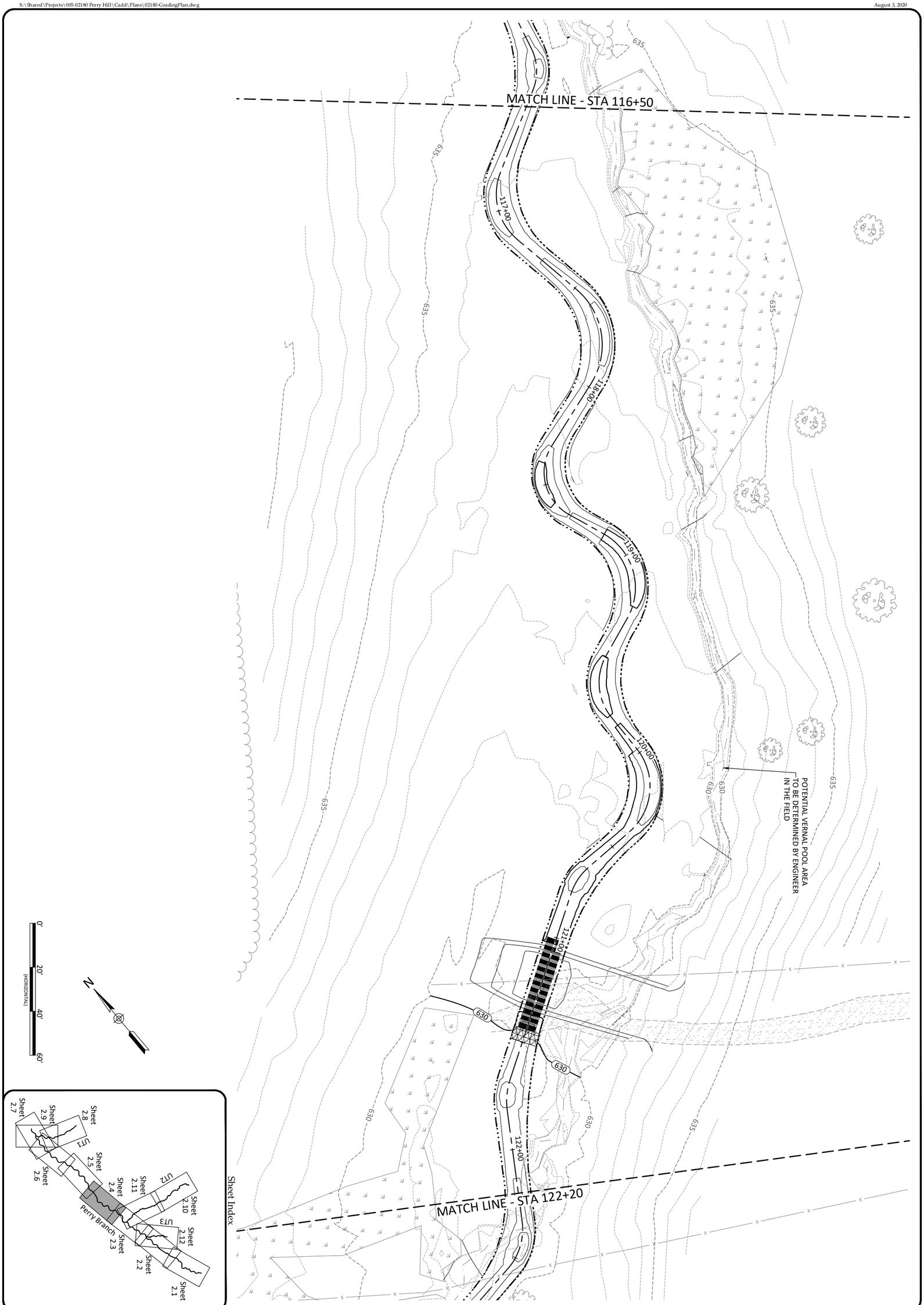
Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL SEAL 047920 ENGINEER GEOFFREY L. SMITH
7/23/20

WILDLANDS ENGINEERING
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 047920 GEOFFREY L. SMITH
7/23/20

WILDLANDS ENGINEERING
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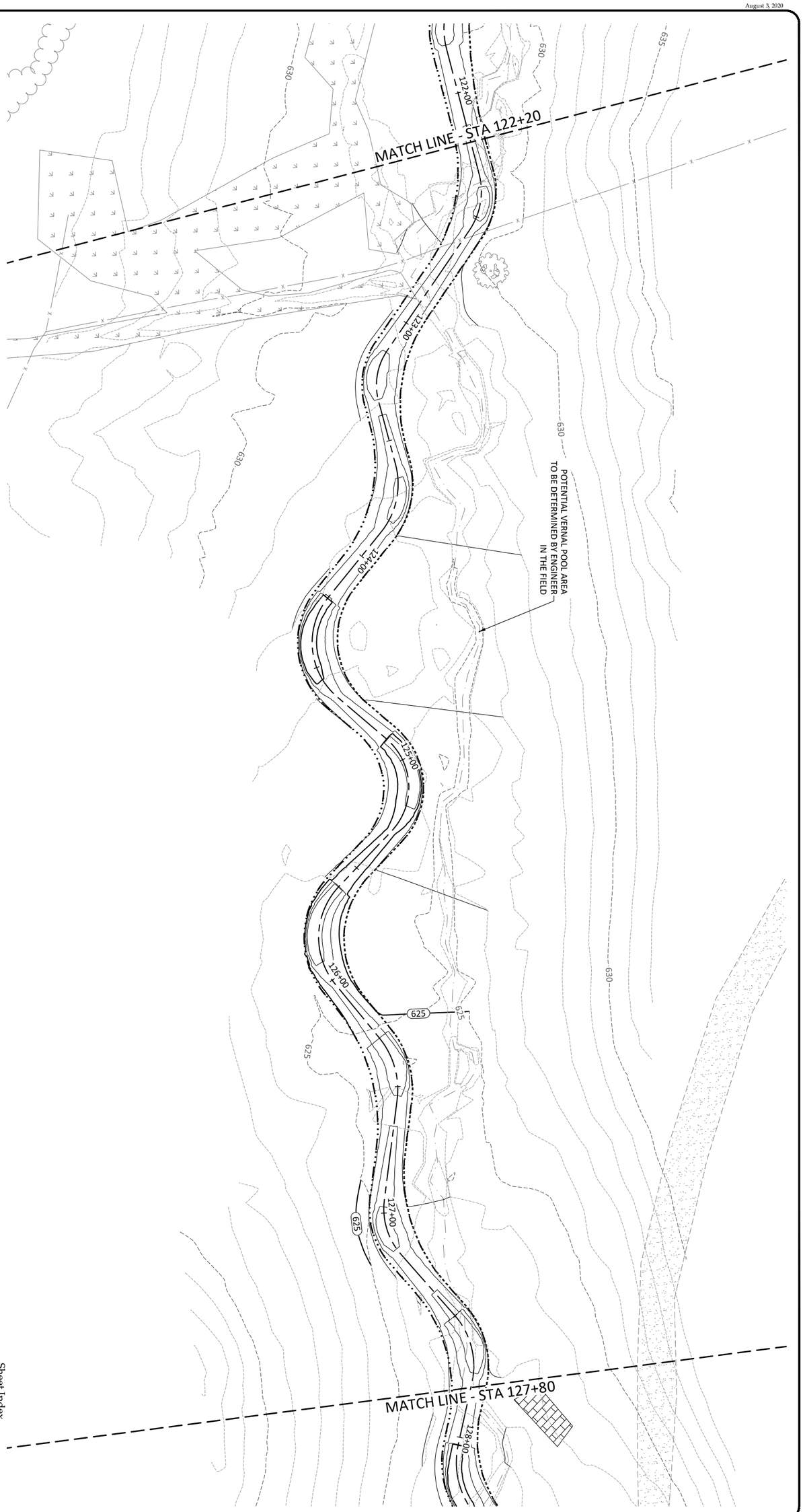
Mount Pleasant, SC 29464
Tel: 843.277.6221



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(HORIZONTAL)

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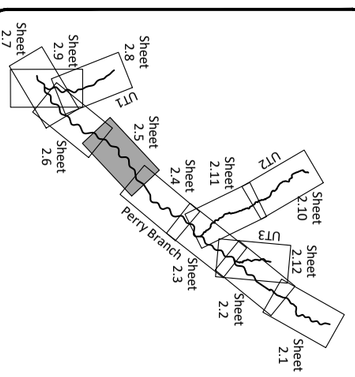

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Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 047920 GODFREY L. LYNCH
7/23/20

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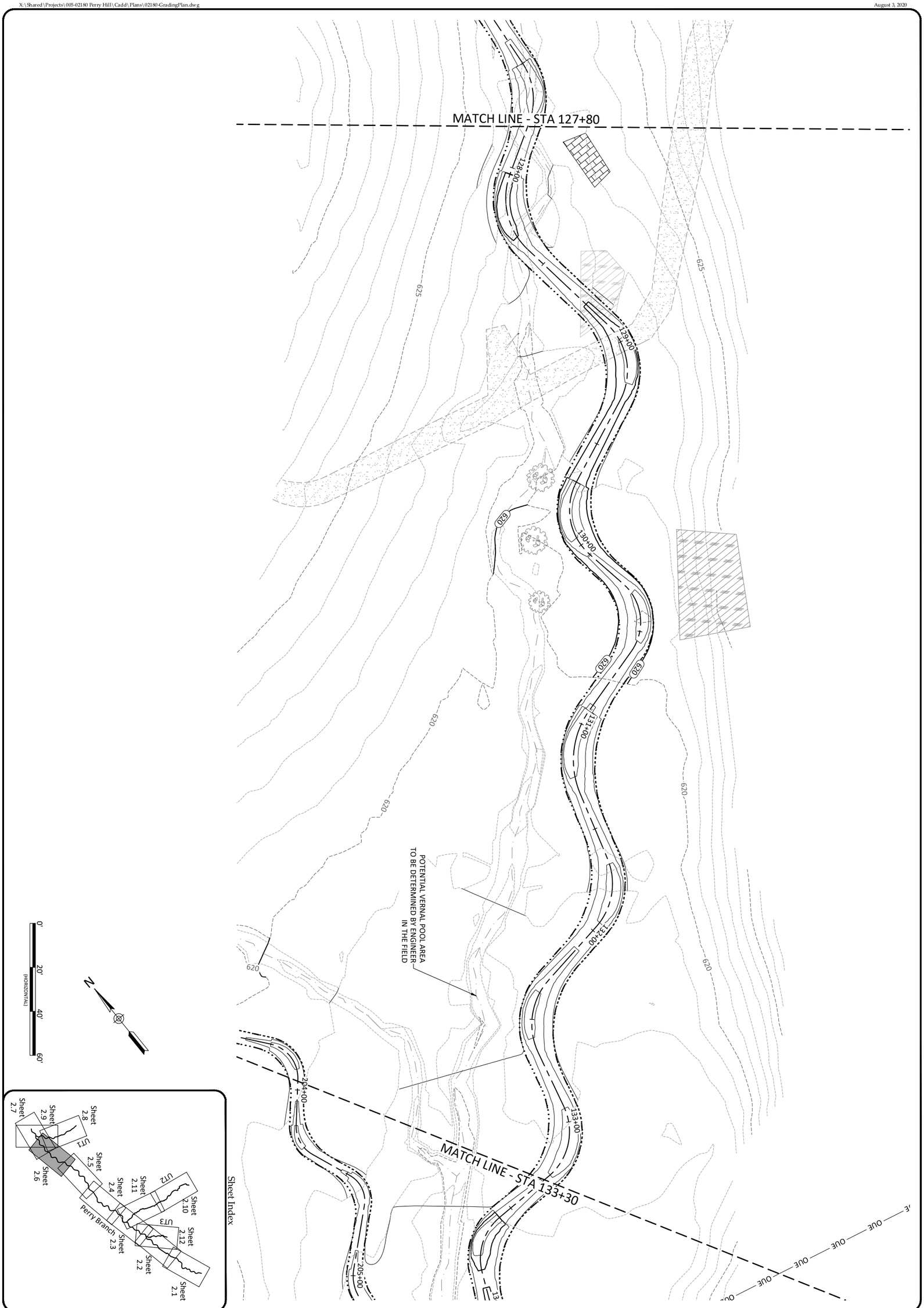
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 042920 GEOFFREY L. SMITH
7/23/20

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Mount Pleasant, SC 29464
Tel: 843.277.6221

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Grading Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 042920 GREGORY L. CRISP
7/23/20

WILDLANDS ENGINEERING
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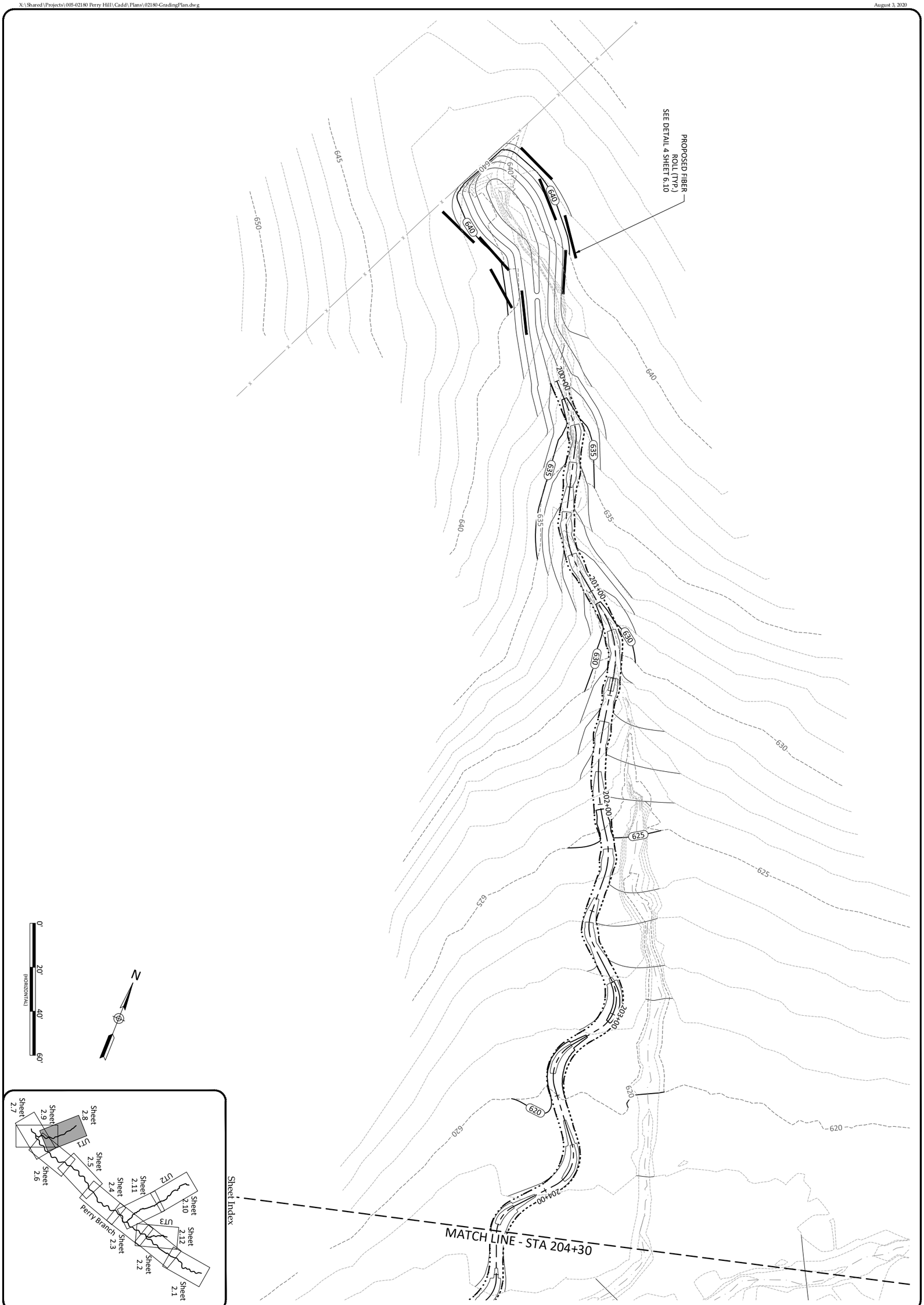
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

UT1
Grading Plan

NORTH CAROLINA PROFESSIONAL SEAL 042920 ENGINEER GREGORY L. SMITH
7/23/20

WILDLANDS ENGINEERING
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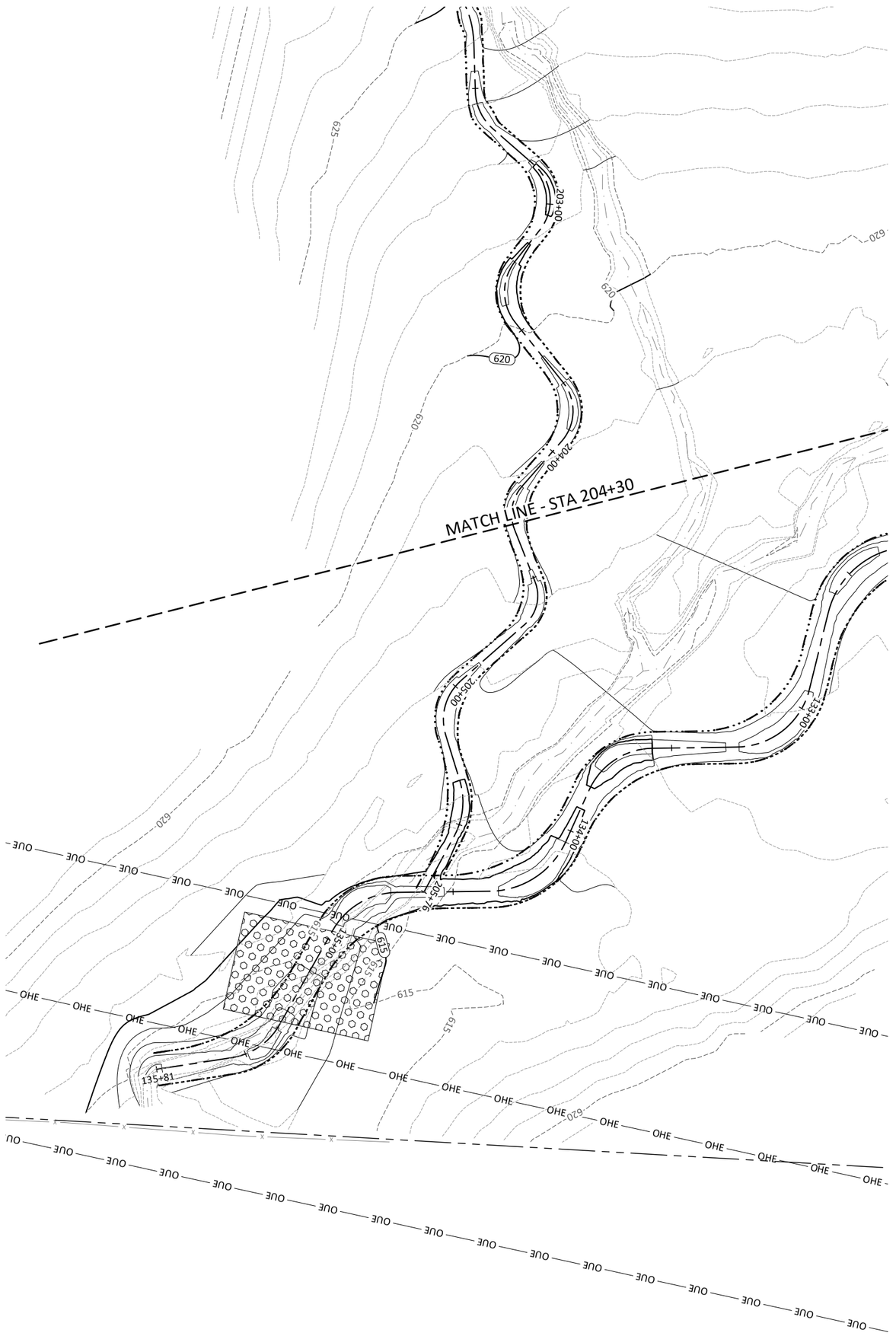
Mount Pleasant, SC 29464
Tel: 843.277.6221



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(HORIZONTAL)

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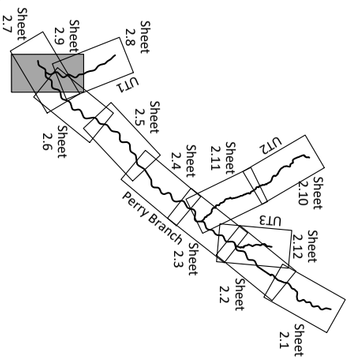

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Date:	07.23.2020
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Project Engineer:	LAD
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Perry Hill Mitigation Site
Orange County, North Carolina

UT1
Grading Plan

NORTH CAROLINA PROFESSIONAL SEAL 042920 ENGINEER GEOFFREY L. SMITH
7/23/20

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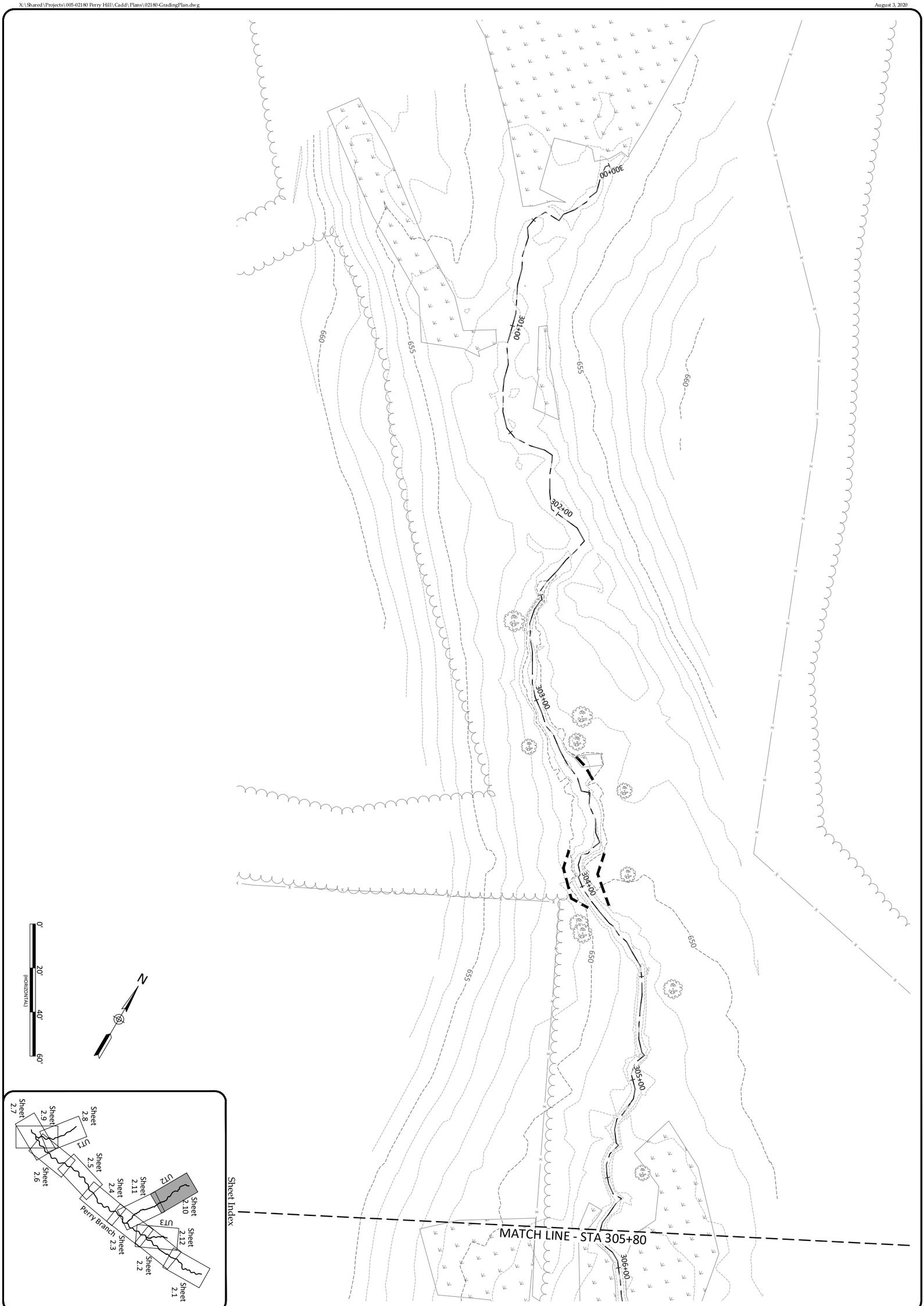
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
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Perry Hill Mitigation Site
Orange County, North Carolina

UT2
Grading Plan

NORTH CAROLINA PROFESSIONAL SEAL 047920 ENGINEER GEOFFREY L. SMITH
7/23/20

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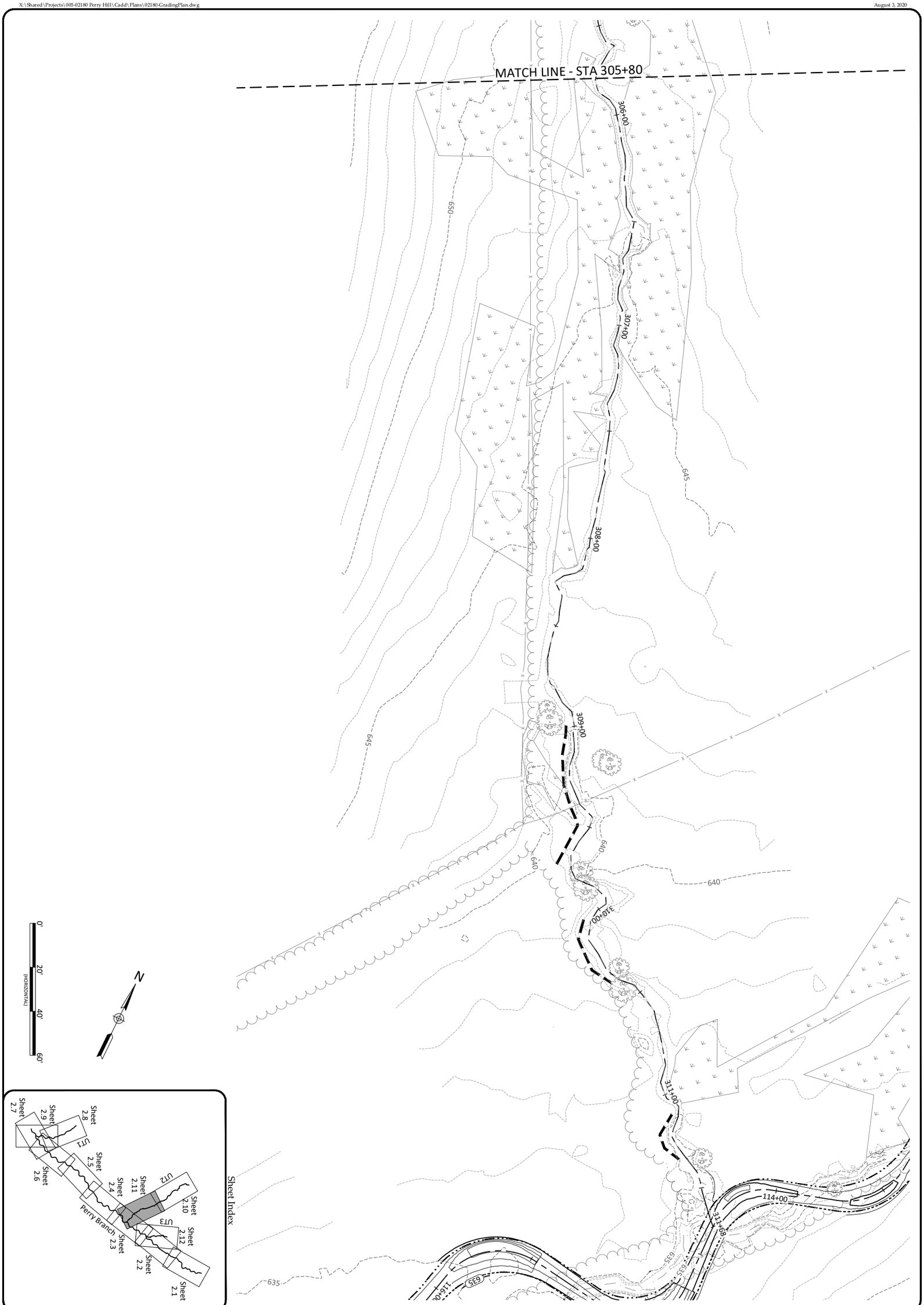
Mount Pleasant, SC 29464
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

UT2
Grading Plan

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7/23/20

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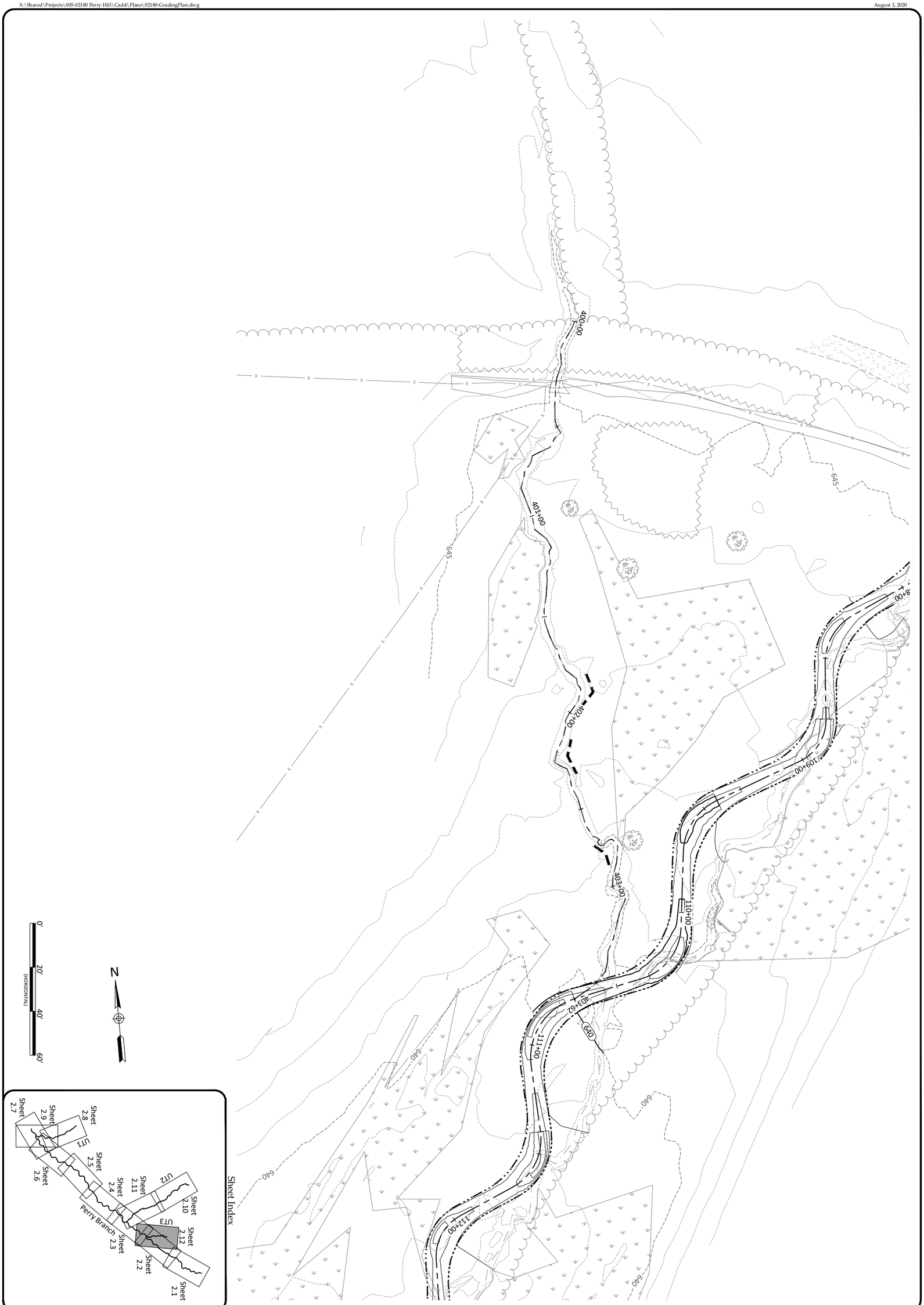
Tel: 843.277.6221



Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

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Perry Hill Mitigation Site
Orange County, North Carolina

UT3
Grading Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 047920 GEOFFREY L. SMITH 7/23/20

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Mount Pleasant, SC 29464
Tel: 843.277.6221

August 3, 2020

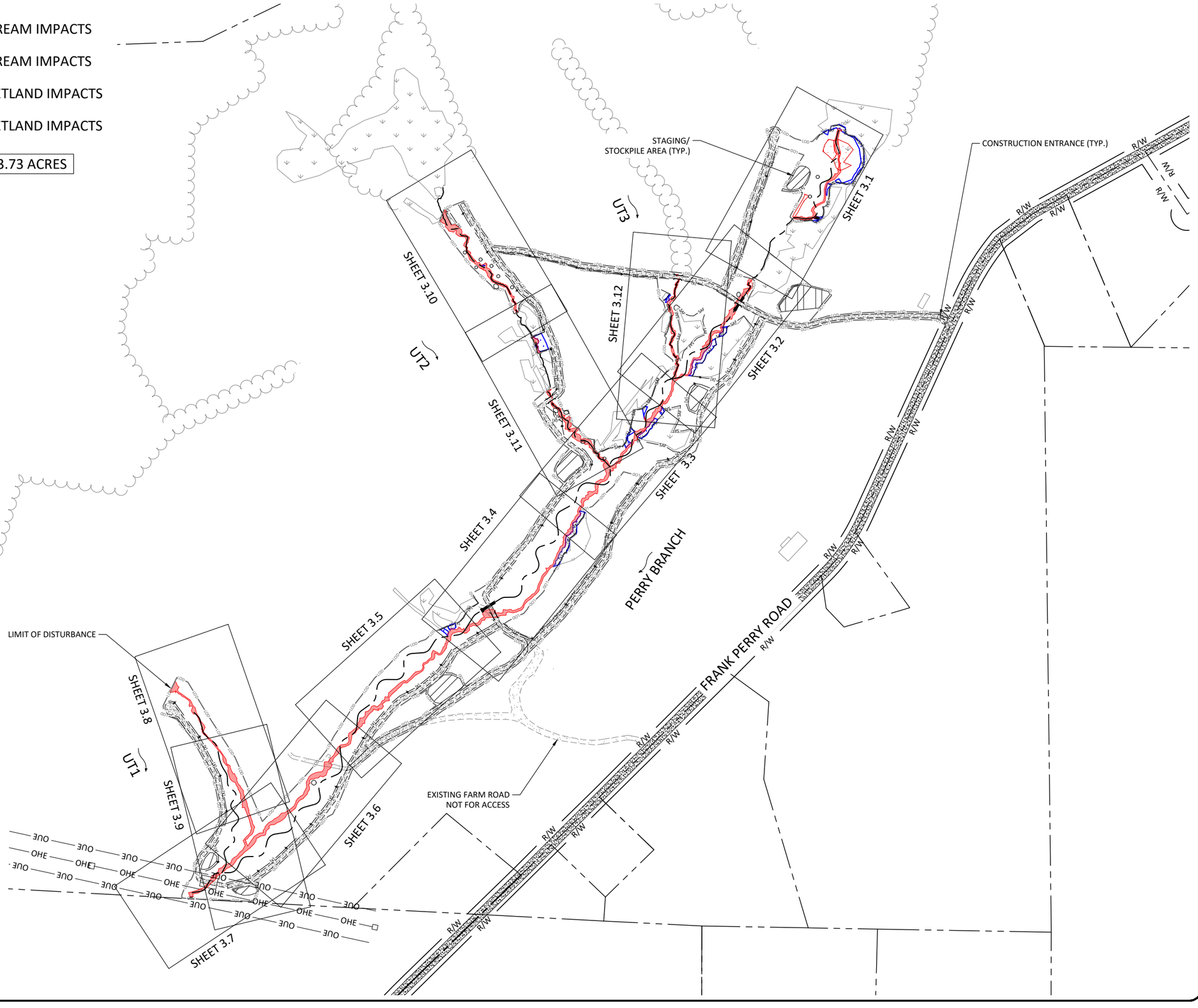
PERMANENT STREAM IMPACTS

TEMPORARY STREAM IMPACTS

PERMANENT WETLAND IMPACTS

TEMPORARY WETLAND IMPACTS

TOTAL DISTURBED AREA = 13.73 ACRES



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 040920 GEOFFREY S. HILLIS 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

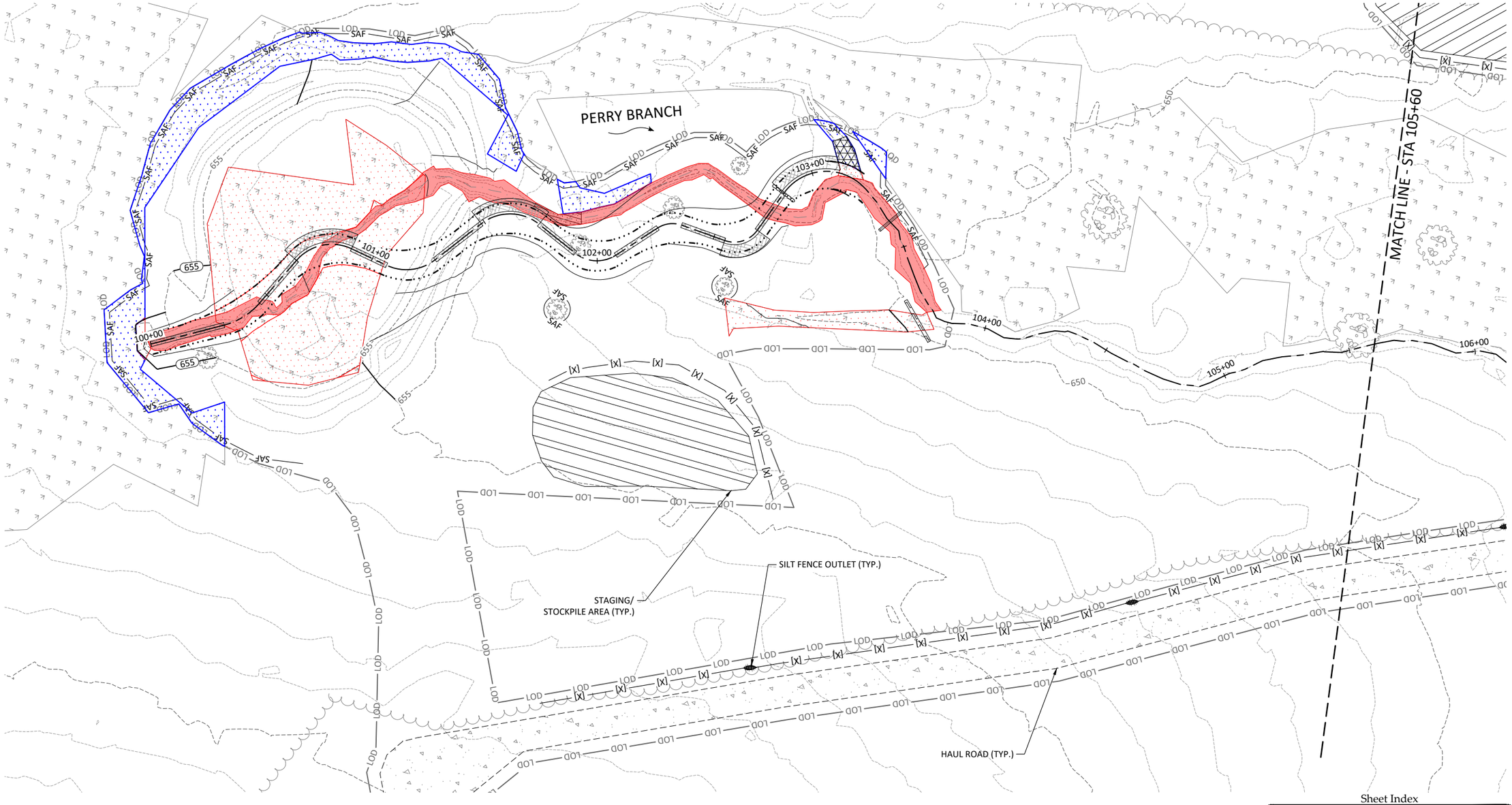
Erosion and Sediment Control Plan Overview

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

Sheet 3.0

August 3, 2020



PERMANENT STREAM IMPACTS

TEMPORARY STREAM IMPACTS

PERMANENT WETLAND IMPACTS

TEMPORARY WETLAND IMPACTS

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(HORIZONTAL)

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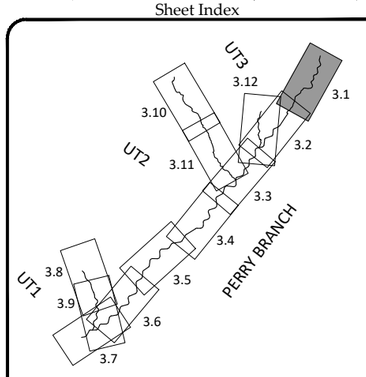

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 040920 H. LINDSAY GEOFFREY

7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 1 & 2
Erosion and Sediment Control Plan

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CK

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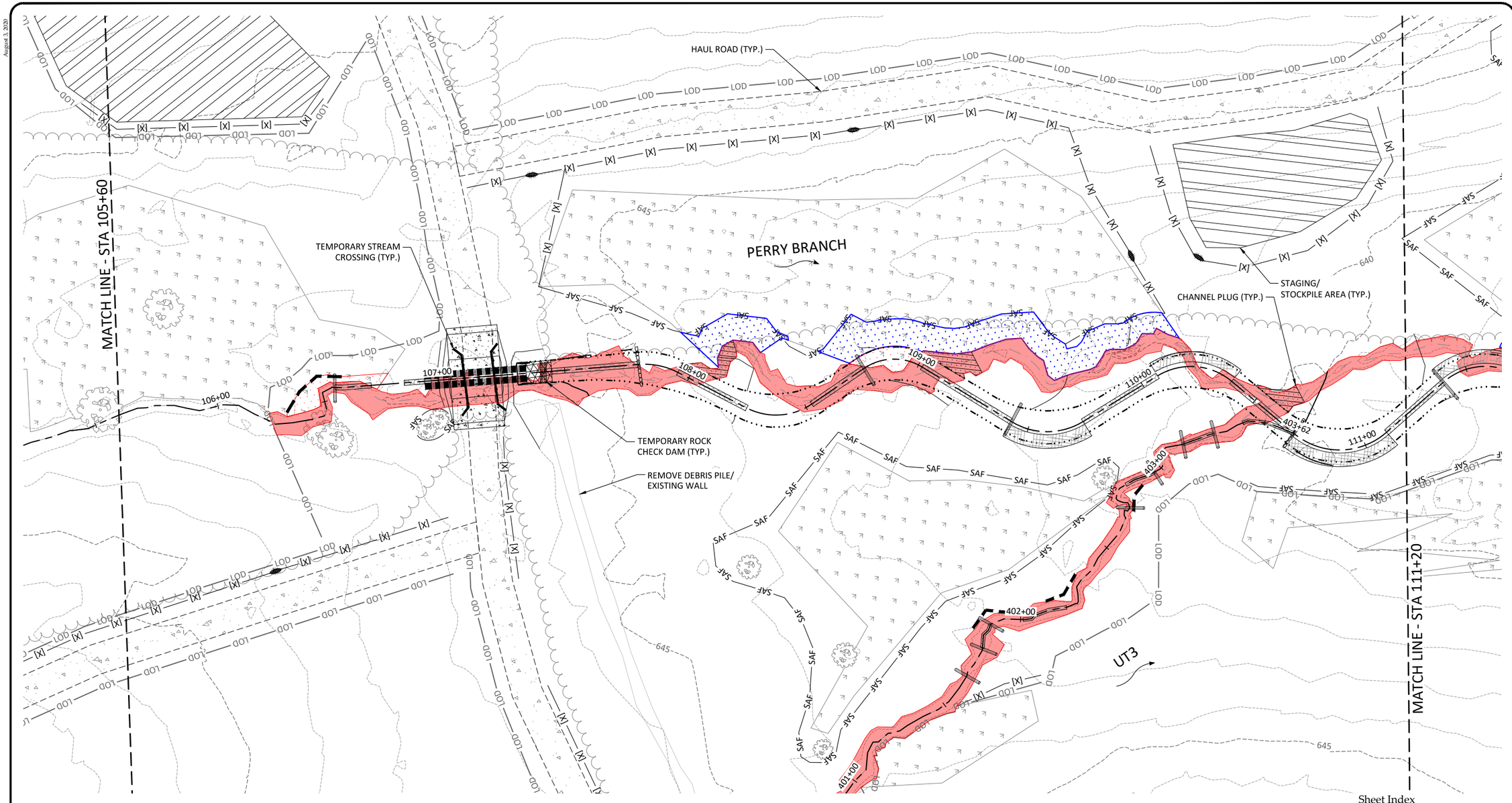
August 3, 2020



PERMANENT STREAM IMPACTS

TEMPORARY STREAM IMPACTS

PERMANENT WETLAND IMPACTS

TEMPORARY WETLAND IMPACTS

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0' 20' 40' 60'
(HORIZONTAL)

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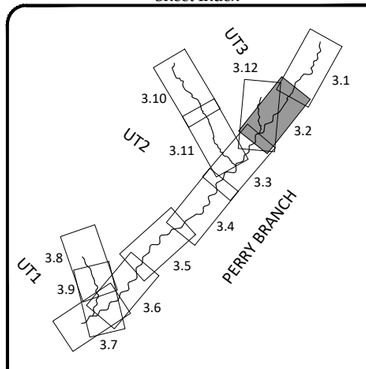

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 2 & 3
Erosion and Sediment Control Plan

Revisions:

Date:	07.23.2020
Job Number:	005-02180
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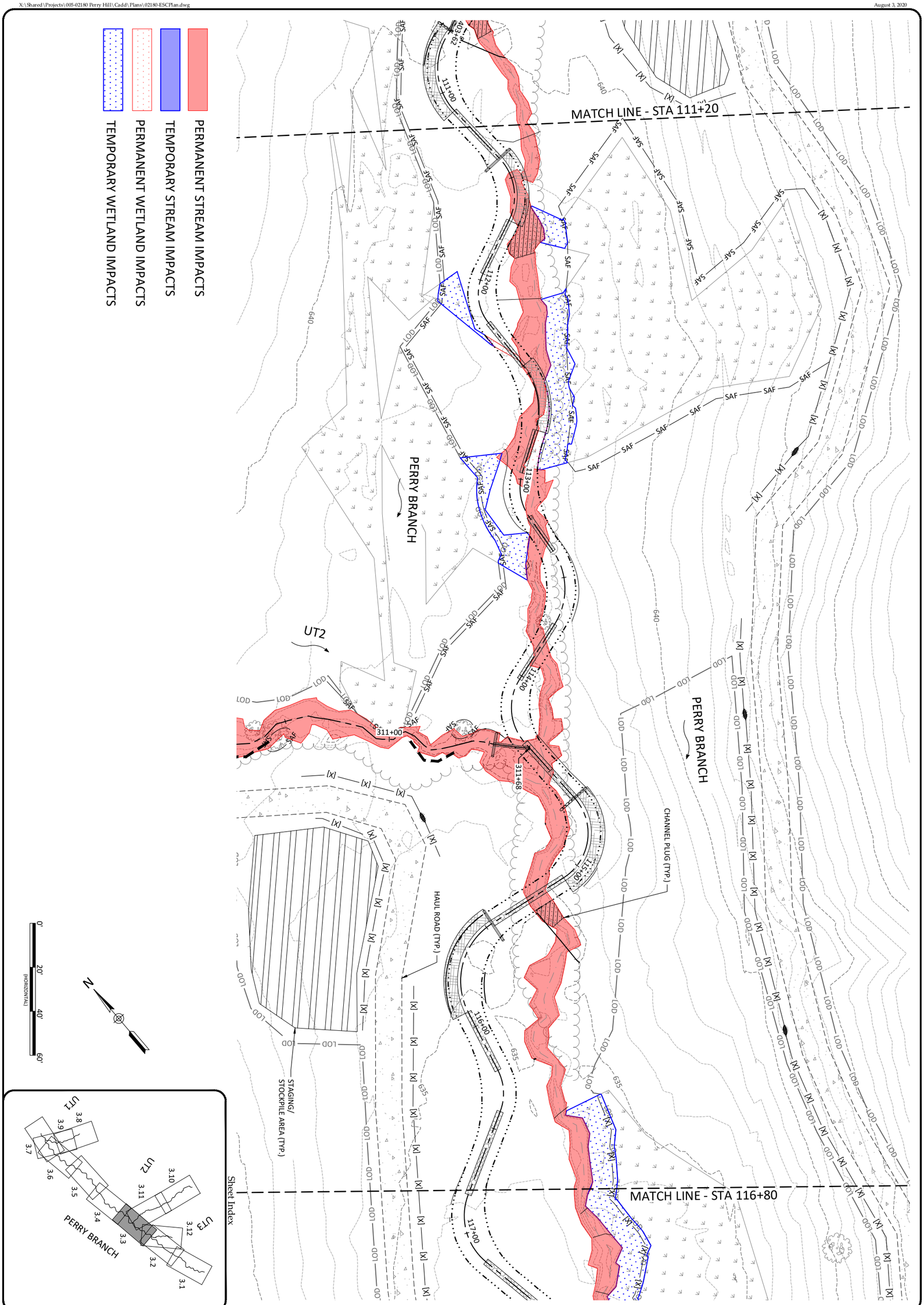

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 3 & 4
Erosion and Sediment Control Plan

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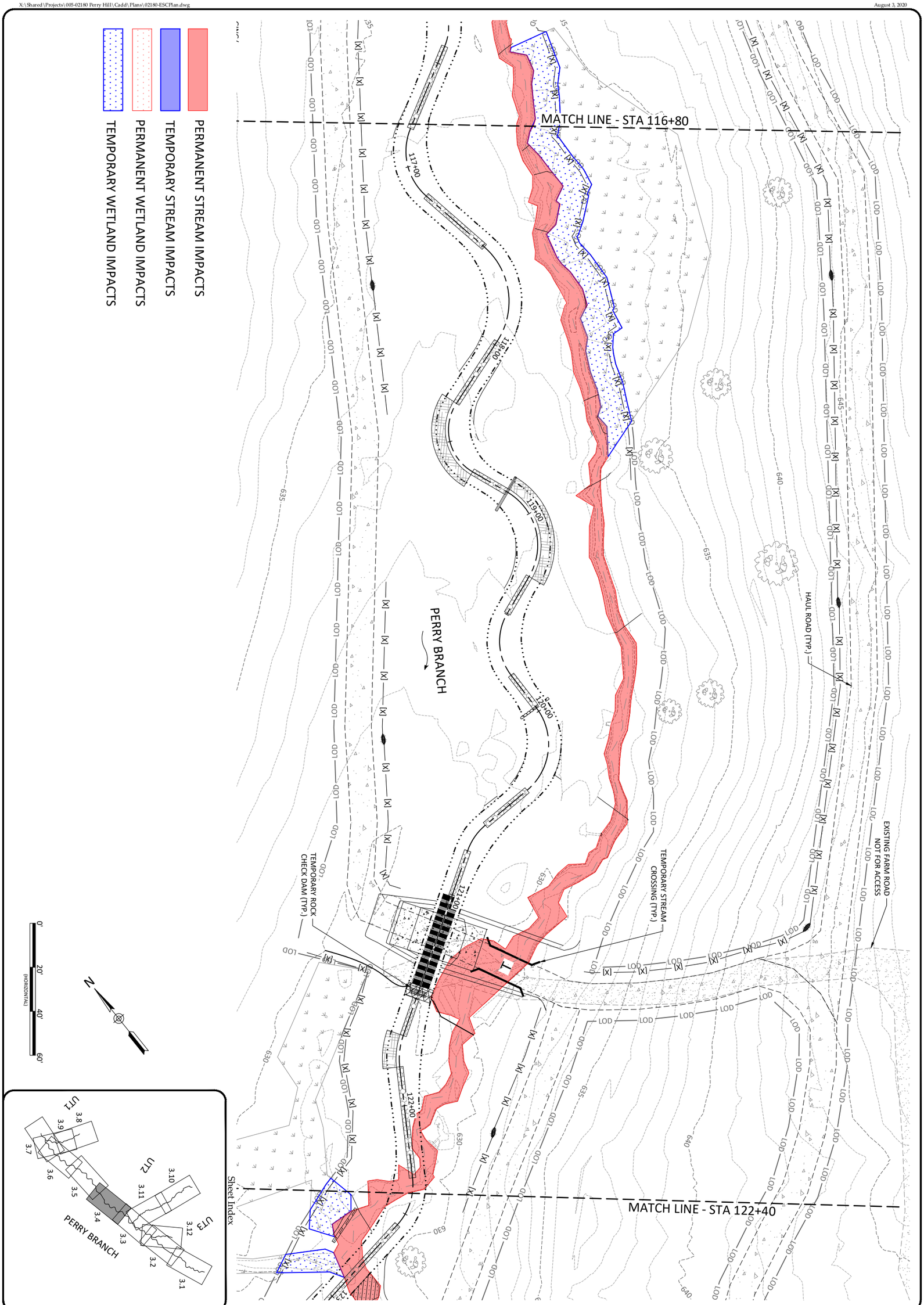

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Erosion and Sediment Control Plan

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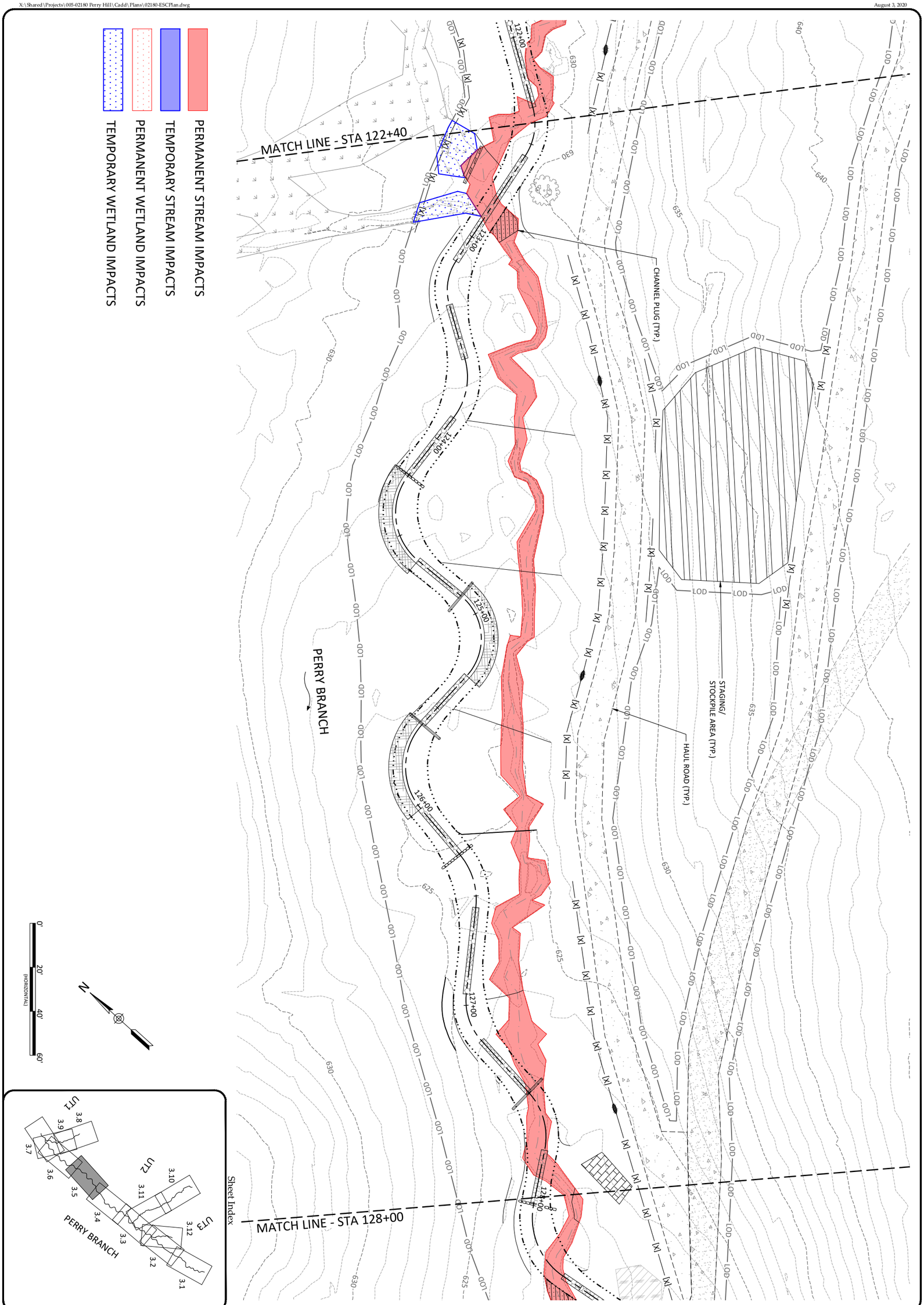

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4
Erosion and Sediment Control Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 047920 GEOFFREY L. LYNCH
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August 3, 2020

MATCH LINE - STA 128+00

MATCH LINE - STA 133+60

REMOVE DEBRIS PILE

HAUL ROAD (TYP.)

CHANNEL PLUG (TYP.)

PERRY BRANCH

UT1

UT2

UT3

LOD

OUE

SAF

[X]

635

630

625

620

124+00

129+00

130+00

131+00

132+00

133+00

134+00

204+00

205+00

PERMANENT STREAM IMPACTS

TEMPORARY STREAM IMPACTS

PERMANENT WETLAND IMPACTS

TEMPORARY WETLAND IMPACTS

N

0' 20' 40' 60'

(HORIZONTAL)

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PERRY BRANCH

UT1

UT2

UT3

Sheet Index

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7/23/20

Perry Hill Mitigation Site

Orange County, North Carolina

Perry Branch Reach 4

Erosion and Sediment Control Plan

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: LAD
Drawn By: MC/ABP
Checked By: CR

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August 3, 2020

PERRY BRANCH

HAUL ROAD (TYP.)

STAGING/
STOCKPILE AREA (TYP.)

TEMPORARY ROCK
CHECK DAM (TYP.)

PERRY BRANCH

UT1

MATCH LINE - STA 133+60

132+00
133+00
134+00
135+00
135+81
205+76
205+00
204+00

635
630
625
620
615

LOD
OHE
OUE
DOT
[X]

PERMANENT STREAM IMPACTS

TEMPORARY STREAM IMPACTS

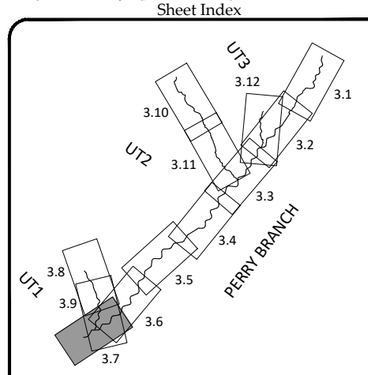
PERMANENT WETLAND IMPACTS

TEMPORARY WETLAND IMPACTS

N

0' 20' 40' 60'
(HORIZONTAL)

Sheet Index



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Perry Hill Mitigation Site

Orange County, North Carolina

Perry Branch Reach 4

Erosion and Sediment Control Plan

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: LAD
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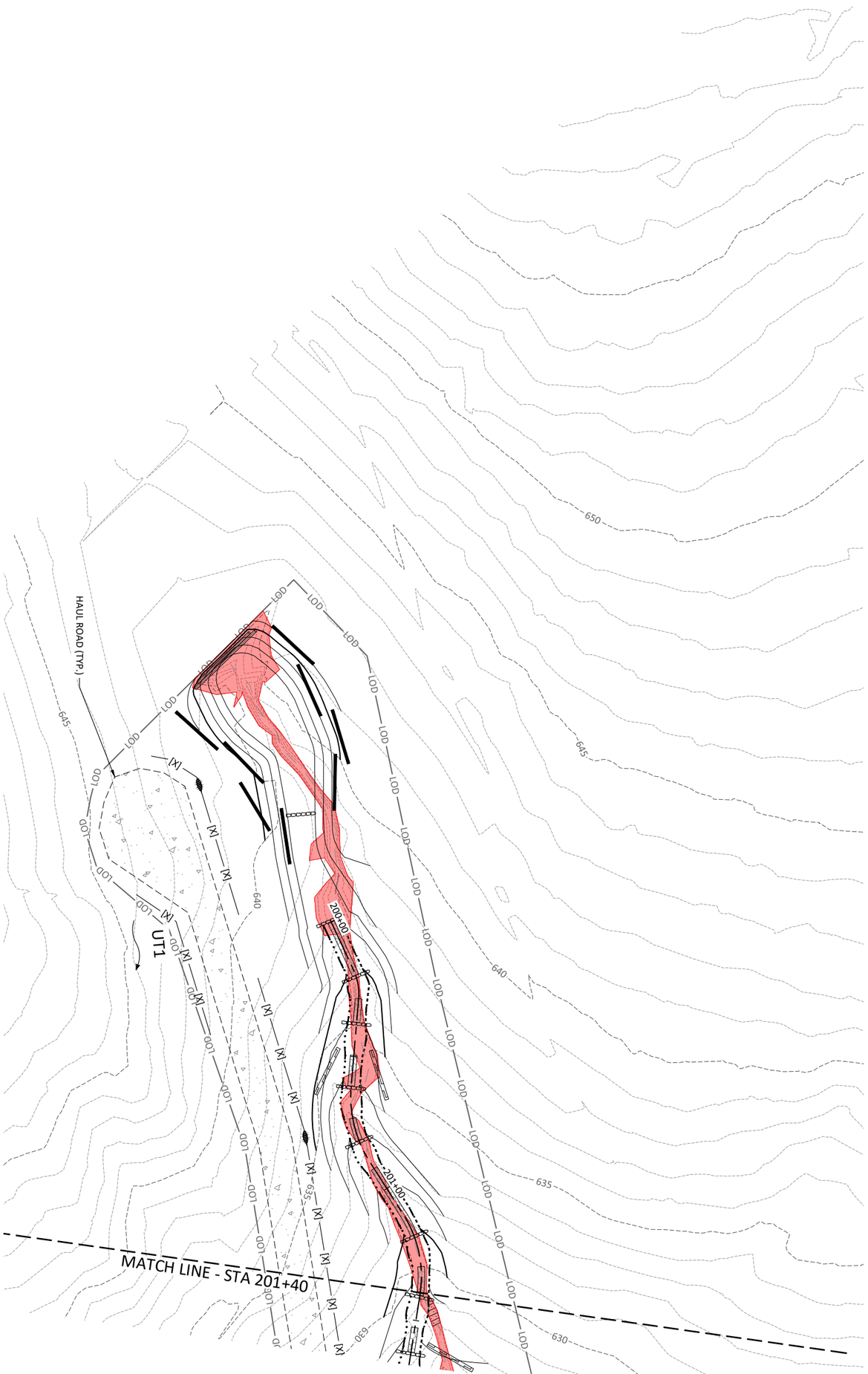
PERMANENT STREAM IMPACTS
TEMPORARY STREAM IMPACTS
PERMANENT WETLAND IMPACTS
TEMPORARY WETLAND IMPACTS



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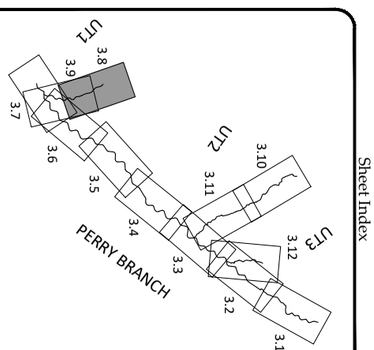

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Perry Hill Mitigation Site
Orange County, North Carolina

UT1 Reach 1
Erosion and Sediment Control Plan

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7/23/20

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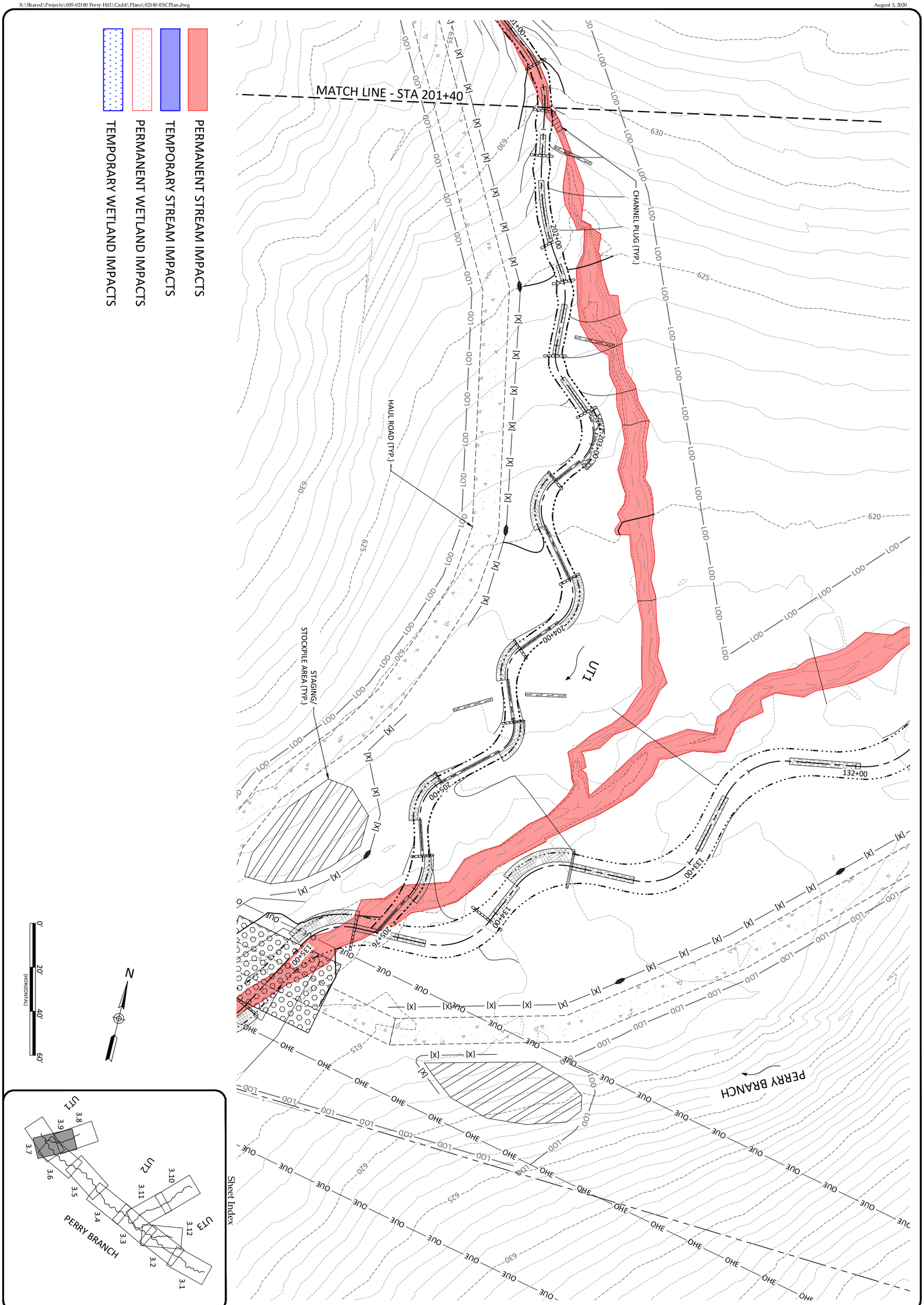

Date:	07.23.2020
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Perry Hill Mitigation Site
Orange County, North Carolina

UT1 Reach 1 & 2
Erosion and Sediment Control Plan

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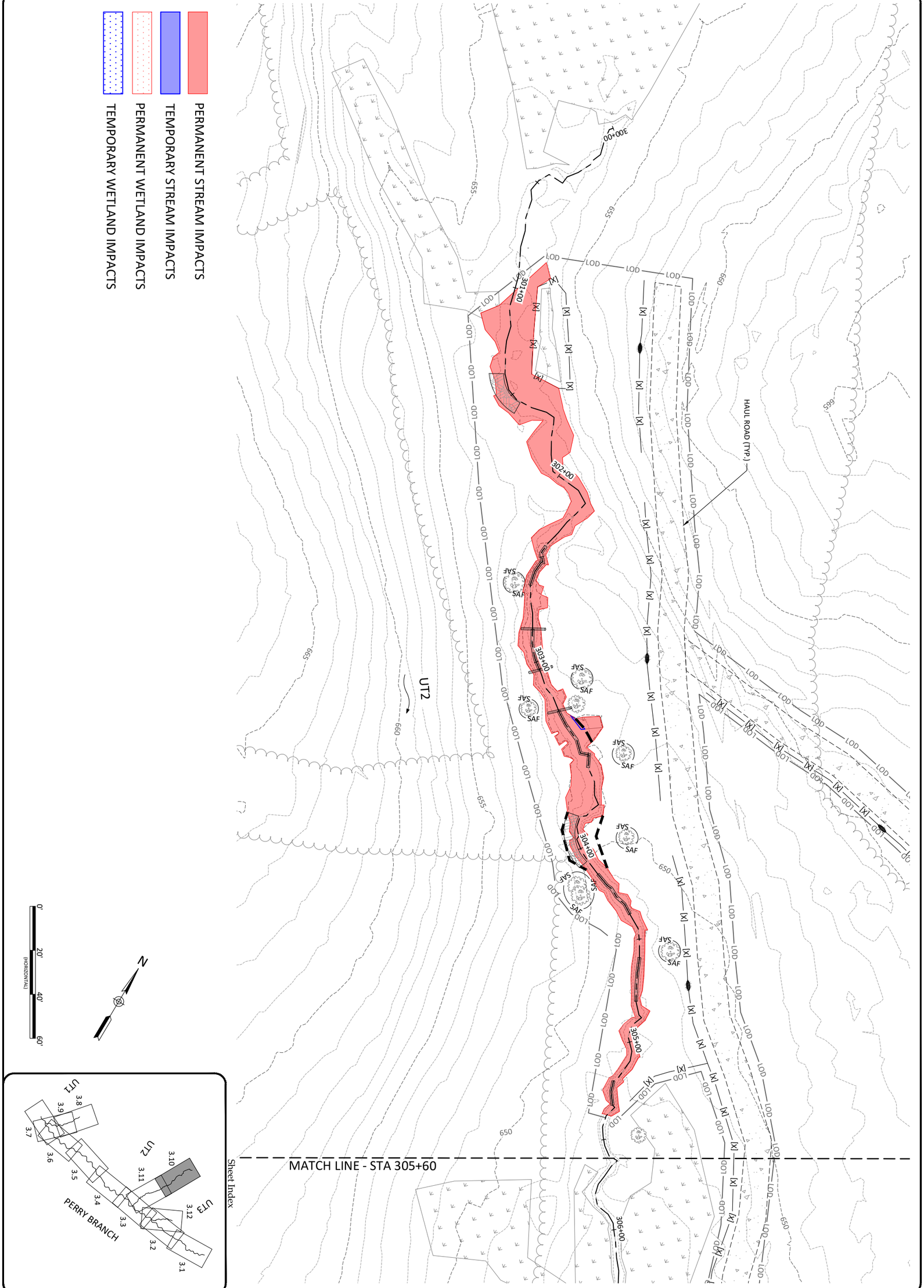

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Job Number:	005-02180
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Perry Hill Mitigation Site
Orange County, North Carolina

UT2 Reach 1 & 2
Erosion and Sediment Control Plan

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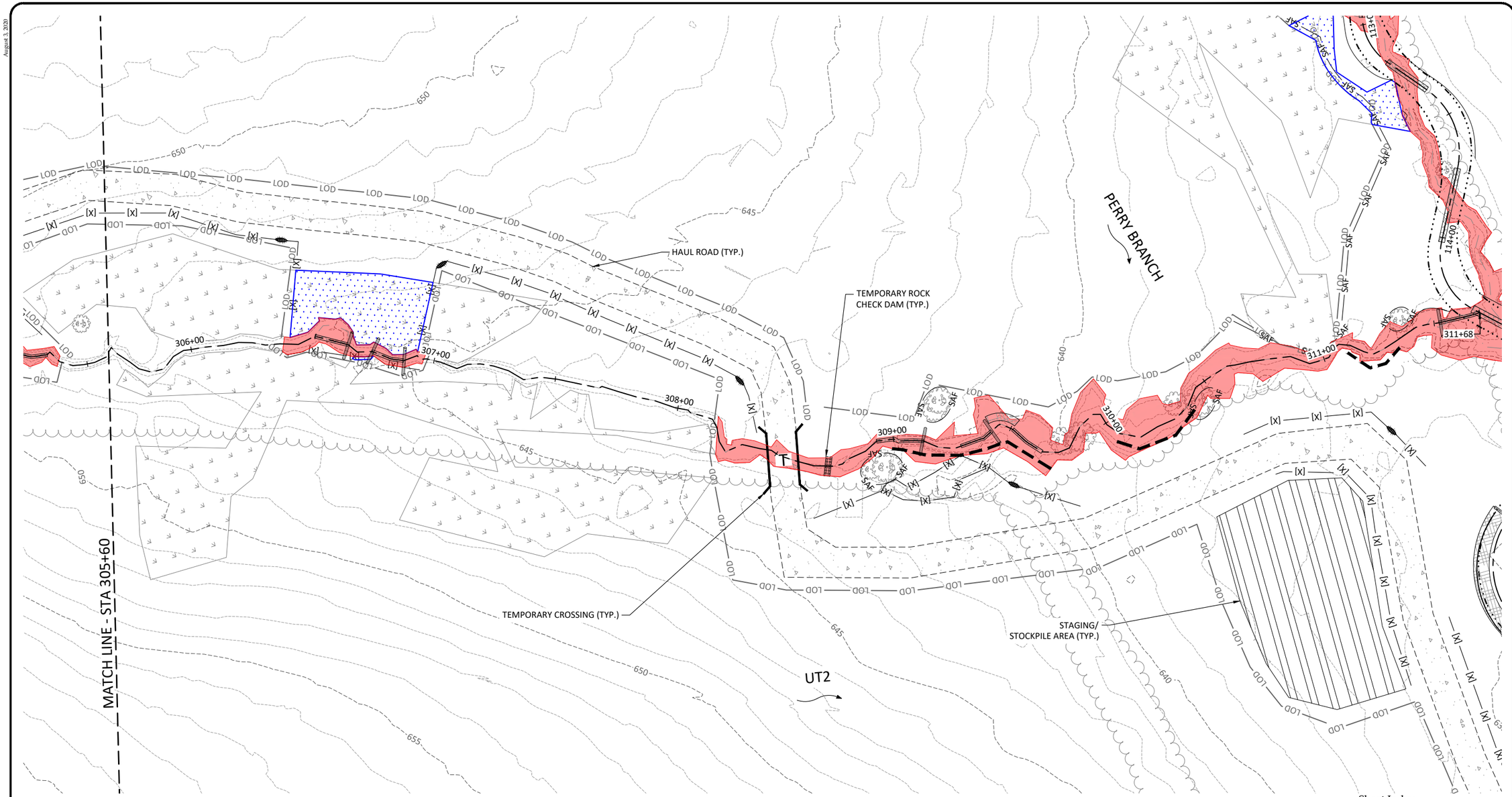
August 3, 2020



PERMANENT STREAM IMPACTS

TEMPORARY STREAM IMPACTS

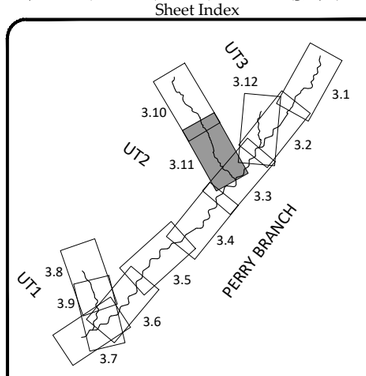
PERMANENT WETLAND IMPACTS

TEMPORARY WETLAND IMPACTS

N

0' 20' 40' 60'
(HORIZONTAL)

Sheet Index



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049820 GEOFFREY L. HILLIS 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT2 Reach 2
Erosion and Sediment Control Plan

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
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Sheet 3.11

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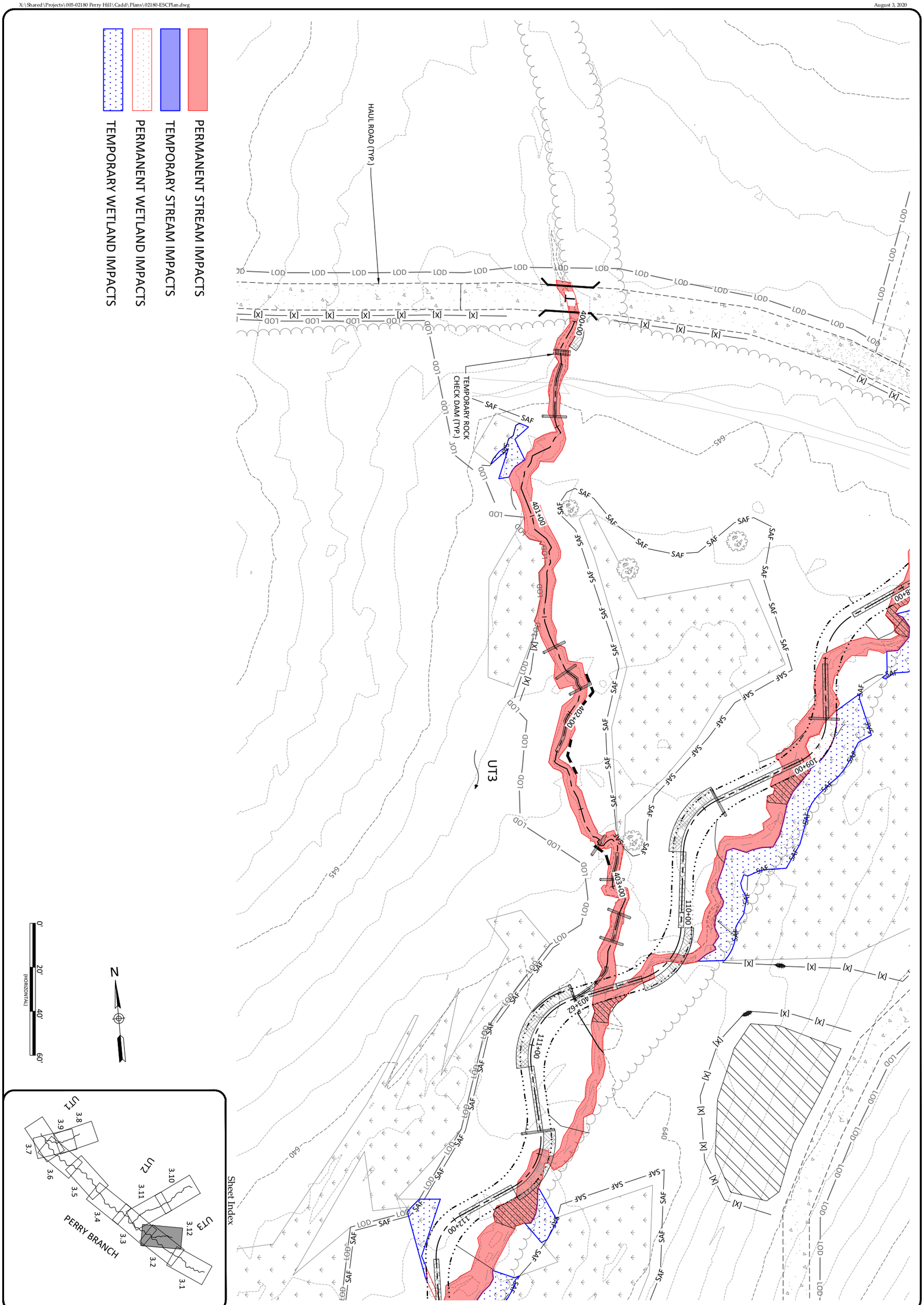

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3.12
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Perry Hill Mitigation Site
Orange County, North Carolina

UT3
Erosion and Sediment Control Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 047920 GEOFFREY L. SMITH 7/23/20

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August 3, 2020

Planting Zones

Streambank Planting Zone
(See Detail 2, Sheet 6.5)

Wetland Planting Zone - Forested

Wetland Planting Zone - Non-Forested

Buffer Planting Zone - Forested

Buffer Planting Zone - Non-Forested

Upland Planting Zone

Notes:

- No one bare root species currently proposed for the buffer, wetland, and upland planting zones makes up more than 20% of the species mix. In the event species substitutions are required, the Engineer shall provide substitute species of similar composition and rates to the proposed planting plan.
- Buffer planting will occur within the proposed conservation easement.
- All non-hatched areas within the proposed conservation easement are currently vegetated and will be planted as needed to achieve the target density if disturbed.
- All disturbed areas outside of the conservation easement shall be planted with the Permanent Seeding Outside Easement seed mix.
- Vegetative planting zones shall be marked by the Engineer using GPS.
- Vegetation planting and replanting should be conducted between November 15 and March 15, unless otherwise noted in the approved Mitigation Plan or remedial action plan.

Streambank Planting Zone

Live Stakes

Species	Common Name	Indiv. Spacing	Min. Size	Stratum	% of Stems	Wetland Indicator Status
Cephalanthus occidentalis	Buttonbush	5 ft.	0.5”-1.5” cal.	Shrub	15%	OBL
Cornus amomum	Silky Dogwood	5 ft.	0.5”-1.5” cal.	Shrub	35%	FACW
Salix sericea	Silky Willow	5 ft.	0.5”-1.5” cal.	Shrub	40%	OBL
Sambucus canadensis	Elderberry	5 ft.	0.5”-1.5” cal.	Shrub	10%	FACW
					100%	

Herbaceous Plugs

Juncus effusus	Common Rush	2 ft.	1.0”- 2.0” plug	Herb	50%	FACW
Carex crinita	Fringed Sedge	2 ft.	1.0”- 2.0” plug	Herb	15%	OBL
Carex lurida	Lurid Sedge	2 ft.	1.0”- 2.0” plug	Herb	20%	OBL
Scirpus cyperinus	Woolgrass	2 ft.	1.0”- 2.0” plug	Herb	15%	FACW
					100%	

Wetland Planting Zone - Forested

Bare Root

Species	Common Name	Indiv. Spacing	Min. Caliper Size	Stratum	% of Stems	Wetland Indicator Status
Platanus occidentalis	Sycamore	12 ft.	0.25”-1.0”	Canopy	10%	FACW
Betula nigra	River Birch	12 ft.	0.25”-1.0”	Canopy	10%	FACU
Quercus lyrata	Overcup Oak	12 ft.	0.25”-1.0”	Canopy	10%	OBL
Quercus michauxii	Swamp Chestnut Oak	12 ft.	0.25”-1.0”	Canopy	10%	FACW
Ulmus americana	American Elm	12 ft.	0.25”-1.0”	Canopy	7%	FACW
Acer negundo	Boxelder	12 ft.	0.25”-1.0”	Canopy	7%	FAC
Cornus amomum	Silky Dogwood	12 ft.	0.25”-1.0”	Subcanopy	10%	FACW
Viburnum nudum	Possumhaw Viburnum	12 ft.	0.25”-1.0”	Subcanopy	6%	FAC

Live Stakes

Salix nigra	Black Willow	8 ft.	0.5''-1.5''	Canopy	10%	OBL
Salix sericea	Silky Willow	8 ft.	0.5''-1.5''	Subcanopy	5%	OBL
Sambucus canadensis	Elderberry	8 ft.	0.5''-1.5''	Subcanopy	8%	FACW
Cephalanthus occidentalis	Buttonbush	8 ft.	0.5''-1.5''	Subcanopy	7%	OBL
					100%	

Wetland Planting Zone - Non-Forested

Bare Root

Species	Common Name	Indiv. Spacing	Min. Caliper Size	Stratum	% of Stems	Wetland Indicator Status
Platanus occidentalis	Sycamore	6 ft.	0.25”-1.0”	Canopy	15%	FACW
Betula nigra	River Birch	6 ft.	0.25”-1.0”	Canopy	15%	FACU
Quercus lyrata	Overcup Oak	6 ft.	0.25”-1.0”	Canopy	10%	OBL
Quercus michauxii	Swamp Chestnut Oak	6 ft.	0.25”-1.0”	Canopy	13%	FACW
Ulmus americana	American Elm	6 ft.	0.25”-1.0”	Canopy	10%	FACW
Acer negundo	Boxelder	6 ft.	0.25”-1.0”	Subcanopy	8%	FAC
Cornus amomum	Silky Dogwood	6 ft.	0.25”-1.0”	Subcanopy	7%	FACW

Live Stakes

Salix nigra	Black Willow	8 ft.	0.5''-1.5''	Canopy	10%	OBL
Salix sericea	Silky Willow	8 ft.	0.5''-1.5''	Subcanopy	4%	OBL
Sambucus canadensis	Elderberry	8 ft.	0.5''-1.5''	Subcanopy	4%	FACW
Cephalanthus occidentalis	Buttonbush	8 ft.	0.5''-1.5''	Subcanopy	4%	OBL
					100%	

Buffer Planting Zone - Forested

Bare Root

Species	Common Name	Indiv. Spacing	Min. Caliper Size	Stratum	% of Stems	Wetland Indicator Status
Quercus phellos	Willow Oak	12 ft.	0.25”-1.0”	Canopy	10%	FAC
Quercus michauxii	Swamp Chestnut Oak	12 ft.	0.25”-1.0”	Canopy	5%	FACW
Celtis laegivata	Sugarberry	12 ft.	0.25”-1.0”	Canopy	5%	FACW
Diospyros viginiana	Persimmon	12 ft.	0.25”-1.0”	Canopy	5%	FAC
Ulmus americana	American Elm	12 ft.	0.25”-1.0”	Canopy	10%	FACW
Fagus grandifolia	American Beech	12 ft.	0.25”-1.0”	Canopy	10%	FACU
Asimina triloba	Pawpaw	12 ft.	0.25”-1.0”	Subcanopy	10%	FAC
Cornus florida	Flowering Dogwood	12 ft.	0.25”-1.0”	Subcanopy	10%	FACU
Carpinus caroliniana	Ironwood	12 ft.	0.25”-1.0”	Subcanopy	5%	FAC
Cornus amomum	Silky Dogwood	12 ft.	0.25”-1.0”	Subcanopy	10%	FACW
Euonymus americanus	Strawberry Bush	12 ft.	0.25"-1.0"	Subcanopy	10%	FAC
Viburnum dentatum	Arrowwood Viburnum	12 ft.	0.25”-1.0”	Subcanopy	10%	FAC
					100%	

Buffer Planting Zone - Non-Forested

Bare Root

Species	Common Name	Indiv. Spacing	Min. Caliper Size	Stratum	% of Stems	Wetland Indicator Status
Platanus occidentalis	Sycamore	6 ft.	0.25”-1.0”	Canopy	20%	FACW
Betula nigra	River Birch	6 ft.	0.25”-1.0”	Canopy	15%	FACU
Quercus michauxii	Swamp Chestnut Oak	6 ft.	0.25”-1.0”	Canopy	10%	FACW
Quercus phellos	Willow Oak	6 ft.	0.25”-1.0”	Canopy	5%	FAC
Quercus rubra	Northern Red Oak	6 ft.	0.25”-1.0”	Canopy	5%	FACU
Populus deltoides	Eastern Cottonwood	6 ft.	0.25”-1.0”	Canopy	10%	FAC
Acer negundo	Boxelder	6 ft.	0.25”-1.0”	Canopy	10%	FAC
Ulmus americana	American Elm	6 ft.	0.25”-1.0”	Canopy	5%	FACW
Diospyros viginiana	Persimmon	6 ft.	0.25”-1.0”	Canopy	10%	FAC
Acer floridanum	Southern Sugar Maple	6 ft.	0.25”-1.0”	Canopy	3%	-
Asimina triloba	Pawpaw	6 ft.	0.25”-1.0”	Subcanopy	5%	FAC
Viburnum prunifolium	Blackhaw Viburnum	6 ft.	0.25”-1.0”	Subcanopy	2%	FACU
					100%	

Upland Planting Zone

Bare Root

Species	Common Name	Indiv. Spacing	Min. Caliper Size	Stratum	% of Stems	Wetland Indicator Status
Platanus occidentalis	Sycamore	6 ft.	0.25”-1.0”	Canopy	15%	FACW
Betula nigra	River Birch	6 ft.	0.25”-1.0”	Canopy	20%	FACU
Nyssa sylvatica	Black Gum	6 ft.	0.25”-1.0”	Canopy	10%	FAC
Quercus falcata	Southern Red Oak	6 ft.	0.25”-1.0”	Canopy	5%	FACU
Quercus rubra	Northern Red Oak	6 ft.	0.25”-1.0”	Canopy	5%	FACU
Diospyros virginiana	Persimmon	6 ft.	0.25”-1.0”	Canopy	12%	FAC
Quercus alba	White Oak	6 ft.	0.25”-1.0”	Canopy	10%	FACU
Ulmus alata	Winged Elm	6 ft.	0.25”-1.0”	Canopy	10%	FACU
Populus deltoides	Eastern Cottonwood	6 ft.	0.25”-1.0”	Canopy	8%	FAC
Oxydendrum arboreum	Sourwood	6 ft.	0.25”-1.0”	Subcanopy	5%	UPL
					100%	

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NORTH CAROLINA PROFESSIONAL SEAL 049320 ENGINEER HILLS GEOFFREY 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Planting Tables - Live Stakes, Herbaceous Plugs, and Bare Roots
Planting Plan

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: GLS
Drawn By: MC/ABP
Checked By: CR

Sheet 4.0

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Seed Mixes

Permanent Wetland Seeding					
Pure Live Seed (20 lbs/ acre)					
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**	**Wetland Indicator Status**
All Year	*Panicum anceps*	Beaked Panicgrass	Herb	2.0	FAC
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.6	FACW
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	1.0	FAC
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	1.5	FACW
All Year	*Elymus riparius*	Riverbank Wild Rye	Herb	2.0	FACW
All Year	*Panicum virgatum*	Switchgrass	Herb	1.0	FAC
All Year	*Tripsacum dacyloides*	Eastern Gamagrass	Herb	2.0	FACW
All Year	*Carex lurida*	Lurid Sedge	Herb	0.4	OBL
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	4.0	OBL
All Year	*Carex lupulina*	Hop Sedge	Herb	0.4	OBL
All Year	*Juncus effusus*	Common Rush	Herb	1.5	FACW
All Year	*Helianthus angustifolia*	Swamp Sunflower	Herb	1.0	FACW
All Year	*Bidens aristosa*	Bur-Marigold	Herb	1.6	FACW

Permanent Buffer Seeding					
Pure Live Seed (20 lbs/ acre)					
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**	**Wetland Indicator Status**
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.0	FACW
All Year	*Tridens flavus*	Purpletop	Herb	1.0	FACU
All Year	*Dichanthelium clandestinum*	Deertongue	Herb	3.5	FAC
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	3.0	FACW
All Year	*Elymus riparius*	Riverbank Wild Rye	Herb	1.5	FACW
All Year	*Panicum virgatum*	Switchgrass	Herb	1.0	FAC
All Year	*Sorghastrum nutans*	Indiangrass	Herb	2.5	FACU
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	1.5	OBL
All Year	*Juncus tenuis*	Path Rush	Herb	0.2	FAC
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0	FACU
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0	FACU
All Year	*Chamaecrista fasciculata var.*	Patridge Pea	Herb	1.0	FACU
All Year	*Heliopsis helianthoides*	Oxeye Sunflower	Herb	0.8	FACU
All Year	*Bidens aristosa*	Bur-Marigold	Herb	1.0	FACW

Permanent Upland Seeding					
Pure Live Seed (20 lbs/ acre)					
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**	**Wetland Indicator Status**
All Year	*Tridens flavus*	Purpletop	Herb	2.0	FACU
All Year	*Dichanthelium clandestinum*	Deertongue	Herb	4.5	FAC
All Year	*Panicum virgatum*	Switchgrass	Herb	1.5	FAC
All Year	*Sorghastrum nutans*	Indiangrass	Herb	3.5	FACU
All Year	*Juncus tenuis*	Path Rush	Herb	1.0	FAC
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	2.0	FACU
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	2.0	FACU
All Year	*Chamaecrista fasciculata var.*	Patridge Pea	Herb	2.0	FACU
All Year	*Heliopsis helianthoides*	Oxeye Sunflower	Herb	1.5	FACU

Temporary Seeding					
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**	**Wetland Indicator Status**
Aug 15-May 1	*Secale cereale*	Rye Grain	Herb	140	-
May 1 - Aug 15	*Setaria italica*	German Millet	Herb	50	FACU
All Year	*Trifolium repens*	White Clover	Herb	5	FACU
All Year	*Trifolium incarnatum*	Crimson Clover	Herb	5	-

Note: Mix White Clover and Crimson Clover to Rye Grain or German Millet depending on time of year. White Clover and Crimson Clover require a nitrogen inoculant to be added prior to application on Site.

Permanent Seeding Outside Easement					
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**	**Wetland Indicator Status**
All Year	*Festuca arundinacea*	Tall Fescue	Herb	40	-

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NORTH CAROLINA PROFESSIONAL SEAL 040920 ENGINEER GEOFFREY L. HOLLINGER 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Planting Tables - Seed Mixes
Planting Plan

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: GLS
Drawn By: MC/ABP
Checked By: CR

Sheet 4.1

August 3, 2020

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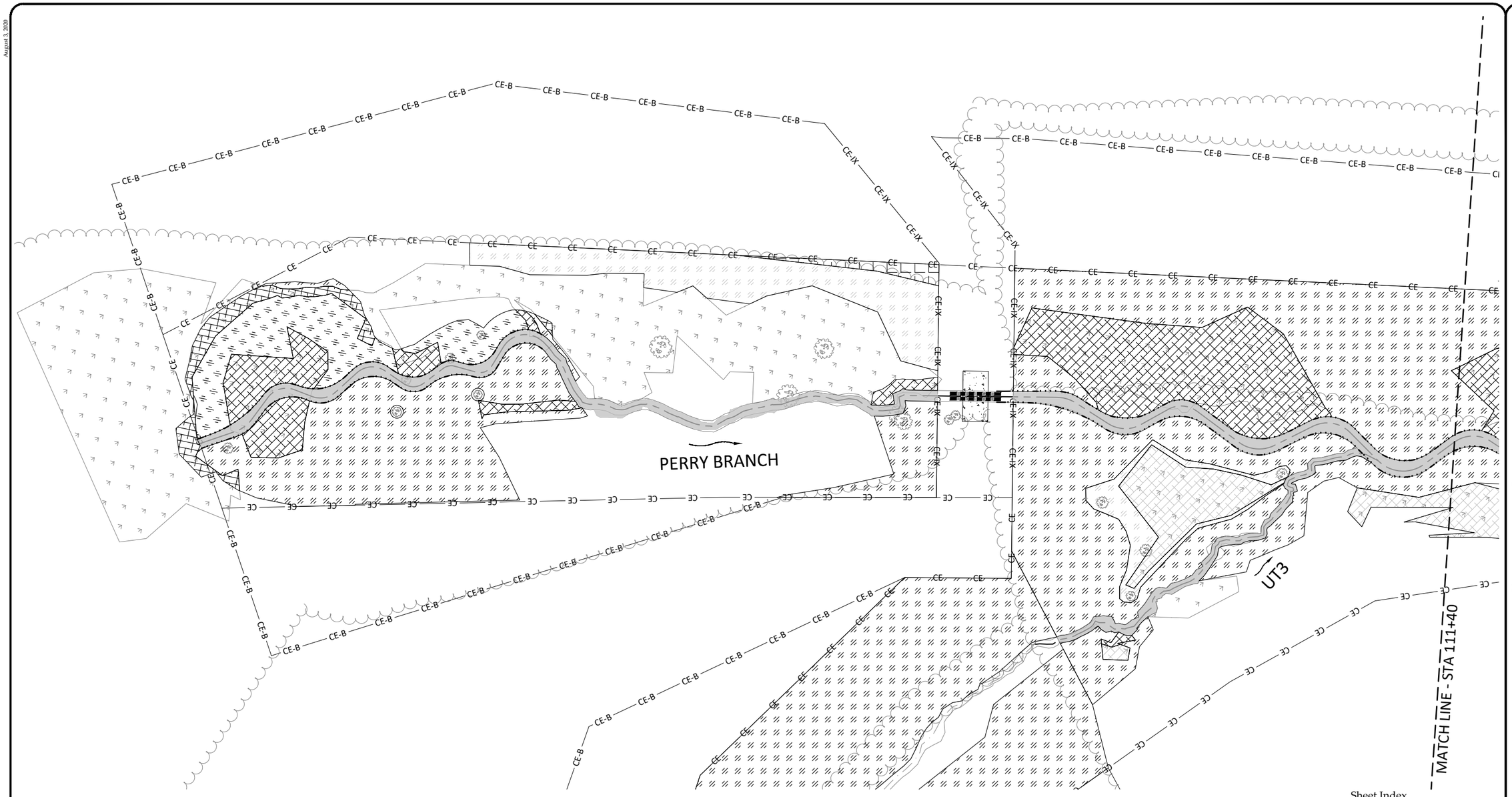
August 3, 2020



Planting Zones

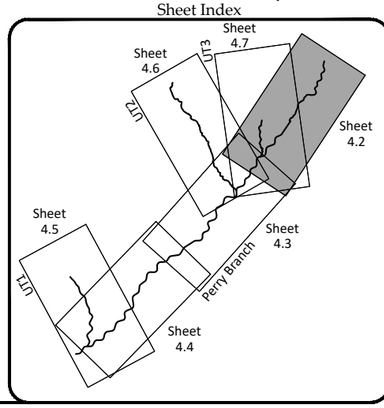
- Streambank Planting Zone (See Detail 2, Sheet 6.5)
- Wetland Planting Zone - Forested
- Wetland Planting Zone - Non-Forested
- Buffer Planting Zone - Forested
- Buffer Planting Zone - Non-Forested
- Upland Planting Zone

Note:
- Buffer planting will occur within the proposed conservation easement.
- All non-hatched areas within the proposed conservation easement are currently vegetated and will be planted as needed to achieve the target density if disturbed.
- All disturbed areas outside of the conservation easement shall be planted with the Permanent Upland Seeding mix.
- Vegetative planting zones shall be marked by the Engineer using GPS.

N

0' 40' 80' 120'
(HORIZONTAL)

Sheet Index



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NORTH CAROLINA PROFESSIONAL SEAL 049020 ENGINEER GEOFFREY L. HILLIS 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Planting Plan - Perry Hill I

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: GLS
Drawn By: MC/ABP
Checked By: CR

Sheet 4.2

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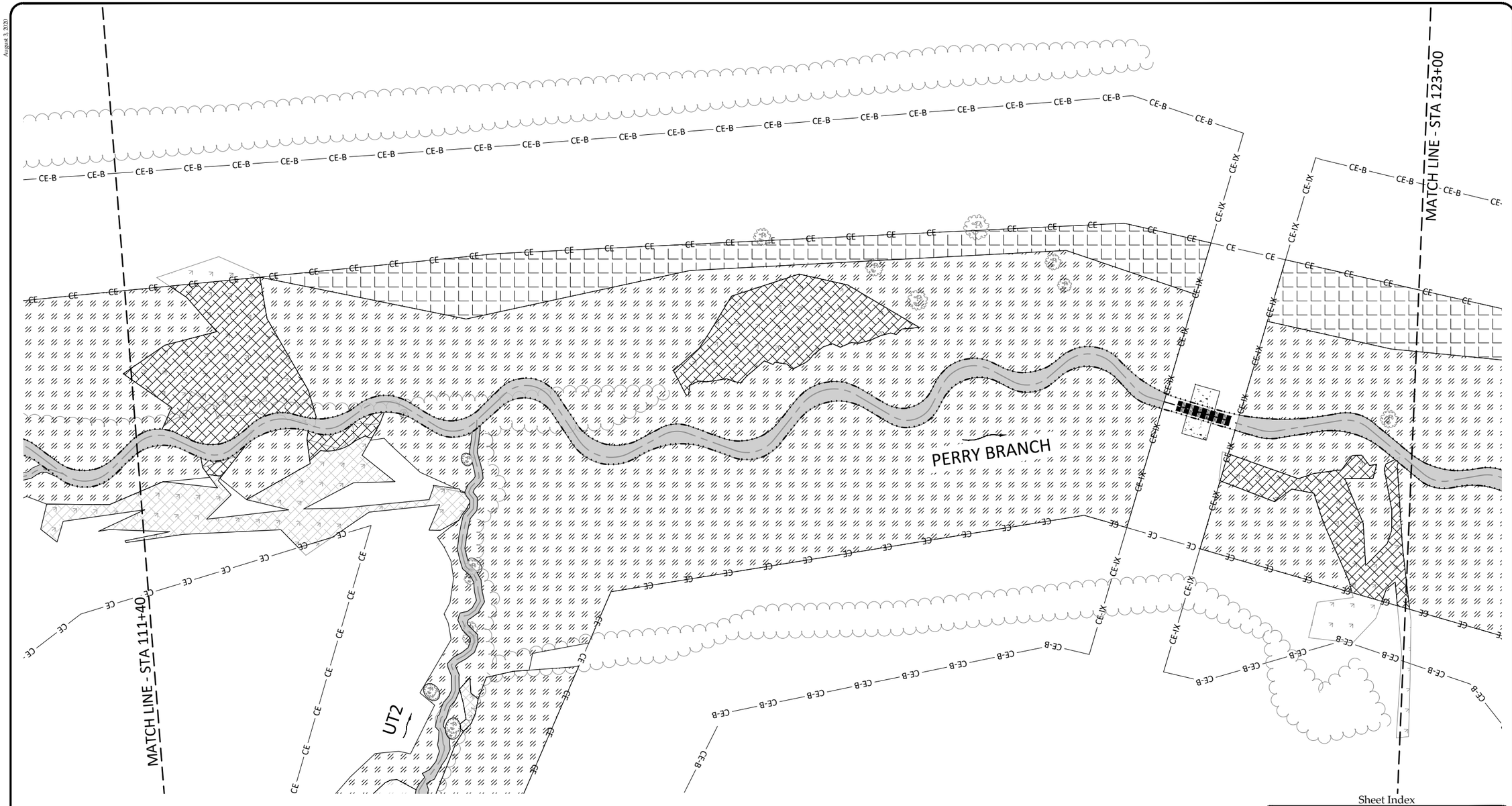
August 3, 2020



Planting Zones

- Streambank Planting Zone (See Detail 2, Sheet 6.5)
- Buffer Planting Zone - Non-Forested
- Wetland Planting Zone - Forested
- Upland Planting Zone
- Wetland Planting Zone - Non-Forested

Note:

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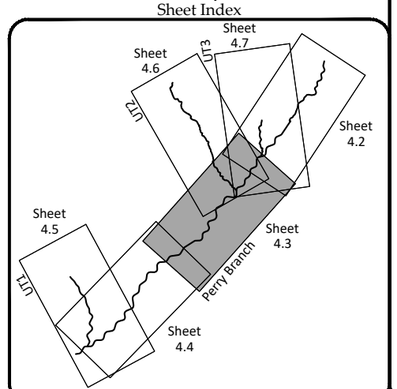
(HORIZONTAL)

Sheet Index



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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Planting Plan - Perry Hill I

Revisions:

Date:	07.23.2020
Job Number:	005-02183
Project Engineer:	GHLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 4.3

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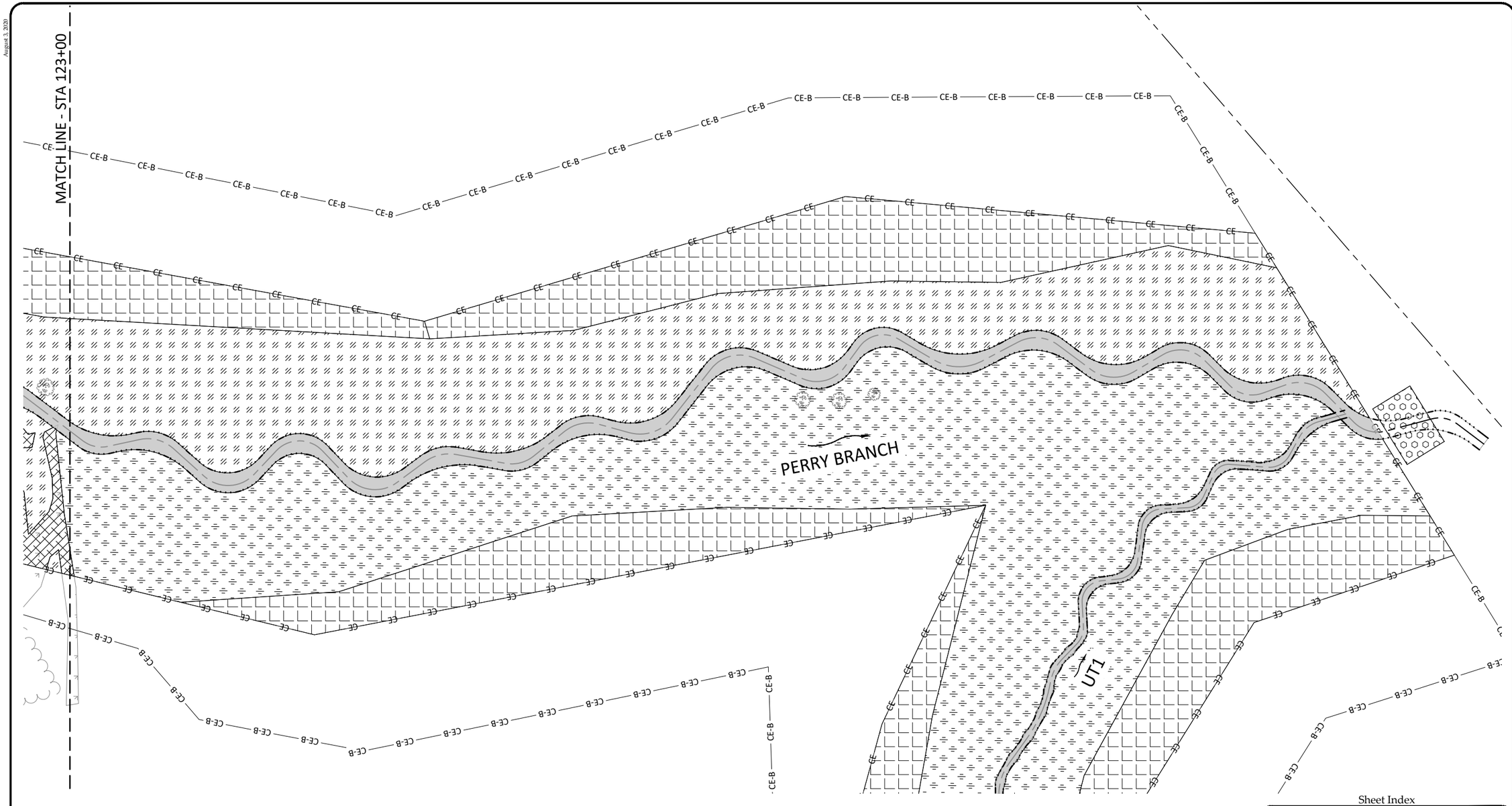
August 3, 2020

MATCH LINE - STA 123+00



Planting Zones

Streambank Planting Zone
(See Detail 2, Sheet 6.5)

Upland Planting Zone

Wetland Planting Zone - Non-Forested

Buffer Planting Zone - Non-Forested

Note:

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N

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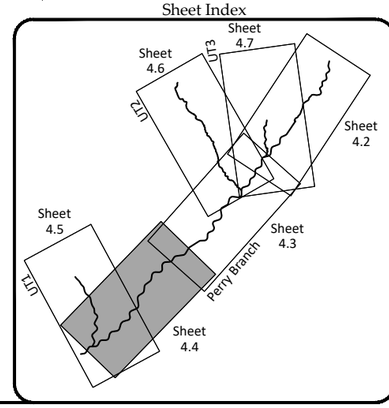
(HORIZONTAL)

Sheet Index



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NORTH CAROLINA PROFESSIONAL SEAL 049302 ENGINEER GEOFFREY L. HILL 7/23/20

Perry Hill Mitigation Site

Orange County, North Carolina

Perry Branch

Planting Plan - Perry Hill I

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 4.4

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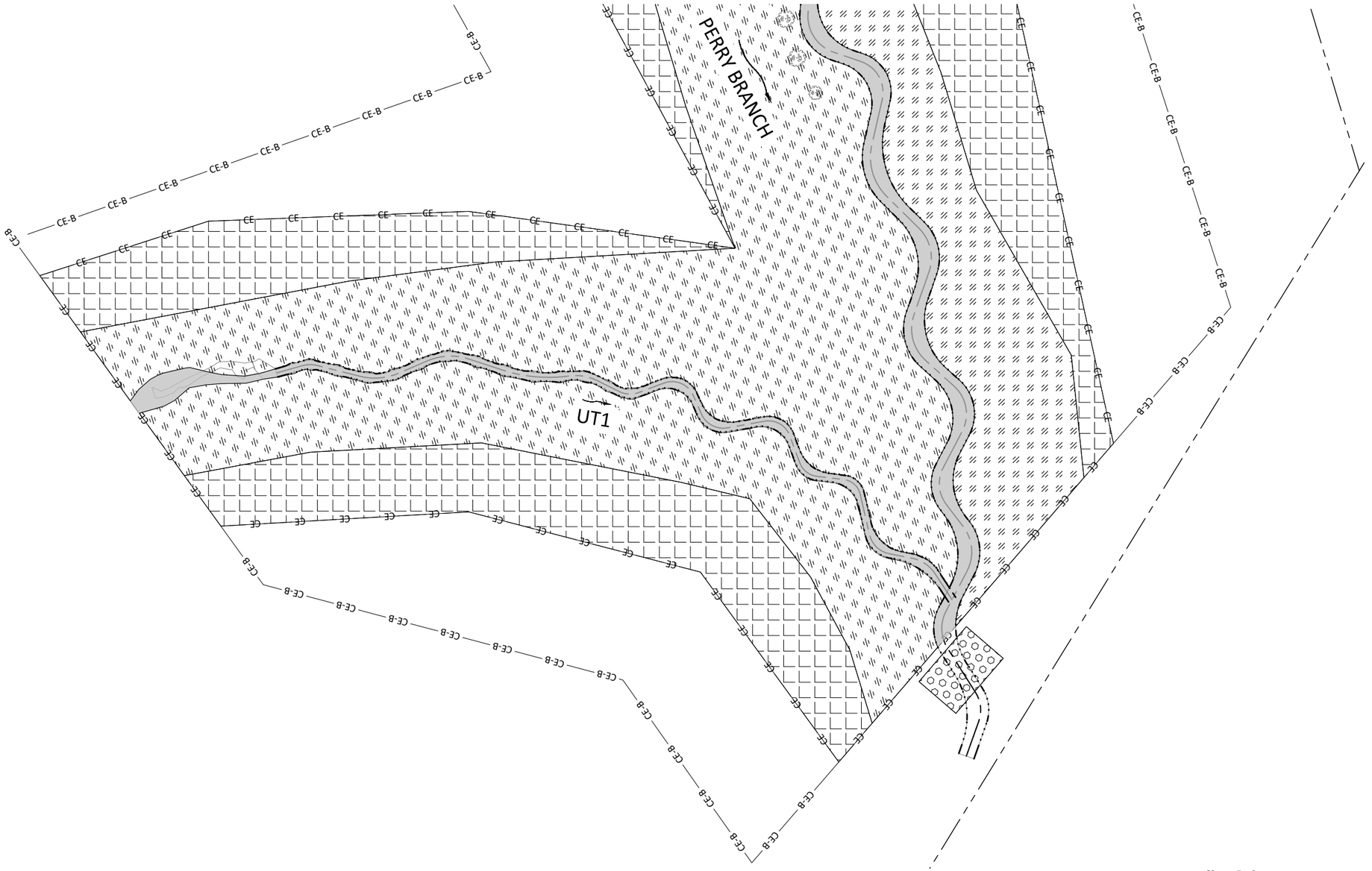

Planting Zones

Streambank Planting Zone
(See Detail 2, Sheet 6.5)

Buffer Planting Zone - Non-Forested

Upland Planting Zone

Note:
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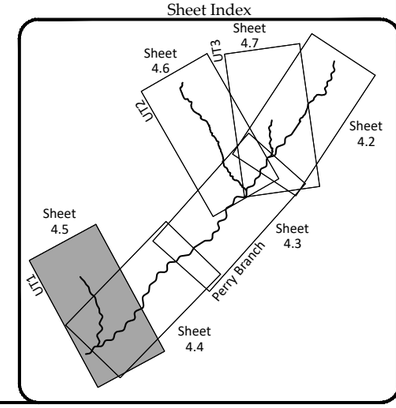

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049920 GEOFFREY L. SMILLIE 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT1
Planting Plan - Perry Hill I

Revisions:

Date:	07.23.2020
Job Number:	005-02180
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August 3, 2020

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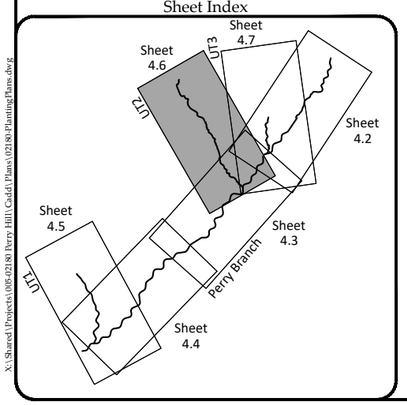

Planting Zones

- Streambank Planting Zone (See Detail 2, Sheet 6.5)
- Wetland Planting Zone - Forested
- Wetland Planting Zone - Non-Forested
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N

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(HORIZONTAL)

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Perry Hill Mitigation Site
Orange County, North Carolina

UT2
Planting Plan - Perry Hill I

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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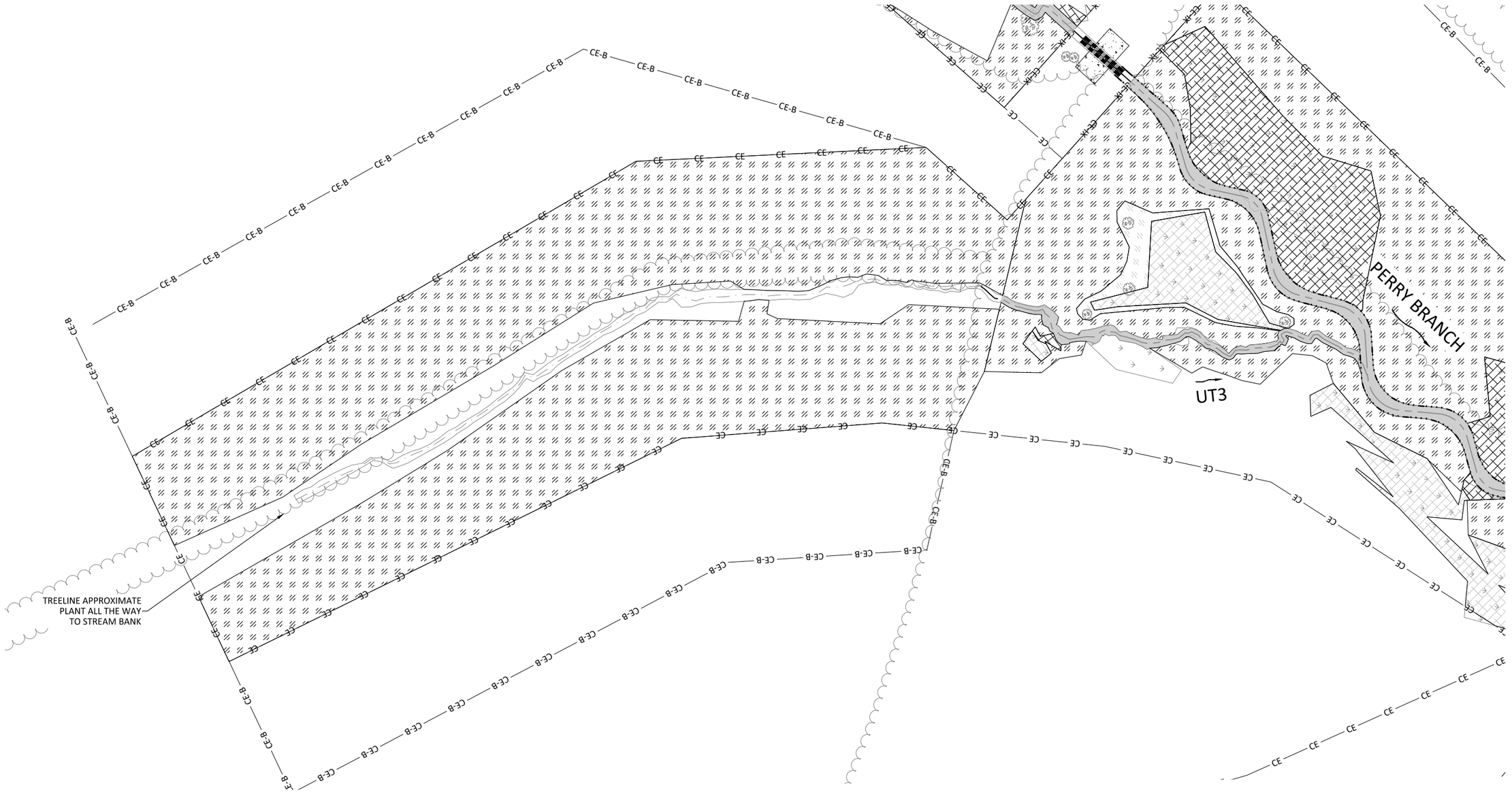
August 3, 2020



Planting Zones

- Streambank Planting Zone (See Detail 2, Sheet 6.5)
- Wetland Planting Zone - Forested
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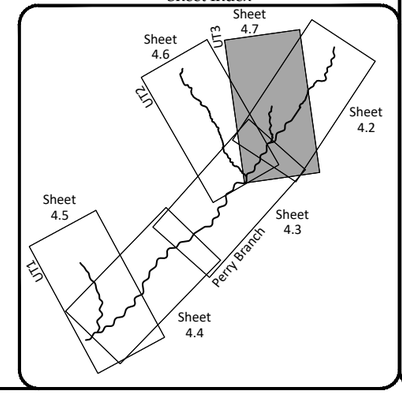
(HORIZONTAL)

Sheet Index



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Perry Hill Mitigation Site
Orange County, North Carolina

UT3
Planting Plan - Perry Hill I

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
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August 3, 2020

PERRY BRANCH

UT3

MATCH LINE - STA 111+40

Planting Zones

Upland Planting Zone

Note:
- Buffer planting will occur within the proposed conservation easement.
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N

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(HORIZONTAL)

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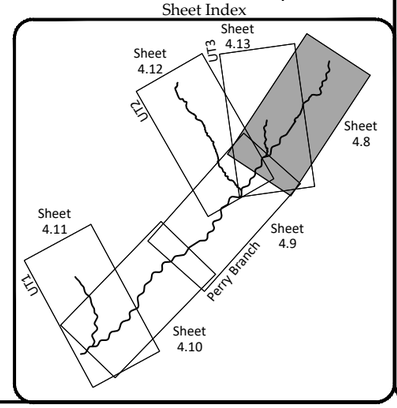

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049320 HILLS GEOFFREY S. 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina
Perry Branch
Planting Plan - Perry Hill II

Revisions:

Date:	07.23.2020
Job Number:	005-02158
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 4.8

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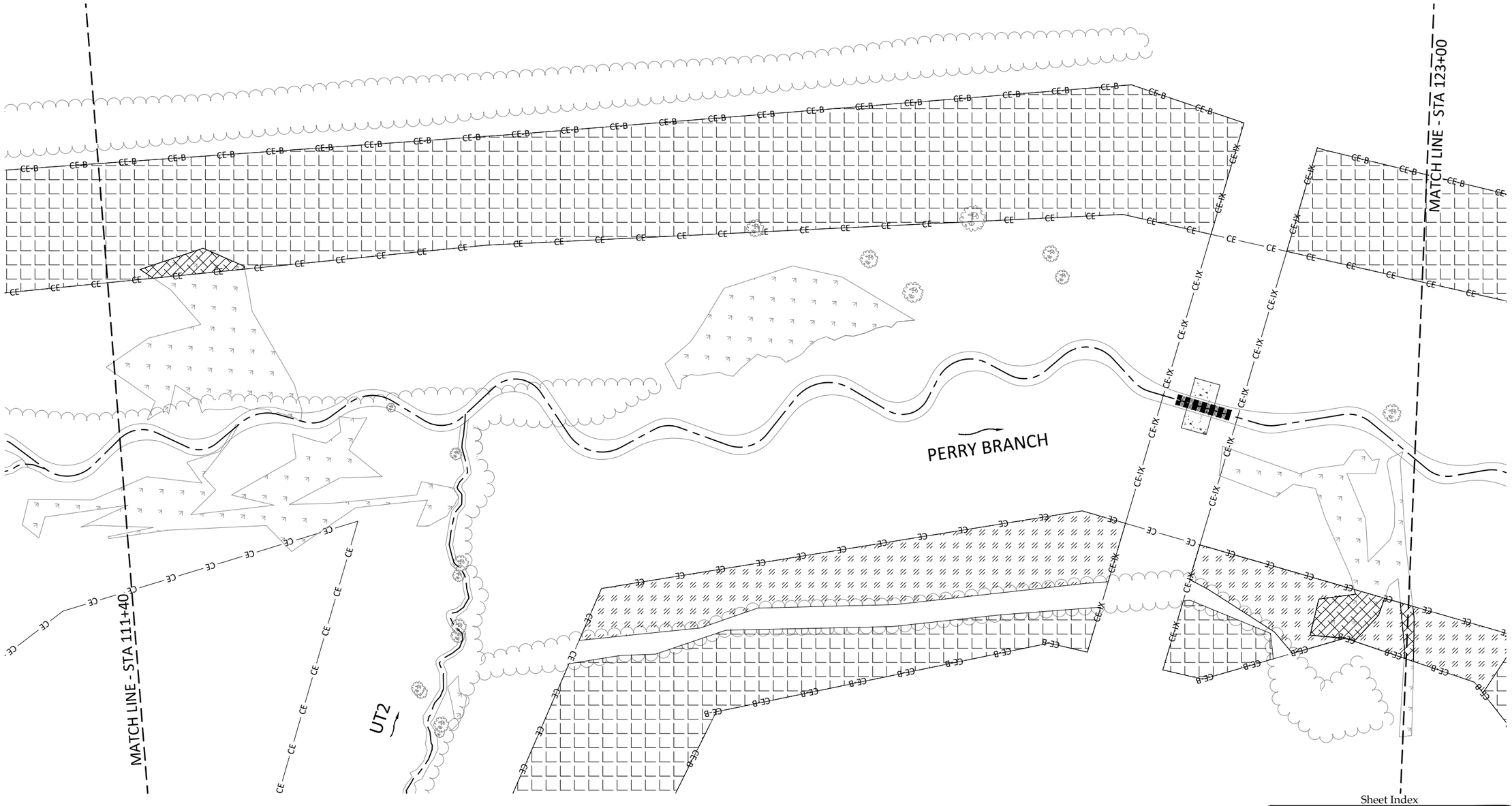
August 3, 2020



Planting Zones

- Wetland Planting Zone - Non-Forested
- Buffer Planting Zone - Non-Forested
- Upland Planting Zone

Note:

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N

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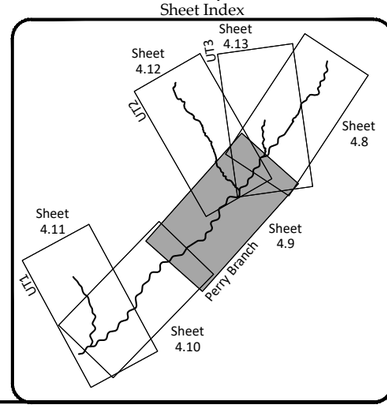
(HORIZONTAL)

Sheet Index



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043920 HILLIS GEOFFREY 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Planting Plan - Perry Hill II

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 4.9

August 3, 2020

MATCH LINE - STA 123+00

PERRY BRANCH

UT1

UT2

UT3

Planting Zones

- Wetland Planting Zone - Non-Forested
- Buffer Planting Zone - Non-Forested
- Upland Planting Zone

Note:
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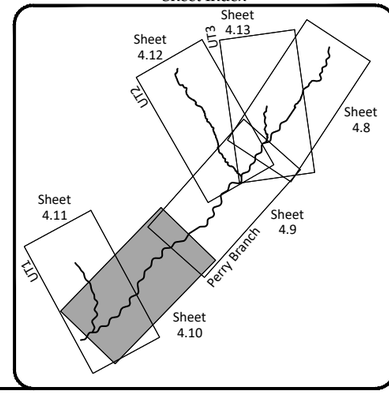
N

0' 40' 80' 120'
(HORIZONTAL)

Sheet Index



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NORTH CAROLINA PROFESSIONAL SEAL 049320 ENGINEER GEOFFREY S. HILLIS 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Planting Plan - Perry Hill II

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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August 3, 2020

Planting Zones

Upland Planting Zone

Note:

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N

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NORTH CAROLINA PROFESSIONAL SEAL 049920 ENGINEER GEOFFREY L. HOLLIS
7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT1
Planting Plan - Perry Hill II

Revisions:

Date:	07.23.2020
Job Number:	005-02158
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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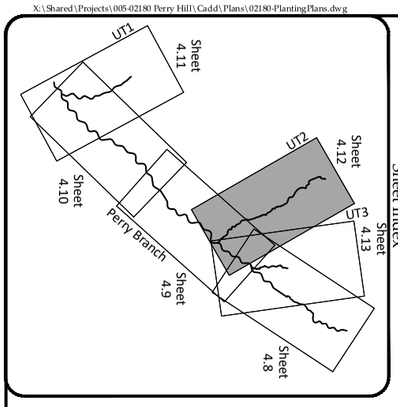

Sheet Index

0' 40' 80' 120'
(HORIZONTAL)

N

Planting Zones

Buffer Planting Zone - Non-Forested

Upland Planting Zone

Note:

- Buffer planting will occur within the proposed conservation easement.
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UT2

UT3

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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4.12
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Perry Hill Mitigation Site
Orange County, North Carolina

UT2
Planting Plan - Perry Hill II

NORTH CAROLINA PROFESSIONAL SEAL 048920 ENGINEER GRANT L. SMITH FREY
7/23/20

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Mount Pleasant, SC 29464
Tel: 843.277.6221

August 3, 2020

Planting Zones

Upland Planting Zone

Note:

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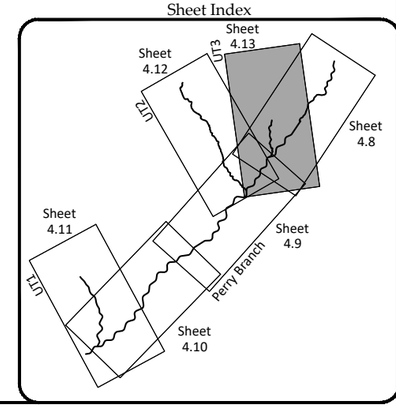
Sheet Index



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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049320 GEOFFREY L. SMITH 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

UT3
Planting Plan - Perry Hill II

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 4.13

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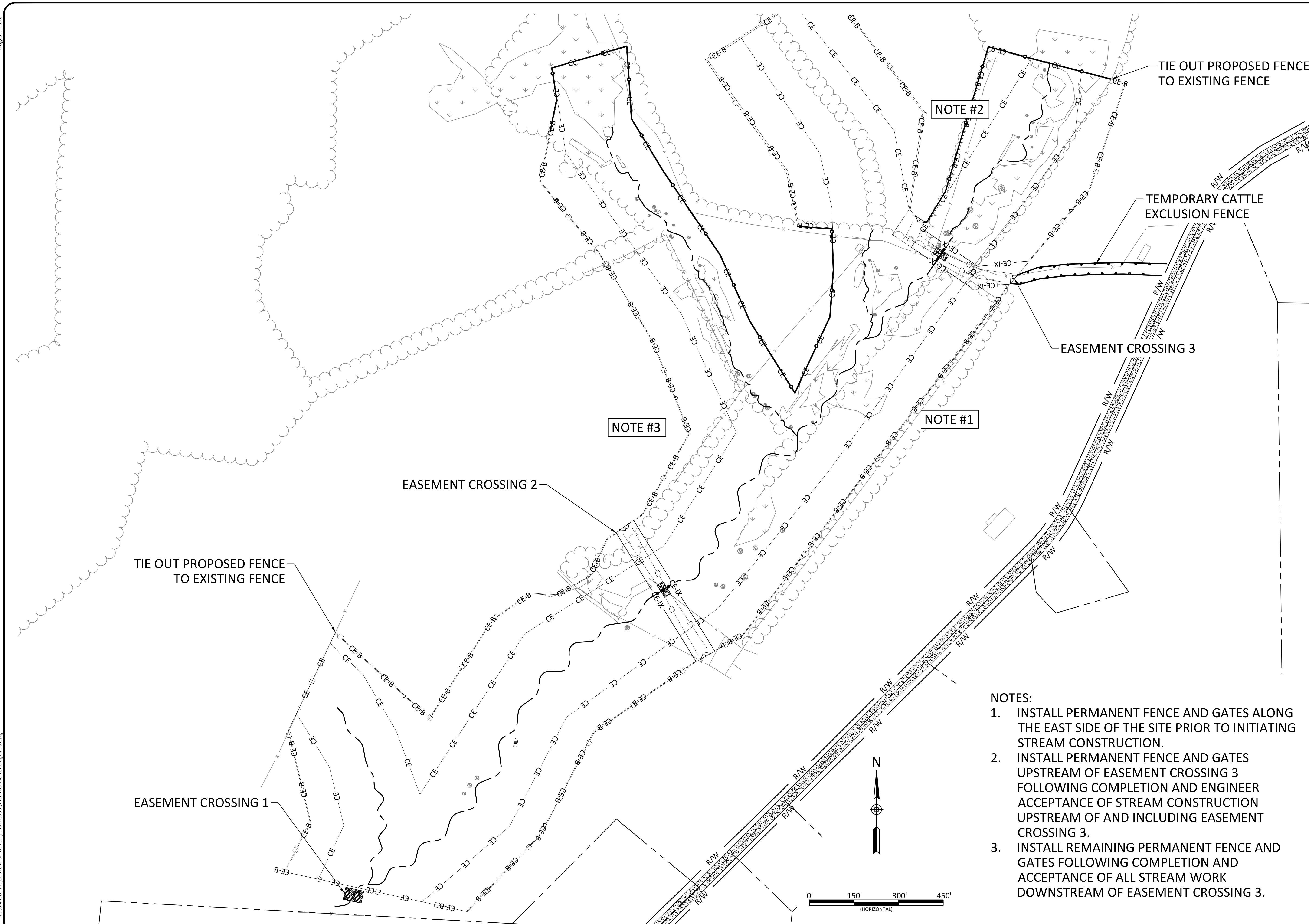

NOTES:

1. INSTALL PERMANENT FENCE AND GATES ALONG THE EAST SIDE OF THE SITE PRIOR TO INITIATING STREAM CONSTRUCTION.
2. INSTALL PERMANENT FENCE AND GATES UPSTREAM OF EASEMENT CROSSING 3 FOLLOWING COMPLETION AND ENGINEER ACCEPTANCE OF STREAM CONSTRUCTION UPSTREAM OF AND INCLUDING EASEMENT CROSSING 3.
3. INSTALL REMAINING PERMANENT FENCE AND GATES FOLLOWING COMPLETION AND ACCEPTANCE OF ALL STREAM WORK DOWNSTREAM OF EASEMENT CROSSING 3.

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. SMITH 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Fencing Plan Overview

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	LAD
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

Sheet 5.0

August 3, 2020
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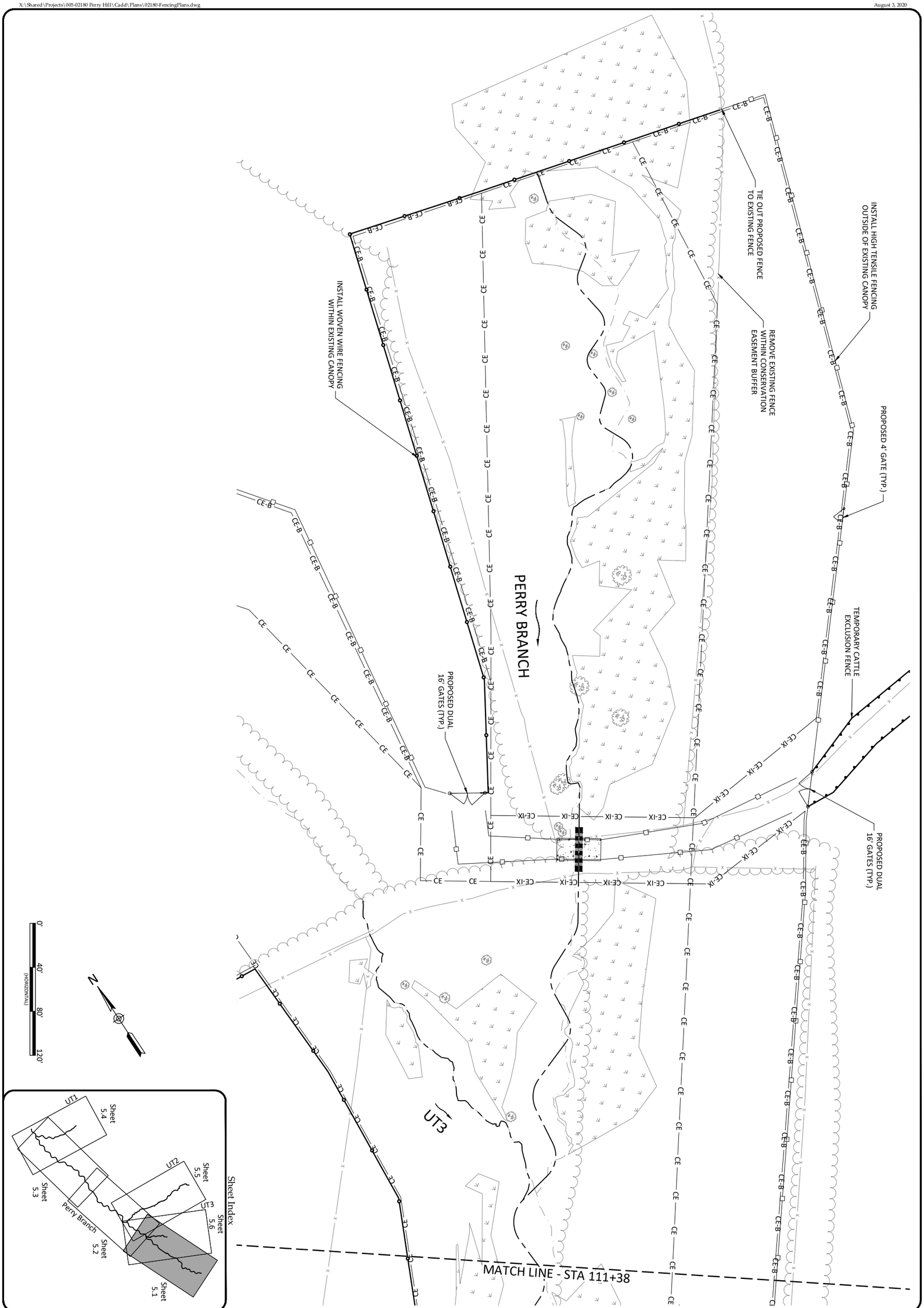

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Fencing Plan

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7/23/20

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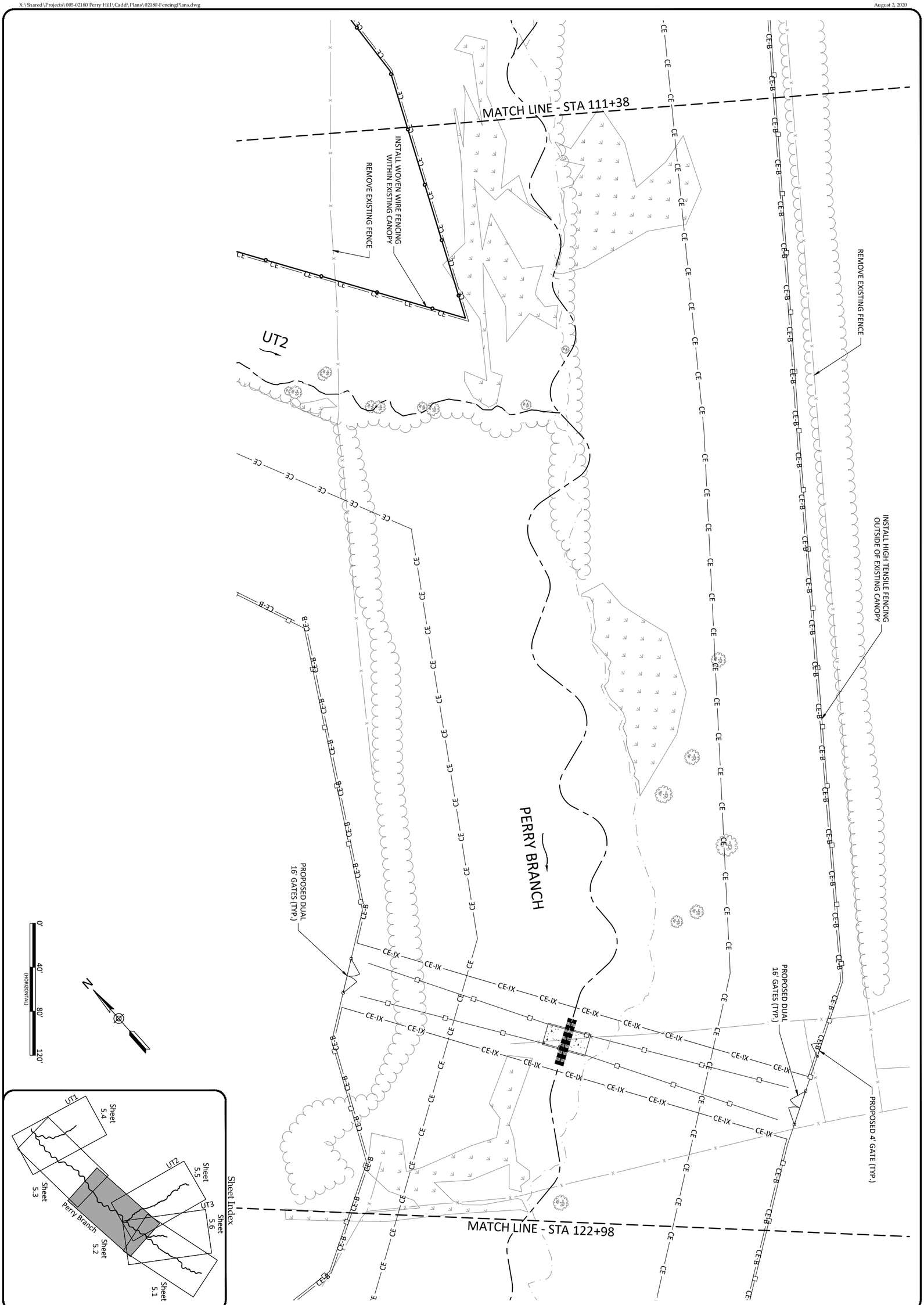

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Fencing Plan

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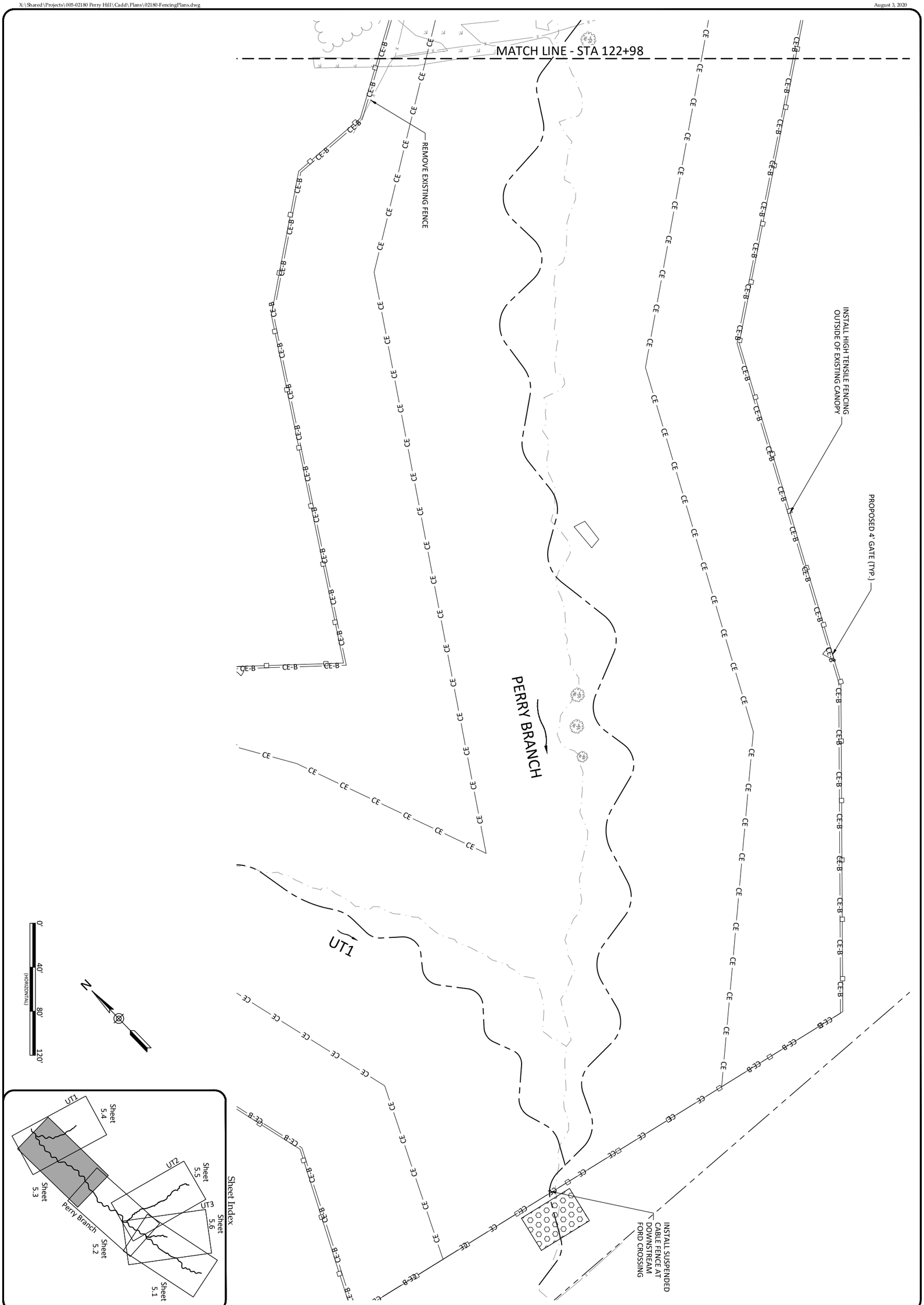

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

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Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch
Fencing Plan

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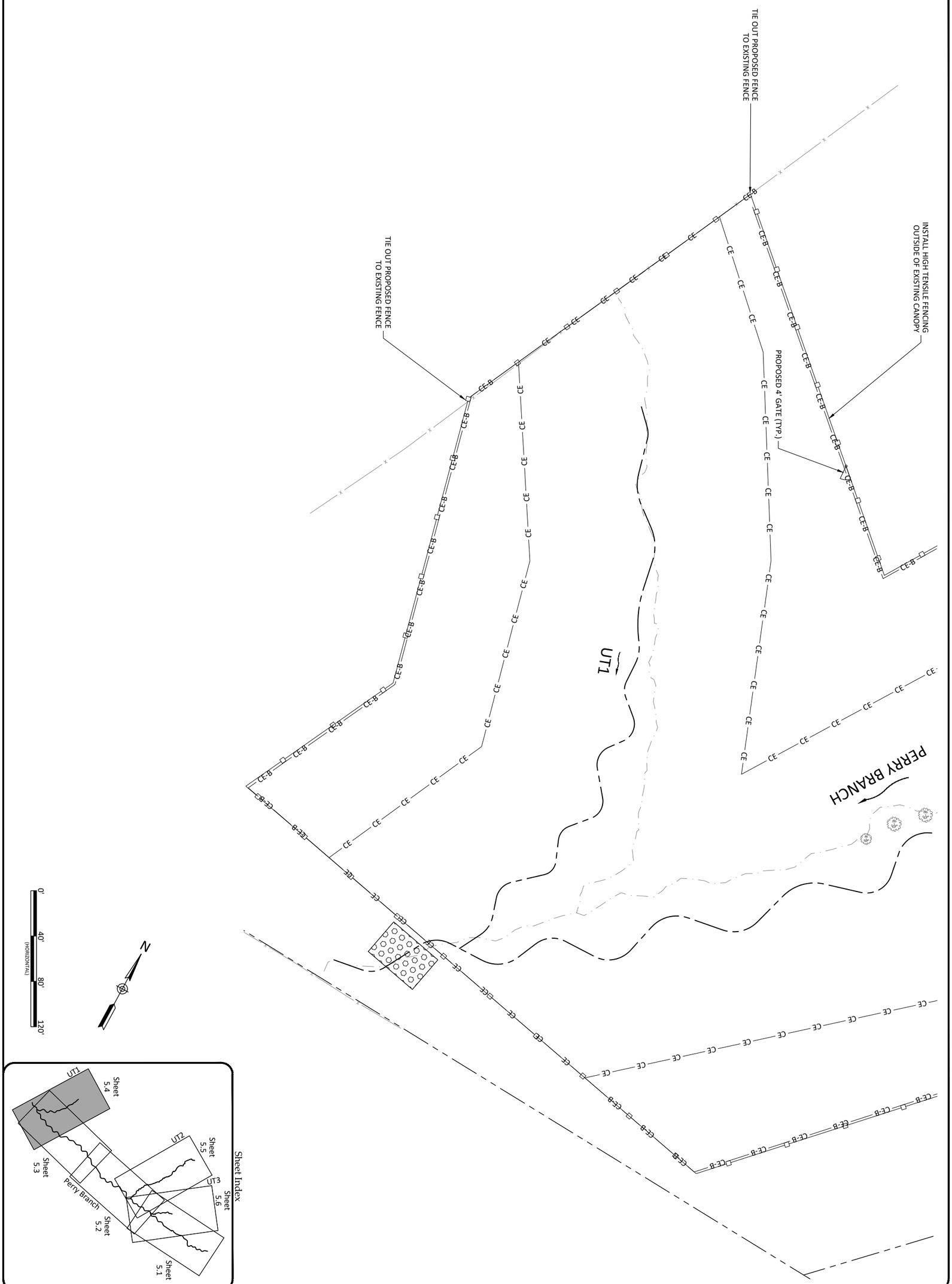

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Job Number:	005-02180
Project Engineer:	GLS
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Perry Hill Mitigation Site
Orange County, North Carolina

UT1
Fencing Plan

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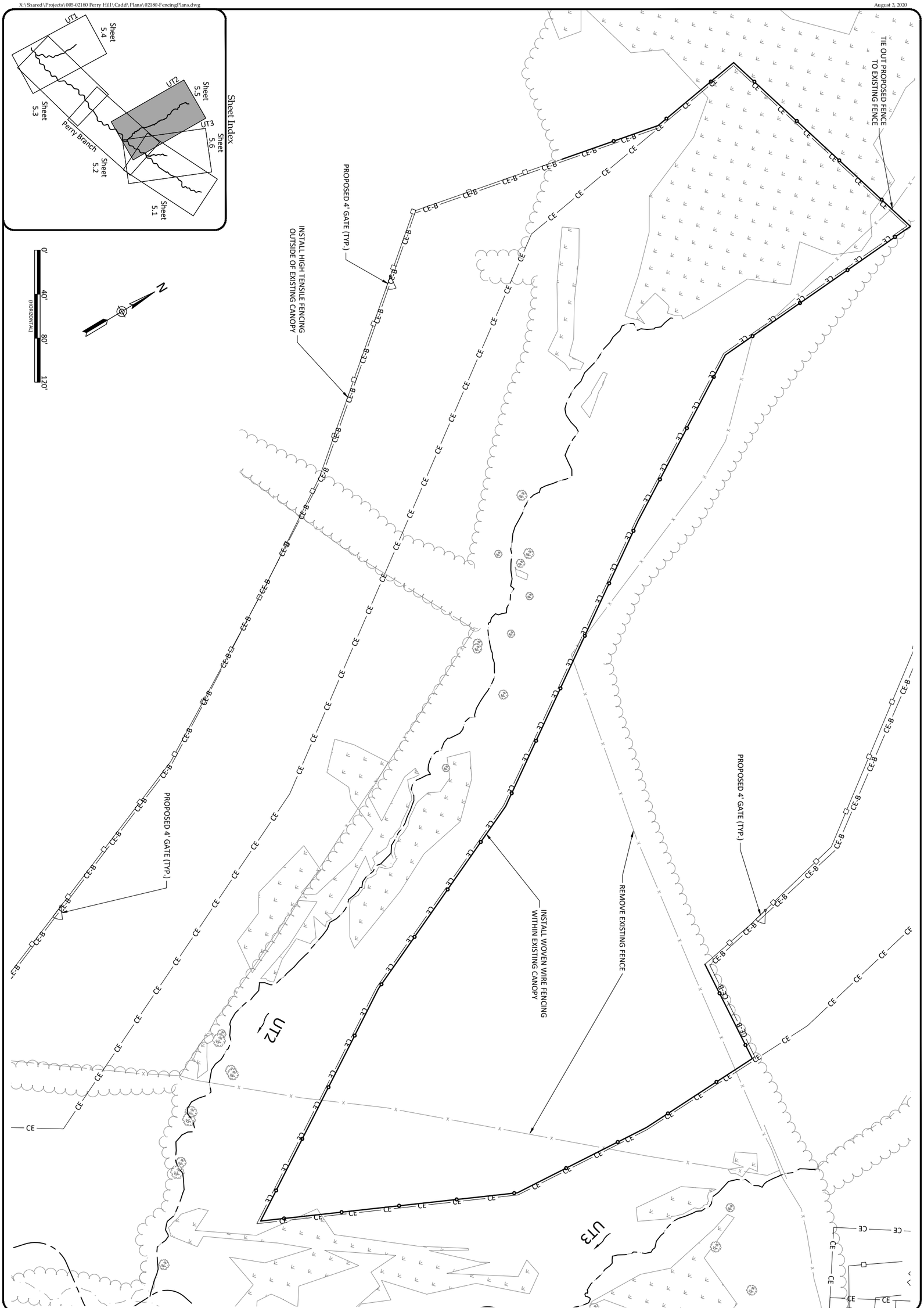

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5.5
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Perry Hill Mitigation Site
Orange County, North Carolina

UT2
Fencing Plan

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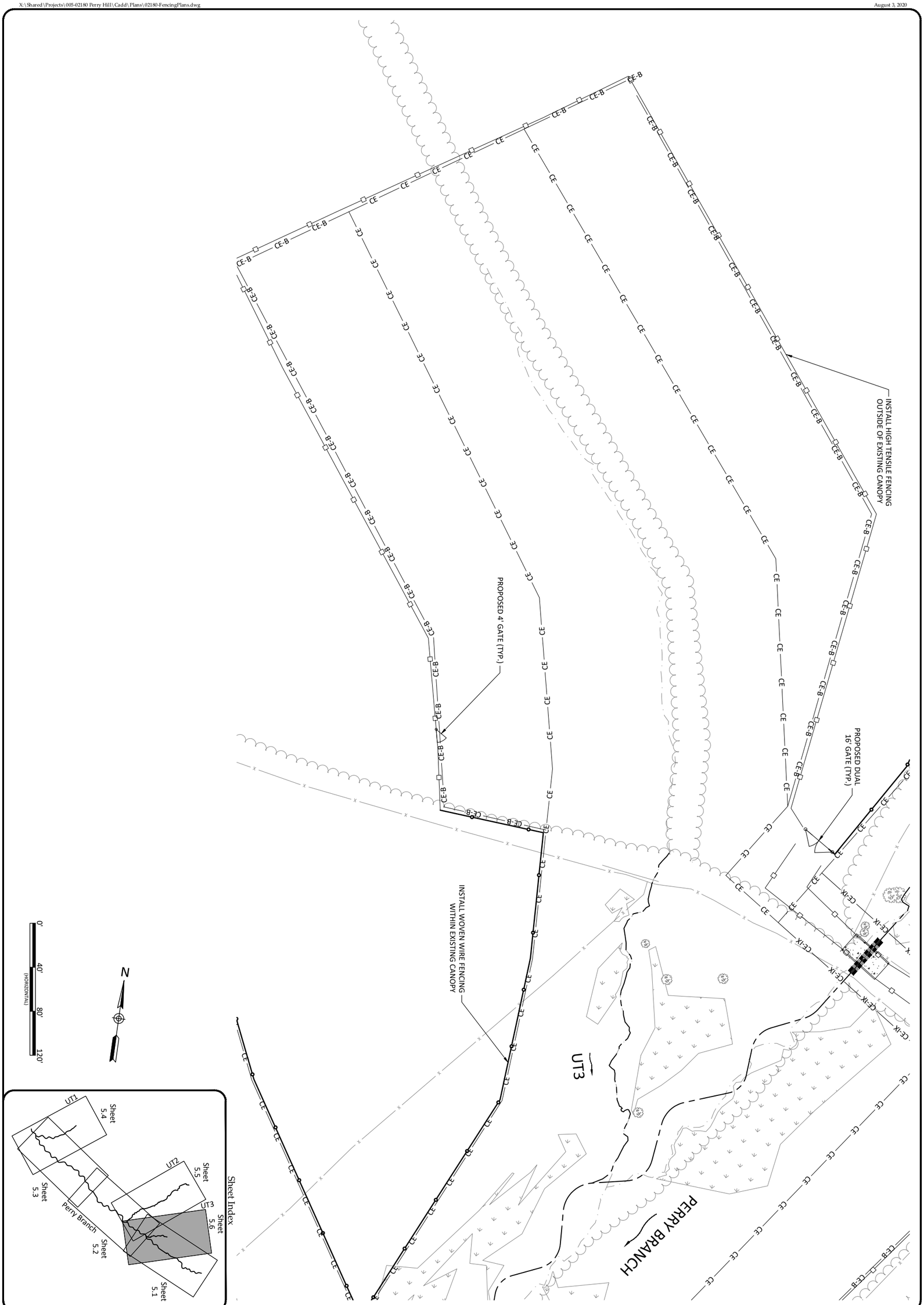

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Perry Hill Mitigation Site
Orange County, North Carolina

UT3
Fencing Plan

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7/23/20

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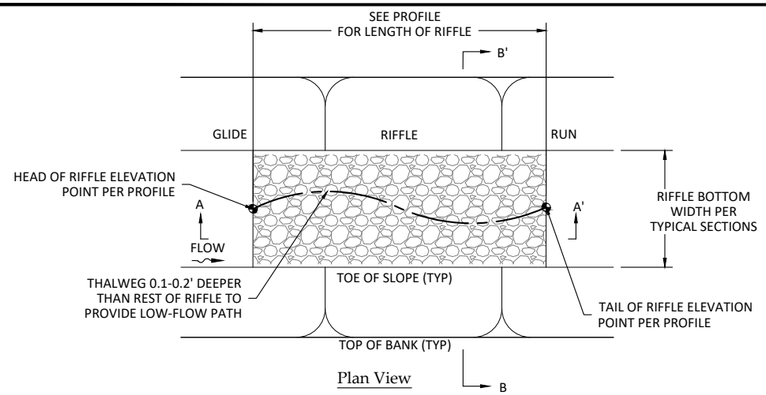
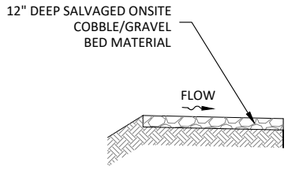
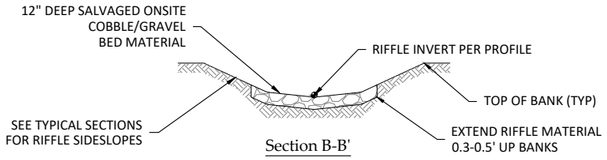


Plan View



Profile A-A'



Section B-B'

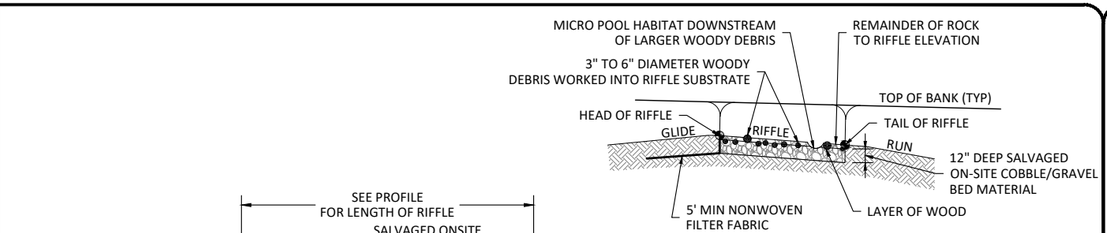
NOTES:

- IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL 1 AND 2, SHEET 6.2 AND DETAIL 2, SHEET 6.3.
- RIFFLE MATERIAL HARVESTED ON-SITE IS PREFERRED.
- RIFFLE MATERIAL SHALL BE A WELL-GRADED MIXTURE OF FINE GRAVELS TO LARGE COBBLE THAT MIMICS EXISTING CHANNEL SUBSTRATE.
- ALL RIFFLES WILL BE SUPPLEMENTED WITH CLASS A STONE.

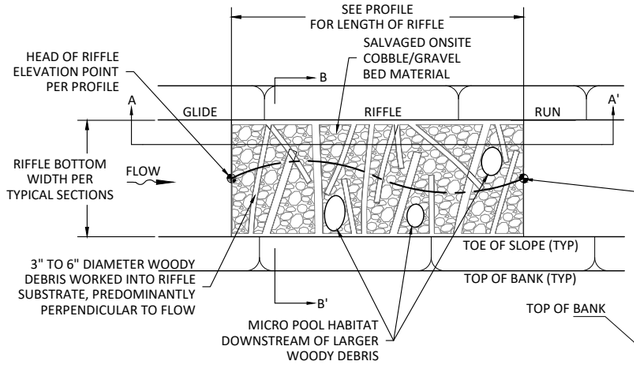
1/6.1 Native Material Riffle
Not to Scale

CR-NM

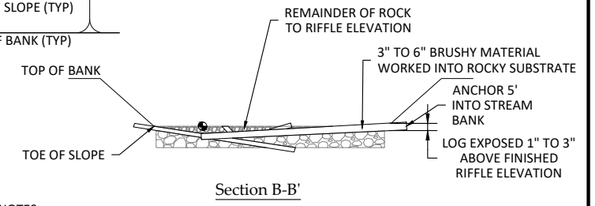
CR-WR



Profile A-A'



Plan View

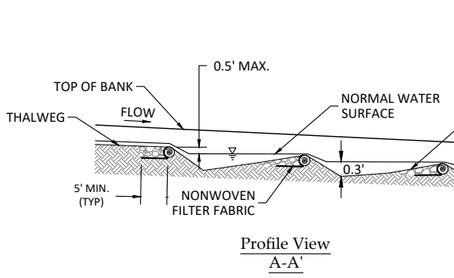


Section B-B'

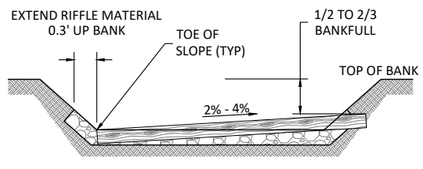
NOTES:

- WOOD SHALL COMPRISE 20% TO 50% OF THE RIFFLE SURFACE AREA.
- BRUSH SHOULD BE PLACED PERPENDICULAR TO CHANNEL UP TO A 15° ANGLE DOWNSTREAM.
- ANY MATERIAL GREATER THAN 1" DIAMETER THAT IS NOT PERPENDICULAR TO THE CHANNEL SHALL BE INSTALLED SUCH THAT THE EXPOSED END IS POINTING DOWNSTREAM.
- WOODY MATERIAL SHOULD NOT PROTRUDE GREATER THAN 3" ABOVE RIFFLE BED.
- BRUSH CUTTERS OR OTHER DEVICE MUST BE USED TO ENSURE PROTRUSION LIMITED TO TOLERANCE.
- IF NECESSARY, QUARRY ROCK OF SIMILAR SIZE MAY BE SUBSTITUTED.

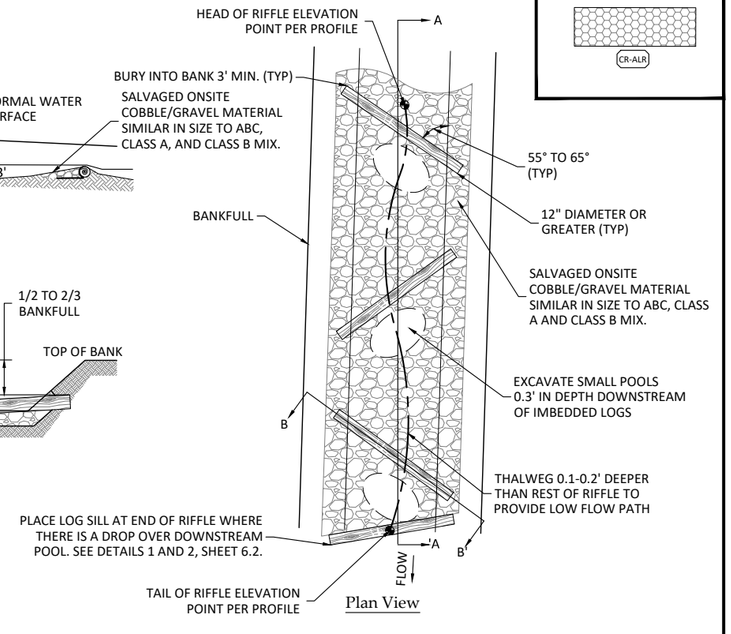
2/6.1 Woody Riffle
Not to Scale



Profile View
A-A'



Log Section
B-B'



Plan View

CR-ALR

NOTES:

- MINIMUM LOG DIAMETER 8" OR GREATER WITH FOOTER LOG, OR SINGLE 12" DIAMETER LOG.
- MINIMUM THREE LOGS PER STRUCTURE.
- RIFFLE MATERIAL HARVESTED ON-SITE IS PREFERRED
- IF NECESSARY, SALVAGED ON-SITE ROCK MAY BE SUBSTITUTED WITH QUARRY ROCK OF SIMILAR SIZE.

3/6.1 Angled Log Riffle
Not to Scale

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Perry Hill Mitigation Site
Orange County, North Carolina

Details

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Drawn By:	MC/ABP
Checked By:	CR

6.1
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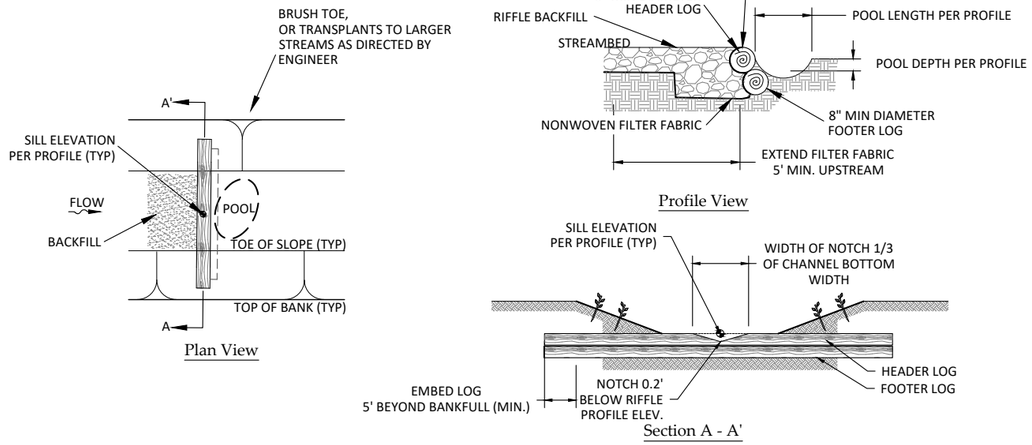
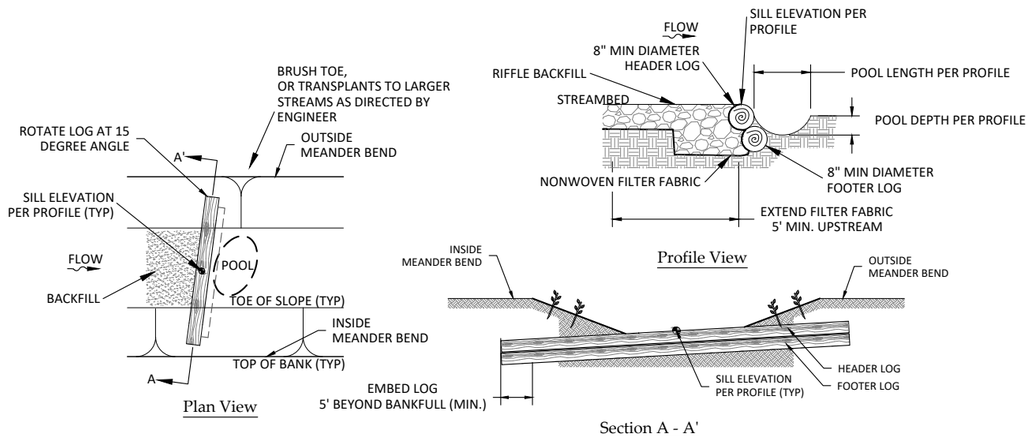


NOTES:

- IN SOME CASES LOG MAY BE ADDED AT UPSTREAM EXTENT OF RIFFLE TO INCREASE OVERALL RIFFLE STABILITY. IN THIS CASE THE LOG SILL WOULD BE INSTALLED DOWNSTREAM OF POOL.
- FOOTER LOG IS NOT NEEDED IF HEADER LOG IS 18" OR GREATER.
- SILLS ARE TO BE INSTALLED WITH THE CENTER ELEVATION UP TO 0.2' BELOW THE ELEVATION WHERE THE SILL MEETS THE STREAM BANK

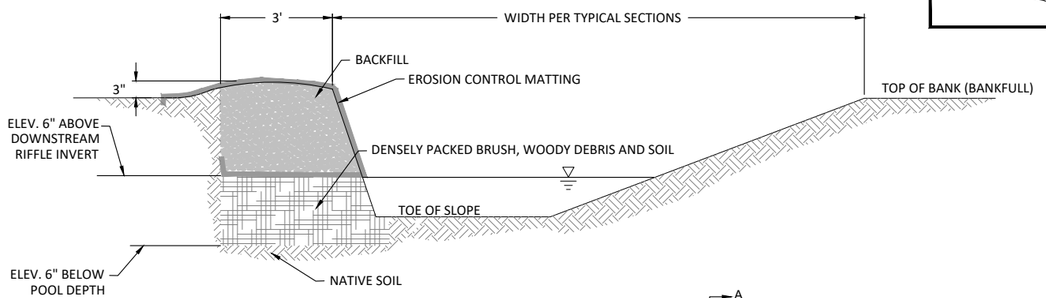
1 / 6.2 Log Sill - (UT2 Reach 2, UT3)
Not to Scale



NOTES:

- IN SOME CASES LOG MAY BE ADDED AT UPSTREAM EXTENT OF RIFFLE TO INCREASE OVERALL RIFFLE STABILITY. IN THIS CASE THE LOG SILL WOULD BE INSTALLED DOWNSTREAM OF POOL.
- FOOTER LOG IS NOT NEEDED IF HEADER LOG IS 18" OR GREATER.
- SILLS ARE TO BE INSTALLED WITH THE CENTER ELEVATION UP TO 0.2' BELOW THE ELEVATION WHERE THE SILL MEETS THE STREAM BANK

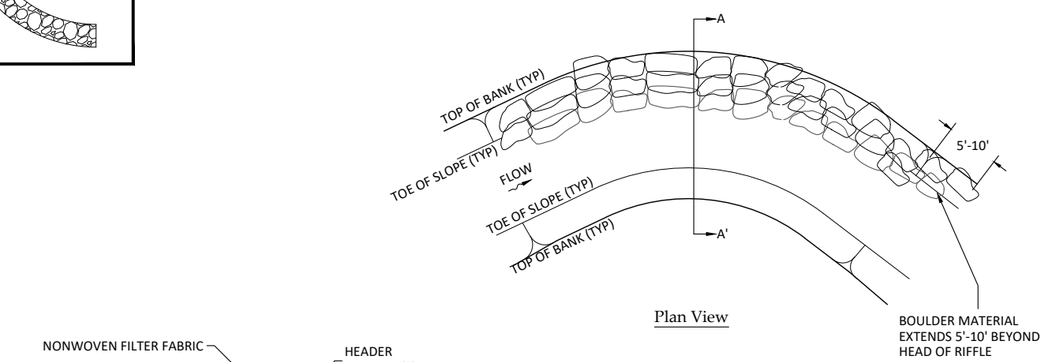
2 / 6.2 Log Sill - (Perry Branch)
Not to Scale



NOTES:

- OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
- INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE AND SOIL TO FILL ANY VOID SPACE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
- BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
- INSTALL MATTING OVER BRUSH/WOODY DEBRIS.
- INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
- SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.

3 / 6.2 Brush Toe
Not to Scale



NOTES:

- BOULDERS SHALL BE BLOCKY IN NATURE. RIPRAP IS NOT A PERMISSIBLE SUBSTITUTE FOR BOULDER TOE.
- ALL BOULDERS SHALL BE MINIMUM OF 2.0' L x 1.0' W x 1.0' H

4 / 6.2 Boulder Toe Protection
Not to Scale

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Perry Hill Mitigation Site
Orange County, North Carolina

Details

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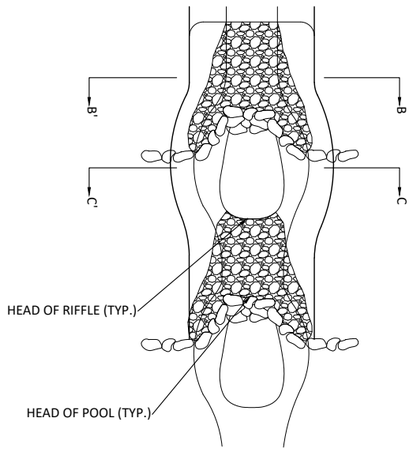
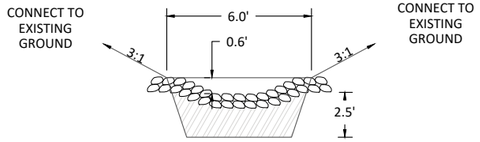
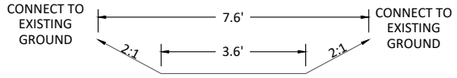




Section B-B'



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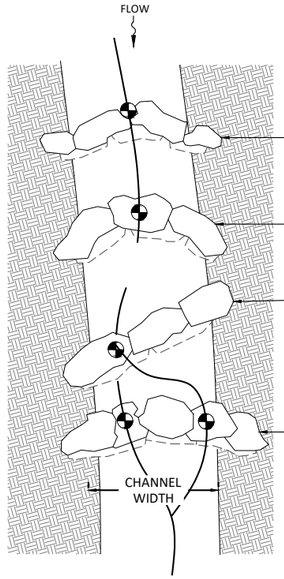


SLIGHT ARCH
THALWEG NEAR CENTER

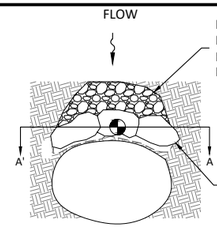
ARCHED
THALWEG NEAR CENTER

ANGLED
THALWEG INSIDE MEANDER BEND WITH ROCK CONFIGURATION ANGLED VERTICALLY 0.2' PER 3.5 TO 6.0' ANGLED LENGTH.
THALWEG ON UPSTREAM $\frac{1}{3}$ OF ANGLED STEP (SIMILAR TO ANGLED LOG STEP).

DOUBLE OR VARIABLE THALWEG PLACEMENT

NOTE: CONTRACTOR TO VARY STEP CONFIGURATIONS. VARY ARCHED, SLIGHT ARCH, AND DOUBLE OR VARIABLE TYPES RANDOMLY. ANGLE STEPS SHOULD BE USED ALONG MEANDER BENDS.

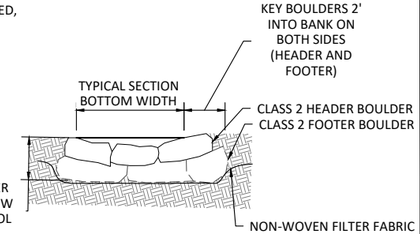
Types of Step Configurations



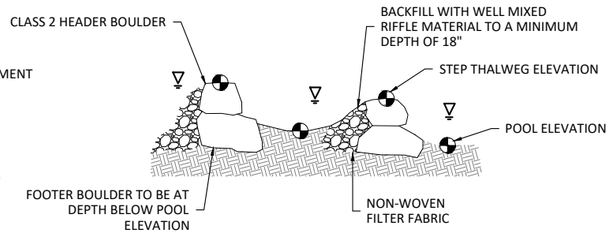
INCORPORATE RIFFLE MATERIAL WITH SIZE CLASS NOTED IN PLANS FOR THE SPECIFIC REACH (TYPICAL RIFFLE SIZING BY REACH). RIFFLE MATERIAL SHOULD BE A MIX OF PROPOSED RIFFLE SIZE CLASS AND CHANNEL SAND AND GRAVEL.

STEP MAY BE ARCHED, SLIGHTLY ARCHED, ANGLED, OR DOUBLE/VARIABLE THALWEG

Plan View



Section View A-A'

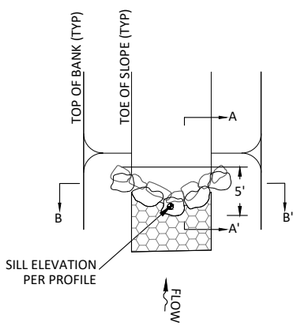


Profile View

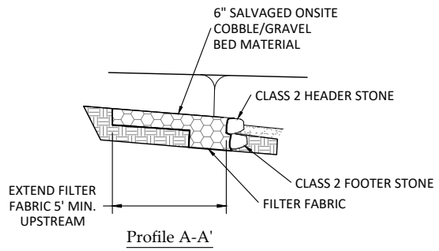
NOTES:

- RIFFLE MATERIAL CONSISTS OF WELL-MIXED NATIVE ROCK SALVAGED ON SITE IN A RANGE OF SIZES SIMILAR TO #57 STONE TO CLASS B.
- IF NATIVE ROCK IS NOT AVAILABLE, QUARRIED ROCK MAY BE SUBSTITUTED IN THE SAME SIZES.

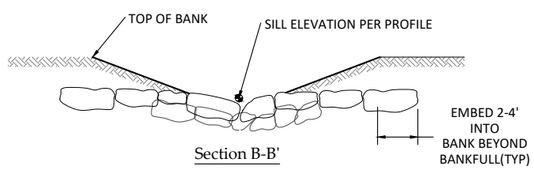
1 / 6.3 Step-Pool Sequence
Not to Scale



Plan View



Profile A-A'

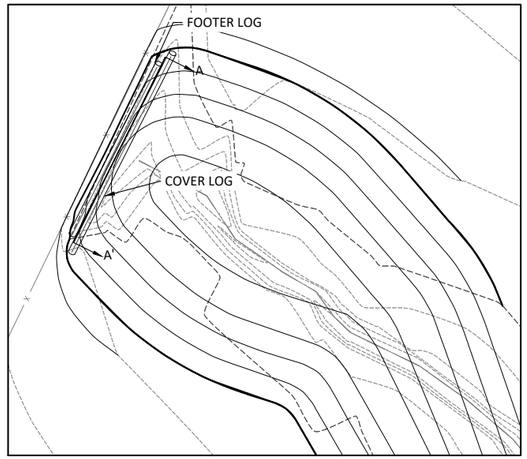


Section B-B'

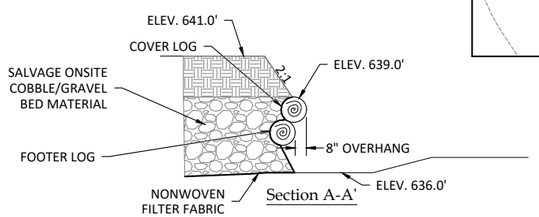
NOTE:

- DUE TO SHALLOW DEPTH, ALL CHANNELS MAY BE CONSTRUCTED WITH ONE HEADER ROCK

2 / 6.3 Rock Sill
Not to Scale



Plan View



Section A-A'

3 / 6.3 Lunker Log
Not to Scale

NOTES:

- 12" MINIMUM DIAMETER COVER AND FOOTER LOG
- DO NOT DISTURB EXISTING FENCE ADJACENT TO LUNKER LOG

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Perry Hill Mitigation Site
Orange County, North Carolina

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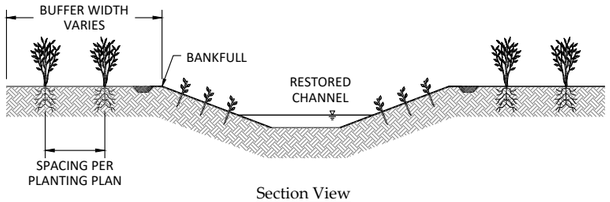


Section View

DIBBLE BAR

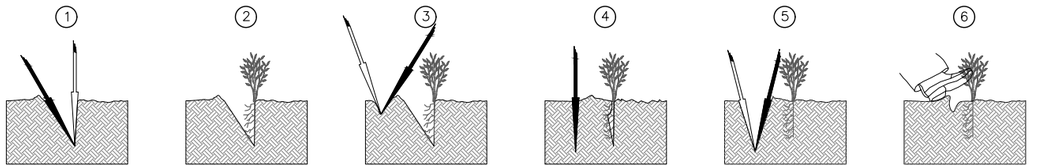
PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS-SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.

ROOTING PRUNING

ALL ROOTS SHALL BE PRUNED TO AN APPORIATE LENGTH TO PREVENT J-ROOTING.

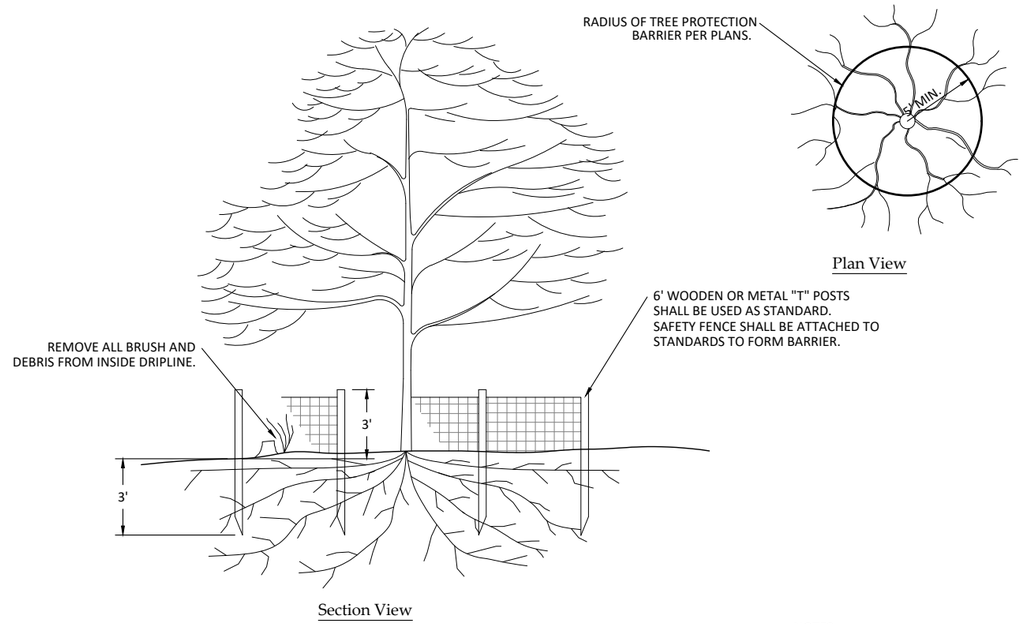
NOTES:

- ALL SOILS WITHIN THE BUFFER PLANTING AREA SHALL BE DISKED, AS REQUIRED, PRIOR TO PLANTING.
- ALL PLANTS SHALL BE PROPERLY HANDLED PRIOR TO INSTALLATION TO INSURE SURVIVAL.



1. INSERT THE DIBBLE, OR SHOVEL, STRAIGHT DOWN INTO THE SOIL TO THE FULL DEPTH OF THE BLADE AND PULL BACK ON THE HANDLE TO OPEN THE PLANTING HOLE. (DO NOT ROCK THE SHOVEL BACK AND FORTH AS THIS CAUSES SOIL IN THE PLANTING HOLE TO BE COMPACTED, INHIBITING ROOT GROWTH.
2. REMOVE THE DIBBLE, OR SHOVEL, AND PUSH THE SEEDLING ROOTS DEEP INTO THE PLANTING HOLE. PULL THE SEEDLING BACK UP TO THE CORRECT PLANTING DEPTH (THE ROOT COLLAR SHOULD BE 1 TO 3 INCHES BELOW THE SOIL SURFACE). GENTLY SHAKE THE SEEDLING TO ALLOW THE ROOTS TO STRAIGHTEN OUT. DO NOT TWIST OR SPIN THE SEEDLING OR LEAVE THE ROOTS J-ROOTED.
3. INSERT THE DIBBLE, OR SHOVEL, SEVERAL INCHES IN FRONT OF THE SEEDLING AND PUSH THE BLADE HALFWAY INTO THE SOIL. TWIST AND PUSH THE HANDLE FORWARD TO CLOSE THE TOP OF THE SLIT TO HOLD THE SEEDLING IN PLACE.
4. PUSH THE DIBBLE, OR SHOVEL, DOWN TO THE FULL DEPTH OF THE BLADE.
5. PULL BACK ON THE HANDLE TO CLOSE THE BOTTOM OF THE PLANTING HOLD. THEN PUSH FORWARD TO CLOSE THE TOP, ELIMINATING AIR POCKETS AROUND THE ROOT.
6. REMOVE THE DIBBLE, OR SHOVEL, AND CLOSE AND FIRM UP THE OPENING WITH YOUR HEEL. BE CAREFUL TO AVOID DAMAGING THE SEEDLING.

1 / 6.4 Bare Root Planting
Not to Scale



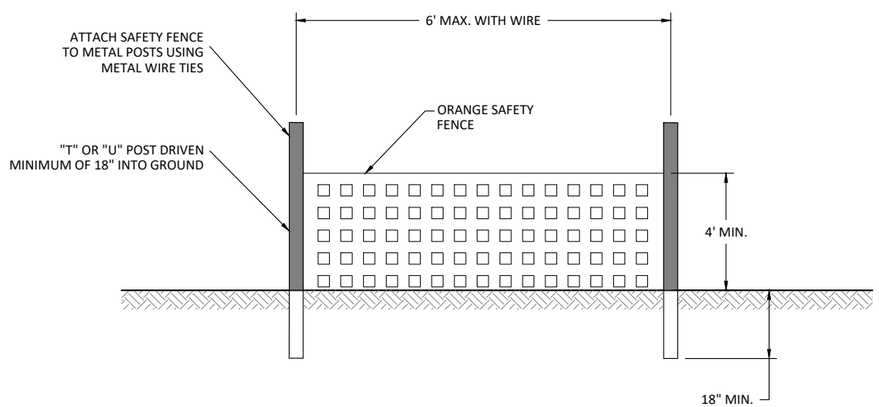
2 / 6.4 Tree Protection
Not to Scale

NOTES:

- ALL TREE PROTECTION BARRIERS SHALL BE REMOVED PRIOR TO CONTRACTOR DEMOBILIZATION.
- SEE PLANS FOR LOCATION OF ALL TREE PROTECTION BARRIERS.

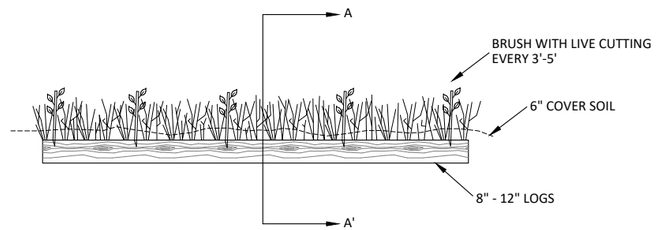
SAF

MATERIAL SPECIFICATIONS		
PHYSICAL PROPERTY	TESTS	REQUIREMENTS
MATERIAL	N/A	POLYETHYLENE
RECOMENDED COLOR	N/A	"INTERNATIONAL ORANGE"
TENSILE YIELD	ASTM D638	AVE. 2000 LBS. PER 4' WIDE
ULTIMATE TENSILE STRENGTH	ASTM D638	AVE. 2900 LBS. PER 4' WIDE
ELONGATION AT BREAK (%)	ASTM D638	GREATER THAN 1000%
CHEMICAL RESISTANCE	N/A	INERT TO MOST CHEMICALS AND ACIDS

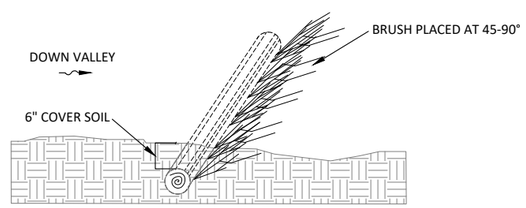


3 / 6.4 Safety Fence
Not to Scale

SAF



Profile View



Section A - A'

4 / 6.4 Floodplain Sill
Not to Scale

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. SMITH 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Details

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Job Number: 005-02180
Project Engineer: GLS
Drawn By: MCABP
Checked By: CR

Sheet 6.4

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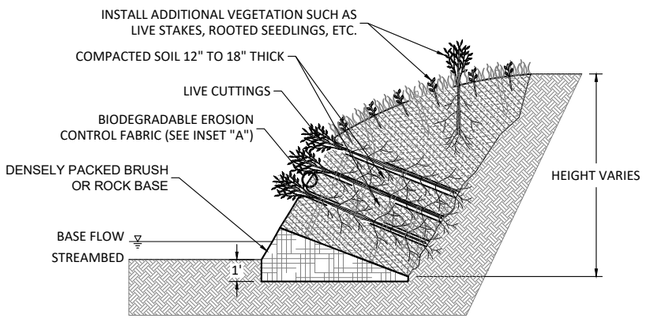
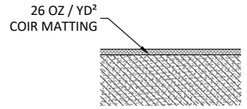
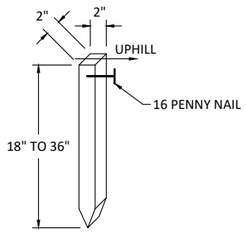


Section View



Inset "A"
Matting and Blanket

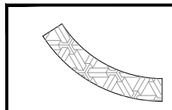


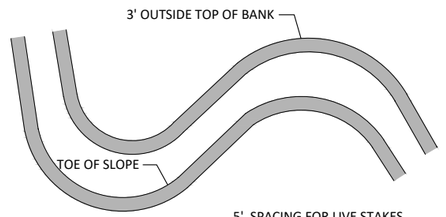
Typical
Stakes

NOTES:

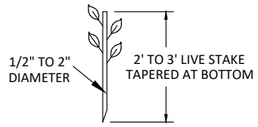
- ROOTED/LEAFED CONDITION OF THE LIVING PLANT MATERIAL IS NOT REPRESENTATIVE OF THE TIME OF INSTALLATION.
- BOTTOM OF FIRST COMPACTED EARTH LIFT TO BE PLACED 6" ABOVE NORMAL BASEFLOW.
- NUMBER OF COMPACTED EARTH LIFTS TO VARY DEPENDING ON DESIGN TOP OF BANK HEIGHT.

1/6.5 Vegetated Soil Lift
Not to Scale

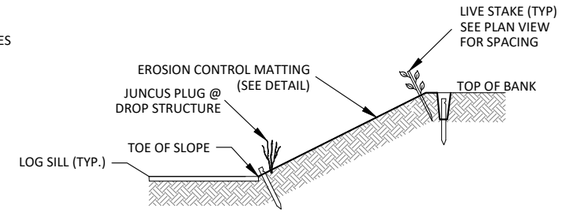




Plan View



Live Stake Detail



Section View

NOTES:

1. LIVE STAKES TO BE PLANTED IN AREAS AS SHOWN ON PLANS AND DIRECTED BY THE ENGINEER.
2. LIVE STAKES WILL BE INSTALLED AT 5' SPACING ON ALL OUTSIDE OF BENDS THAT DO NOT HAVE BRUSH TOE INSTALLED.

2/6.5 Live Staking and Juncus Plugs
Not to Scale

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Checked By:	CR

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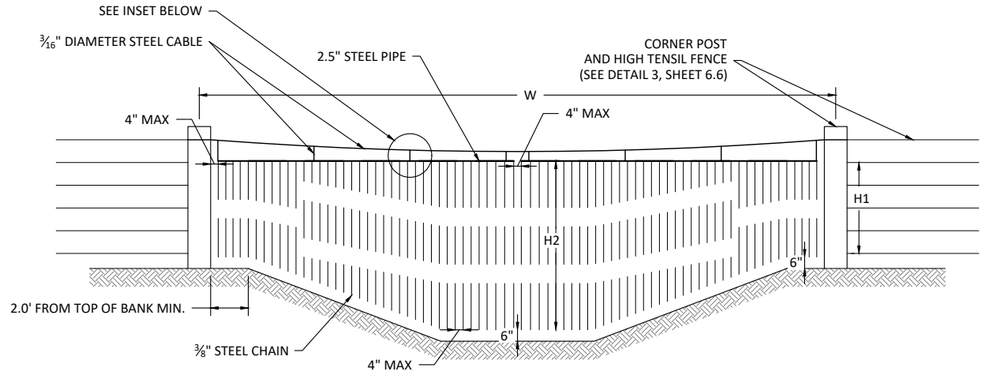
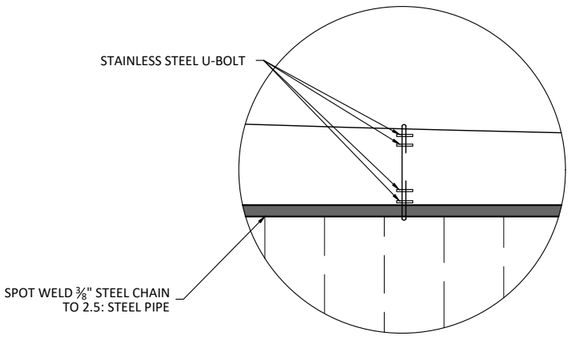
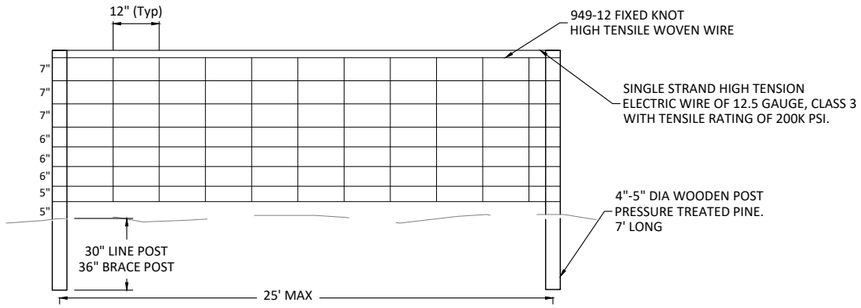




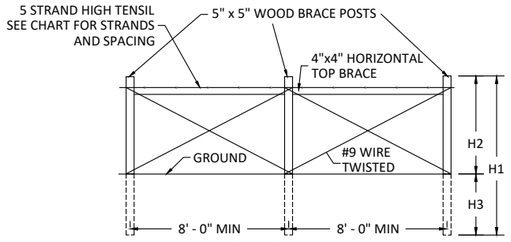
1 / 6.6 Suspended Cable Fence
Not to Scale



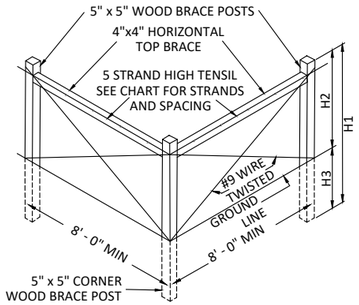
2 / 6.6 Woven Wire Fence
Not to Scale

NOTES:

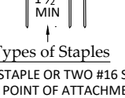
- FENCE SHALL BE INSTALLED A MINIMUM OF 1' FROM CONSERVATION EASEMENT.
- THE FENCE SHALL MEET CLASSIFICATION FOR 949-12 FIXED KNOT HIGH TENSILE WOVEN WIRE.
- A SINGLE STRAND HIGH TENSION ELECTRIC WIRE OF 12.5 GAUGE WITH A TENSILE RATING OF 200K PSI SHALL BE INSTALLED 30 INCHES ABOVE THE GROUND ON THE LIVESTOCK SIDE OF THE FENCE.
- LINE POSTS SHALL BE SET AT LEAST 30 INCHES INTO THE GROUND.
- LINE POSTS SHALL BE 4"-5"" DIA PRESSURE TREATED PINE.
- BRACE POSTS SHALL BE 5" DIAMETER AND SET 3 FEET IN THE GROUND. HORIZONTAL RAIL BRACE POSTS SHALL BE 2" DIAMETER GALVANIZED PIPE, 8' LONG, AND INSTALLED 8"-12" BELOW THE TOP OF THE VERTICAL BRACE POST.
- ALL CORNERS, FENCE LINE ENDS, AND GATE OPENINGS REQUIRE DOUBLE H BRACE ASSEMBLIES. STRAIGHT LINE FENCE SHALL BE 660 FEET MAXIMUM SPACING. STRAIGHT FENCE SPANS 330 FEET OR LESS SHALL USE SINGLE H BRACE ASSEMBLIES.
- 8" LOG CORNER INSULATORS SHOULD BE USED WHERE ADDITIONAL STRENGTH IS REQUIRED.
- DOUBLE WALL 12.5 GAUGE UNDERGROUND WIRE WILL BE USED UNDER GATES.
- REFER TO THE SPECIFICATIONS FOR MORE INFORMATION ON FENCING.



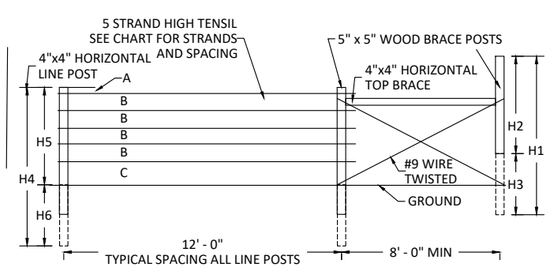
Line Braces
(MAXIMUM SPACING 330')



Corner Braces
USE WHEN CORNER ANGLE IS 15° OR GREATER



Alternate Types of Staples
USE ONE #9 STAPLE OR TWO #16 STAPLES
AT EACH POINT OF ATTACHMENT.



End or Gate Braces

HIGH TENSIL FENCE CHART		
NUMBER OF HIGH TENSIL STRANDS		5
	A	2"
STRAND	B	10"
SPACING	C	12"
BRACE POSTS		
LENGTH	H1	8"
EXPOSED	H2	4'-5"
EMBEDMENT	H3	3'-5"
LINE POSTS		
LENGTH	H4	6'-6"
EXPOSED	H5	4'-5"
EMBEDMENT	H6	2'-0"
HORIZONTAL BRAC		8'-0"

3 / 6.6 Five Strand High Tensil Fence
Not to Scale

NOTE:

- FENCE TO BE OFFSET 2' FROM CONSERVATION EASEMENT

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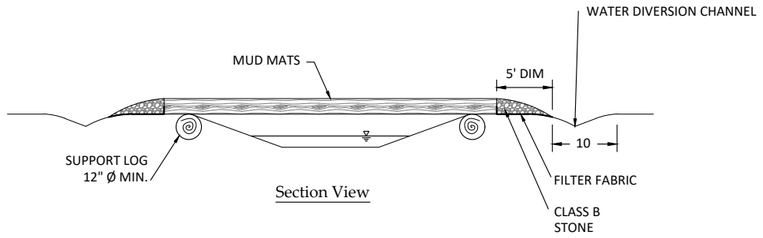
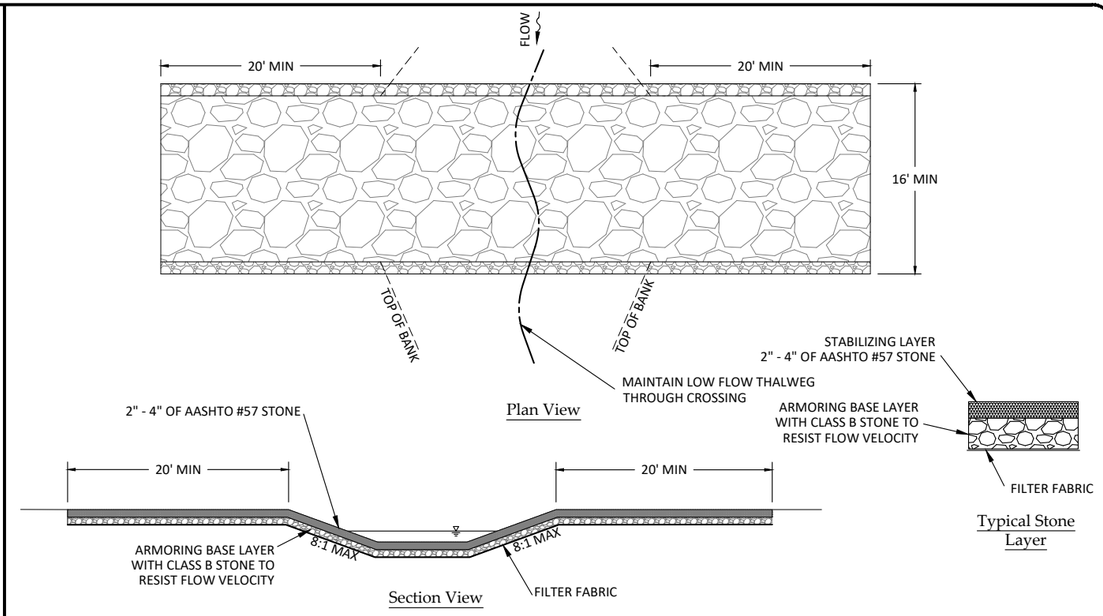


Section View

NOTES:

- CONSTRUCT STREAM CROSSING WHEN FLOW IS AT NORMAL BASEFLOW.
- MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
- INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
- MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
- STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
- CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.
- CONTRACTOR SHALL DETERMINE AN APPROPRIATE WIDTH SO THAT MUD MATS ARE WIDER THAN THE LARGEST EQUIPMENT THAT WILL UTILIZE IT.
- ALL SIDE BOARDS SHALL BE 6'' MINIMUM IN HEIGHT.
- ALL MATS SHALL BE 4' IN WIDTH.
- ALL MATS SHALL HAVE NO GAPS BETWEEN TIMBERS.
- SILT FENCE TO BE INSTALLED AT 45° ANGLE TO THE ROAD WITH STONE OUTLET AT EACH CORNER OF TEH TEMPORARY CROSSING TO FILTER ANY SEDIMENT AND DEBRIS FROM HAUL ROAD FROM ENTERING STREAM.

1/6.7 Temporary Stream Crossing - Timber Mat
Not to Scale



2/6.7 Permanent Ford Crossing
Not to Scale

NOTE:

- FORD CROSSING SURFACE COURSE CONSISTS OF CLASS B STONE

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Perry Hill Mitigation Site
Orange County, North Carolina

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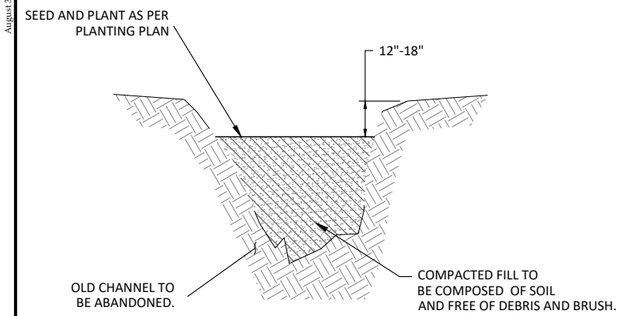
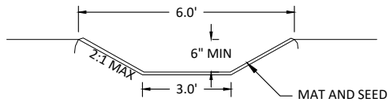
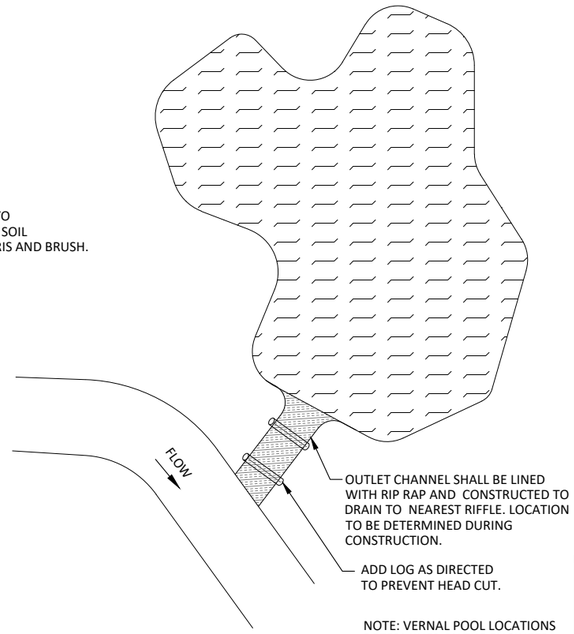


Vernal Pool Section



Outlet Channel Section

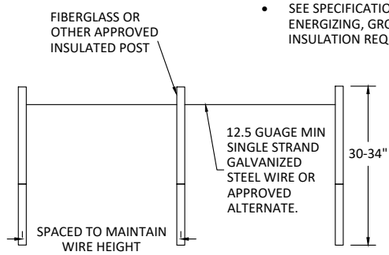


NOTE: VERNAL POOL LOCATIONS DETERMINED BY THE ENGINEER IN THE FIELD

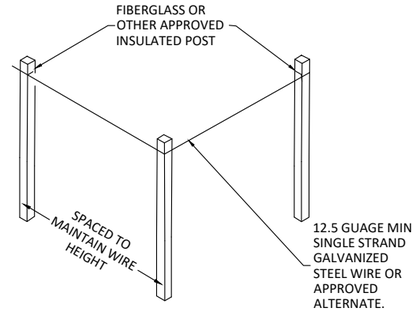
1 / 6.8 Vernal Pool
Not to Scale

NOTE:

- SEE SPECIFICATIONS FOR ENERGIZING, GROUNDING, AND INSULATION REQUIREMENTS.



Line Braces

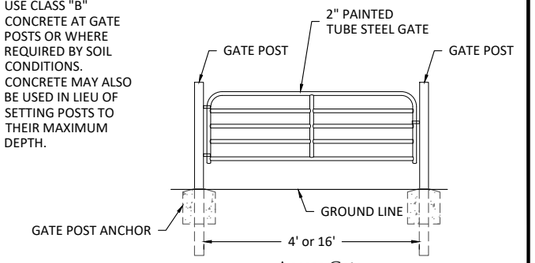


Corner Brace

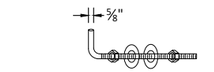
2 / 6.8 Temporary Cattle Exclusion Fence
NCDOT Detail No. 866.04
Not to Scale

NOTE:

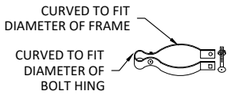
- USE CLASS "B" CONCRETE AT GATE POSTS OR WHERE REQUIRED BY SOIL CONDITIONS. CONCRETE MAY ALSO BE USED IN LIEU OF SETTING POSTS TO THEIR MAXIMUM DEPTH.



Access Gate

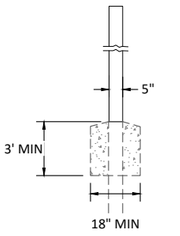


Bolt Hinge
(2 Required)



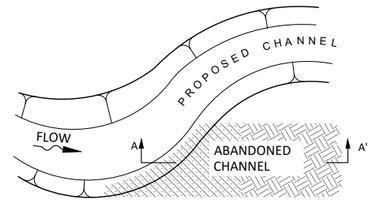
Hinge Clamp
(2 Required)

Hinge Assembly

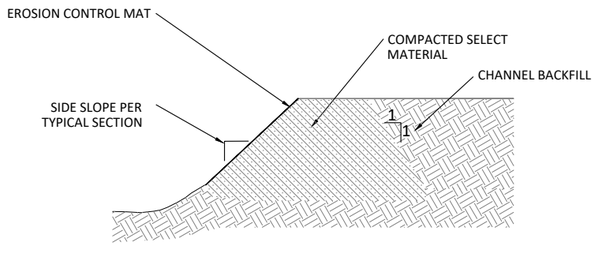


Detail of Gate Post Anchor

3 / 6.8 2" Tube Steel Gate
Not to Scale



Plan View



Section A-A'

4 / 6.8 Channel Plug
Not to Scale

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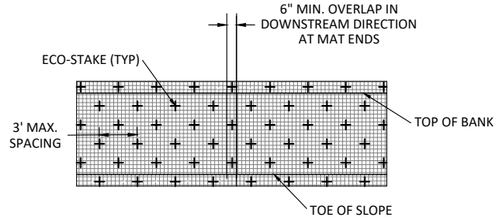
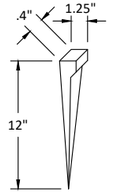
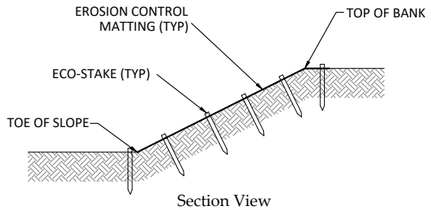


Plan View



Eco-Stake

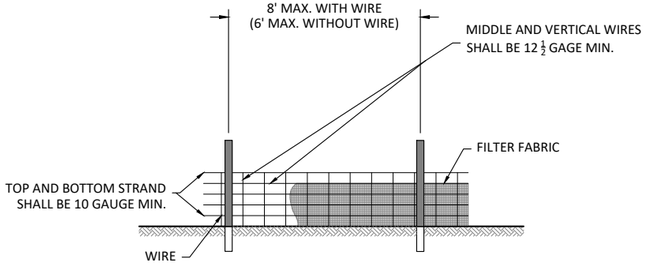


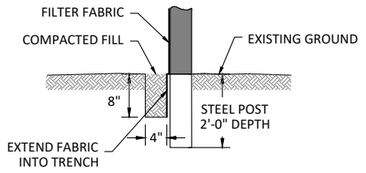
Section View

NOTES:

- TOP ROW OF STAKES SHOULD FACE AWAY FROM THE STREAM.
- BOTTOM ROW OF STAKES SHOULD FACE TOWARDS THE STREAM.
- MIDDLE ROWS OF STAKES SHOULD FACE UPSTREAM.

1 / 6.9 Erosion Control Matting
Not to Scale

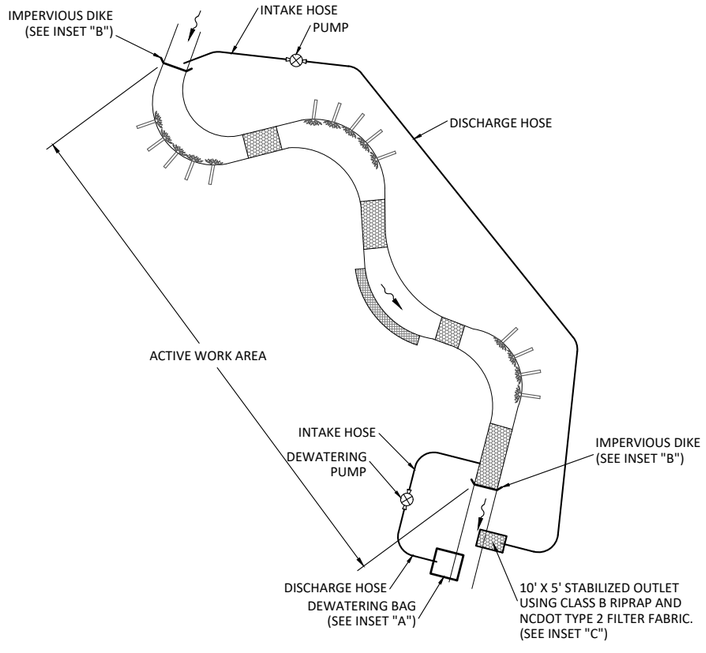




NOTES:

- USE WIRE A MINIUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINES OF WIRES WITH 12" STAY SPACING.
- USE FILTER FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE WIRES AS DIRECTED BY THE ENGINEER.
- PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE. ANGLE STEEL TYPE.

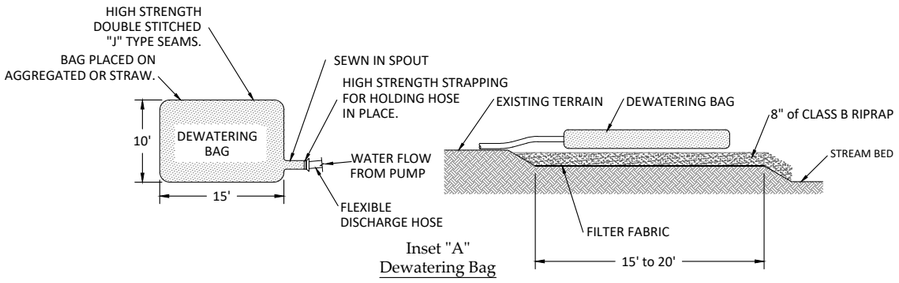
2 / 6.9 Temporary Silt Fence
Not to Scale



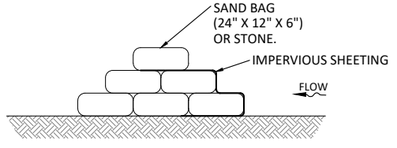
Plan View

NOTE:

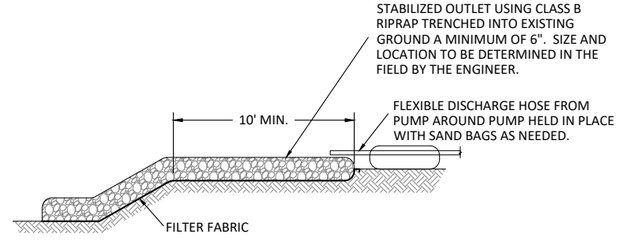
- PROVIDE STABILIZED OUTLET TO STREAMBED.



Inset "A"
Dewatering Bag



Inset "B"
Impervious Dike



Inset "C"
Stabilized Outlet

3 / 6.9 Pump Around System
Not to Scale

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. GEDDES 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Erosion Sediment Control Details

Revisions:

Date:	(07.23.2020)
Job Number:	1305-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CK

Sheet 6.9

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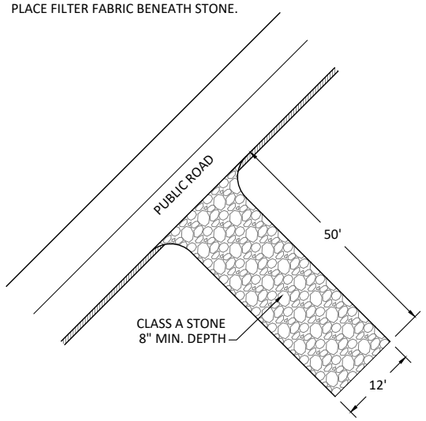
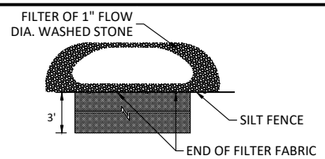
August 3, 2020

NOTES:

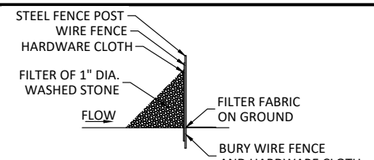
- PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
- LOCATE CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
- MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
- ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED IMMEDIATELY.
- USE CLASS A STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
- PLACE FILTER FABRIC BENEATH STONE.



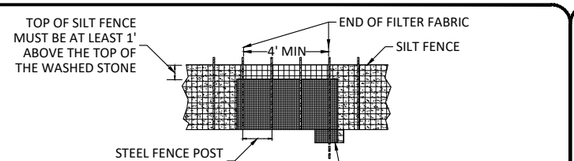
1 / 6.10 Construction Entrance
Not to Scale



Plan View



Section View



Front View

INSTALLATION:

REFER TO THE PLANS FOR LOCATIONS AND SPECIFICATIONS. DURING INSTALLATION OF THE SILT BARRIER OR SILT FENCE, INSPECT THE INSTALLATION TO DETERMINE IF OUTLETS ARE NEEDED ACCORDING TO THE CRITERIA SET FORTH IN THE SPECIFICATIONS FOR THE BARRIER AND FENCE. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER, ARCHITECT, OR RESPONSIBLE PERSONNEL ON THE SITE FOR ASSISTANCE. EROSION CONTROL PERSONNEL HAVE COPIES OF INSTRUCTIONS AND MAY HAVE PHOTOGRAPHS OF PROPERLY INSTALLED OUTLETS AS AN AID TO INSTALLATION.

IF THE SILT FENCE OUTLET IS NOT INSTALLED CORRECTLY THE FIRST TIME, IT WILL HAVE TO BE REBUILT.

DETERMINE THE EXACT LOCATION ON THE GROUND BEFORE COMPLETING INSTALLATION OF THE SILT FENCE, TAKING INTO CONSIDERATION:

INSTALL THE OUTLET AT THE LOWEST POINT (S) IN THE BARRIER OR FENCE WHERE WATER WILL POND.

INSTALL THE OUTLET WHERE IT IS ACCESSIBLE FOR INSTALLATION, MAINTENANCE, AND REMOVAL.

ALLOW AT LEAST:
15 FEET BETWEEN THE BARRIER OR FENCE AND SINGLE-STORY BUILDINGS.
25 FEET FOR FORK LIFTS BETWEEN THE BARRIER OR FENCE AND MULTIPLE-STORY BUILDINGS.
10 FEET BETWEEN THE BARRIER OR FENCE AND THE TOE OF FILL SLOPES.

PLACE THE OUTLET SO THAT WATER FLOWING THROUGH IT WILL NOT CREATE AN EROSION HAZARD BELOW: AVOID STEEP SLOPES BELOW THE OUTLET AND AREAS WITHOUT PROTECTIVE VEGETATION. USE SLOPE DRAINS IF NECESSARY.

DETERMINE THE LOCATION OF THE OUTLET: FOR A SILT BARRIER, WHEN THE TRENCH IS DUG TO BURY THE BOTTOM OF THE FABRIC BECAUSE THE BARRIER WILL BE OMITTED AT THE OUTLET; FOR A SILT FENCE, WHEN THE WIRE FENCE IS IN PLACE BECAUSE THE FILTER FABRIC WILL BE OMITTED AT THE OUTLET.

REFER TO THE ILLUSTRATIONS OF THE OUTLET IN THE PLAN.

CLEAR STUMPS AND ROOTS FROM THE LOCATION OF THE OUTLET. CLEAR ADEQUATE ACCESS FOR THE EQUIPMENT NEEDED FOR INSTALLATION, MAINTENANCE, AND REMOVAL.

FOR A SILT BARRIER:
JUST BELOW THE GAP IN THE BARRIER, PLACE A LAYER OF FILTER FABRIC ON THE GROUND TO PROTECT THE SOIL FROM EROSION BY OUTFLOW FROM THE OUTLET; PLACE 6 INCHES OF THE UPPER EDGE IN THE TRENCH. STAKE THE REMAINING EDGES OF THE FABRIC TO HOLD IT IN PLACE.

ALONG THE GAP WHERE THE OUTLET WILL GO, PLACE STEEL FENCE POSTS FOR STRENGTH. THE POSTS MUST BE A MAXIMUM OF 2 FEET APART AND DRIVEN INTO SOLID GROUND AT LEAST 18 INCHES.

PLACE HARDWARE CLOTH (WELDED GALVANIZED SCREEN WITH SQUARE 1/4 - 1/2-INCH HOLES) ON THE UPHILL SIDE OF THE POSTS TO HOLD THE WASHED STONE IN PLACE. PUT 6 INCHES OF THE BOTTOM OF THE CLOTH IN THE TRENCH AND FASTEN IT TO THE POSTS WITH LENGTHS OF WIRE.

BURY THE BOTTOM OF THE HARDWARE CLOTH AND THE UPPER EDGE OF THE FILTER FABRIC BELOW THE OUTLET IN THE TRENCH AND COMPACT THE FILL.

PLACE A FILTER OF 1-INCH DIAMETER WASHED STONE ON THE UPHILL SIDE OF THE OUTLET. PILE THE STONE UP TO THE TOP OF THE HARDWARE CLOTH AND OVER THE JOINT BETWEEN THE OUTLET AND THE BARRIER.

FOR A SILT FENCE:
JUST BELOW THE GAP IN THE BARRIER, PLACE A LAYER OF FILTER FABRIC ON THE GROUND TO PROTECT THE SOIL FROM EROSION BY OUTFLOW FROM THE OUTLET; PLACE 6 INCHES OF THE UPPER EDGE IN THE TRENCH. STAKE THE OTHER EDGES OF THE FABRIC TO HOLD IT IN PLACE.

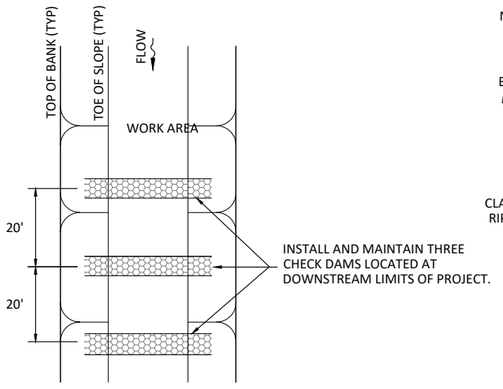
ALONG THE GAP WHERE THE OUTLET WILL GO, PLACE ADDITIONAL STEEL FENCE POSTS FOR STRENGTH. THE POSTS MUST BE A MAXIMUM OF 2 FEET APART AND DRIVEN INTO SOLID GROUND AT LEAST 18 INCHES.

PLACE HARDWARE CLOTH (WELDED GALVANIZED SCREEN WITH SQUARE 1/4 - 1/2-INCH HOLES) ON THE UPHILL SIDE OF THE POSTS TO HOLD THE WASHED STONE IN PLACE. PUT 6 INCHES OF THE BOTTOM OF THE CLOTH IN THE TRENCH AND FASTEN IT TO THE POSTS WITH LENGTHS OF WIRE.

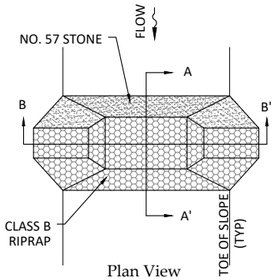
BURY THE BOTTOM OF THE HARDWARE CLOTH, THE UPPER EDGE OF THE FILTER FABRIC BELOW THE OUTLET, AND THE WIRE FENCE IN THE TRENCH AND COMPACT THE FILL.

PLACE A FILTER OF 1-INCH DIAMETER WASHED STONE ON THE UPHILL SIDE OF THE OUTLET. PILE THE STONE UP TO THE TOP OF THE HARDWARE CLOTH AND OVER THE JOINT BETWEEN THE OUTLET AND THE SILT FENCE.

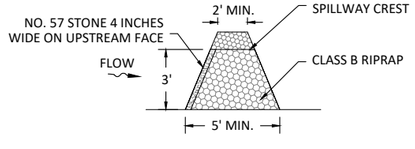
2 / 6.10 Temporary Silt Fence Gravel Outlet
Not to Scale



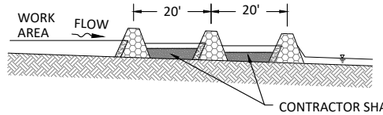
Plan View



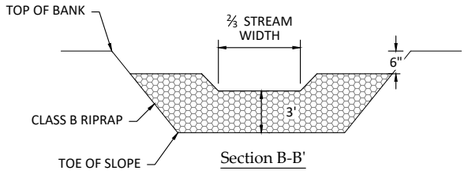
Plan View



Section A-A'

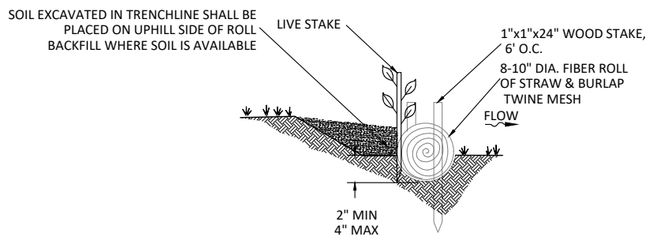


Profile View

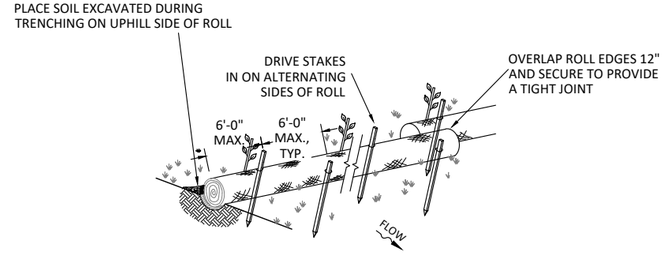


Section B-B'

3 / 6.10 Temporary Rock Check Dam
Not to Scale



Section View



NOTES:

- FIBER ROLLS TO BE PLACED ON THE BANKS OF THE HEADWATER CONVEYANCE PERPENDICULAR TO HILLSLOPE
- LIVE STAKES SHALL BE PLACED AT 5' ON CENTER DIRECTLY BEHIND THE COIR FIBER LOG, ACCORDING TO PLANTING PLAN SPECIES.
- IF FILL MATERIAL IS AVAILABLE, BACKFILL ERODED PATHWAY UP SLOPE OF THE COIR FIBER ROLL TO SMOOTH THE BANK GRADE.

4 / 6.10 Fiber Roll
Not to Scale

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SEAL 048920 GEOFFREY L. CLAYTON NORTH CAROLINA PROFESSIONAL ENGINEER 7/27/20

Perry Hill Mitigation Site
Orange County, North Carolina

Erosion Sediment Control Details

Revisions:

Date:	(07.23.2020)
Job Number:	(005-02180)
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CK

Sheet 6.10

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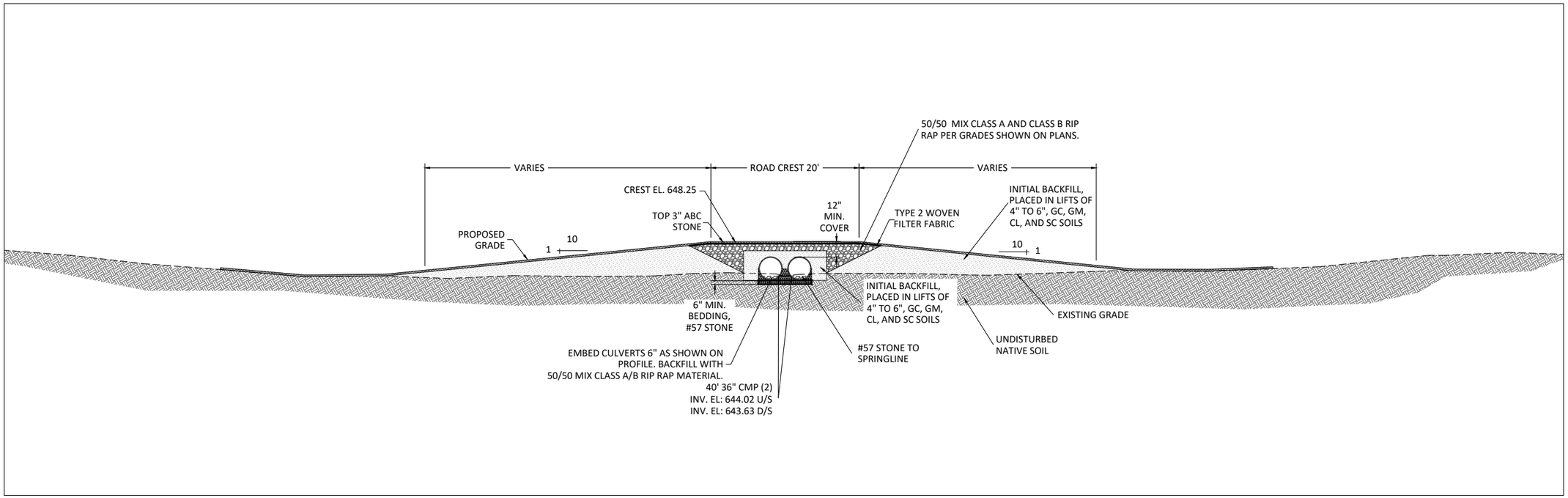
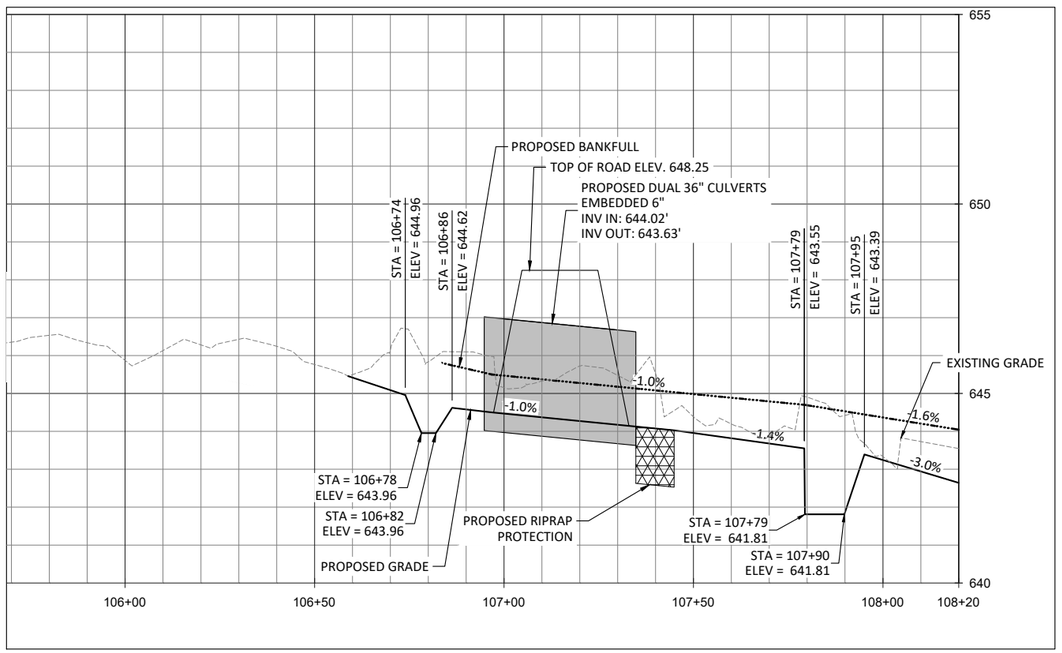
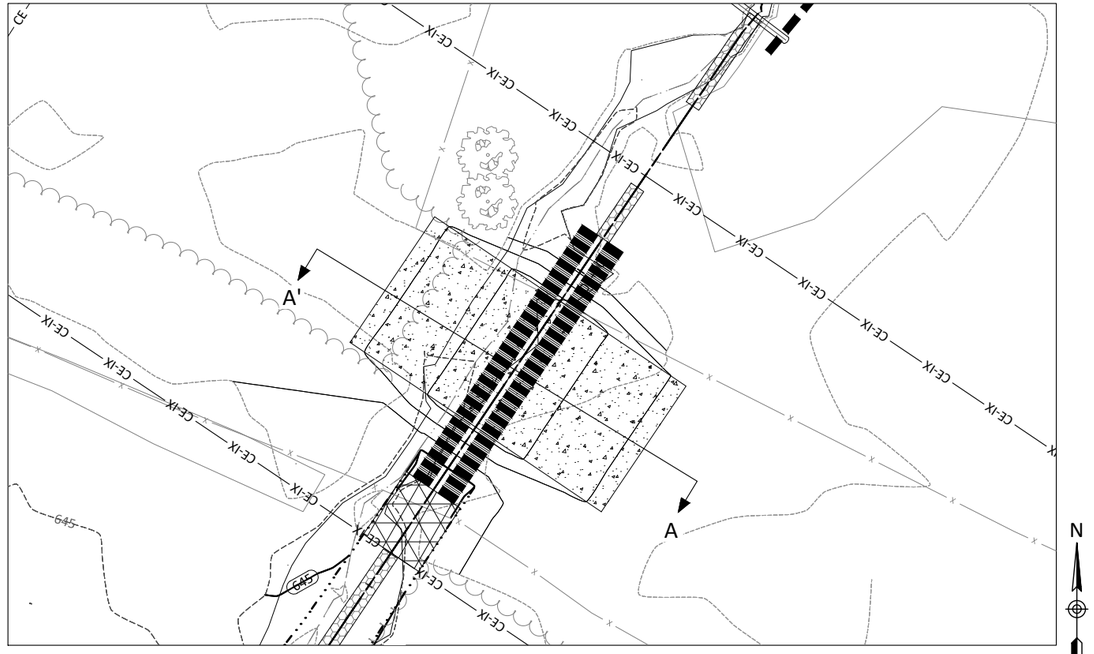


Section View A-A'



Profile View



Plan View

1 / 6.11 CMP Pipe Culvert Crossing - Perry Branch Reach 2
Not to Scale

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 GEOFFREY L. CRISP 7/24/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 2 & 3 Culvert Details

Revisions:

Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Sheet 6.11

August 3, 2020

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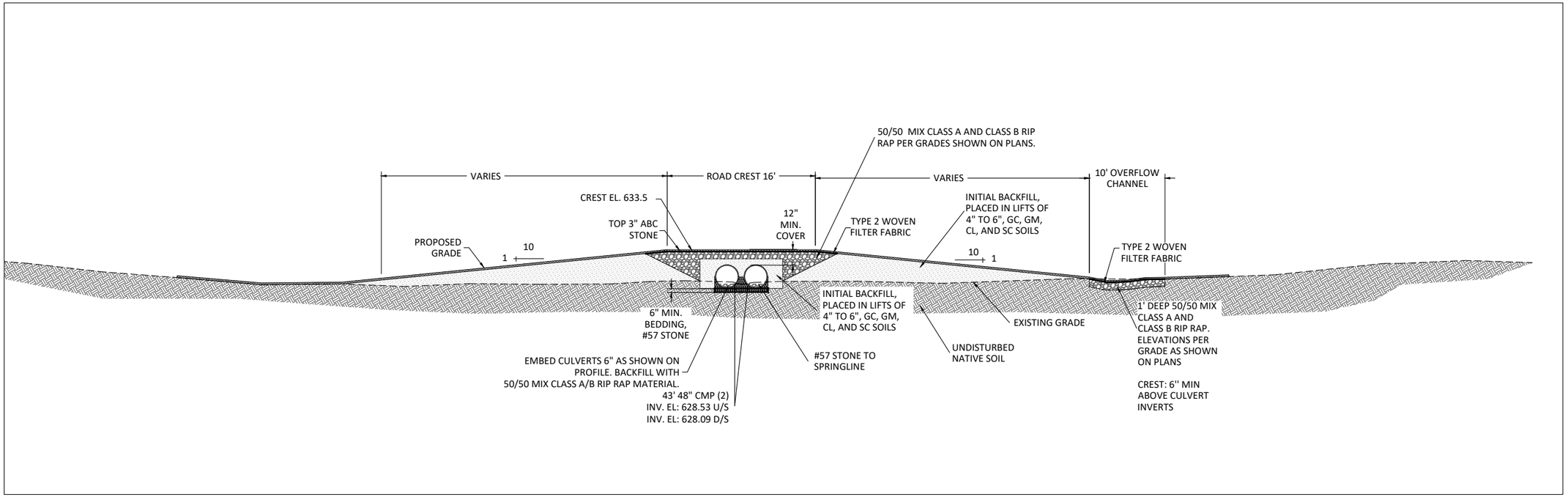
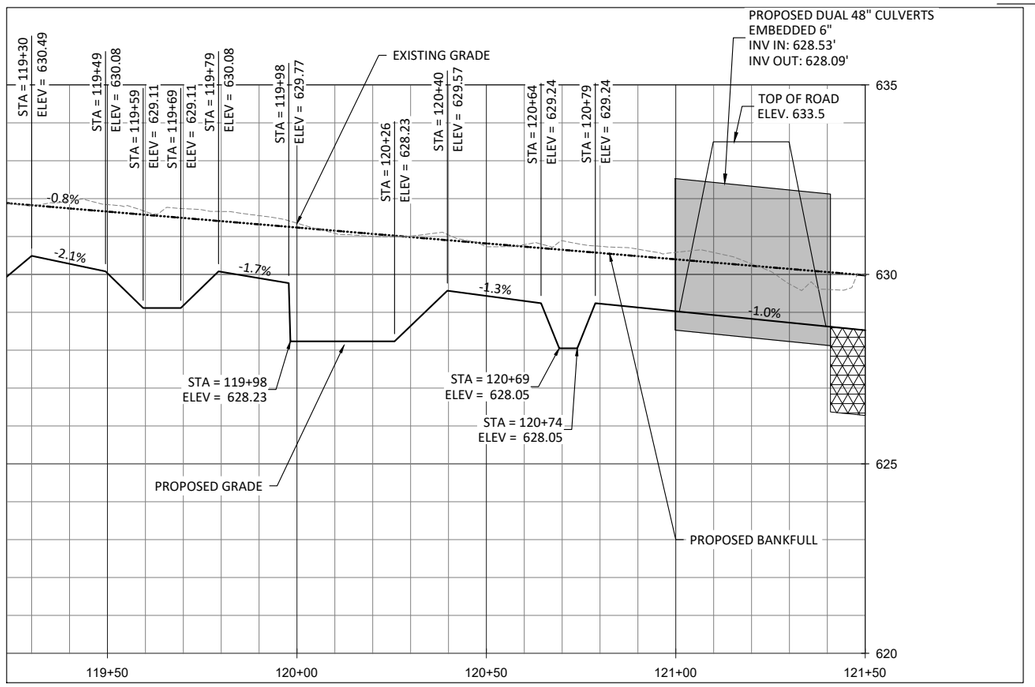
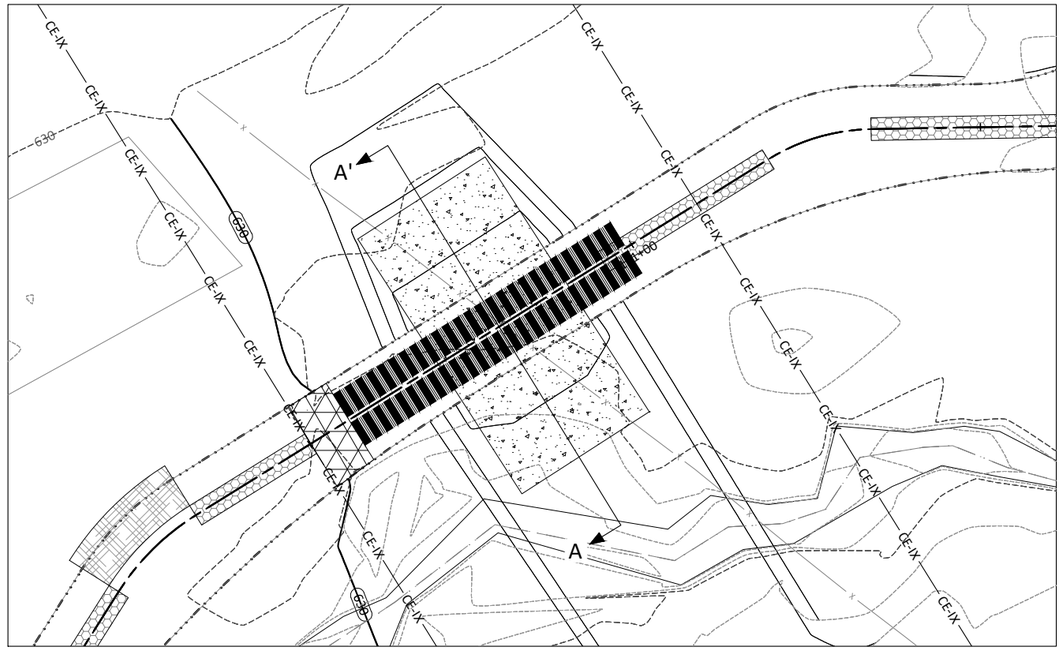
August 3, 2020



Section View A-A'



Profile View



Plan View

1 / 6.12 CMP Pipe Culvert Crossing - Perry Branch Reach 4
Not to Scale

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 048920 JEFFREY L. GEDDINGS 7/27/20

Perry Hill Mitigation Site
Orange County, North Carolina

Perry Branch Reach 4 Culvert Details

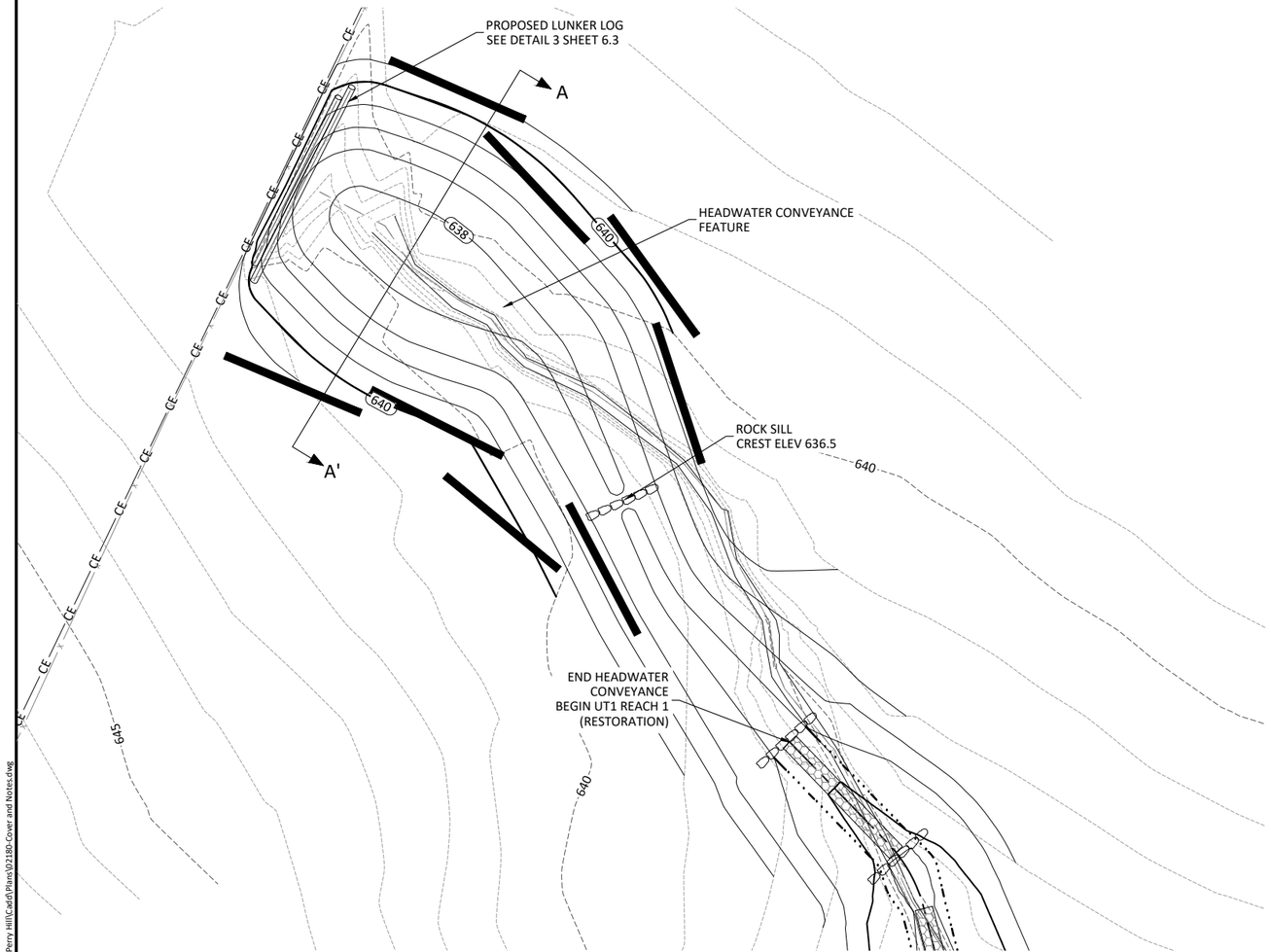
Date:	07.23.2020
Job Number:	005-02180
Project Engineer:	GLS
Drawn By:	MC/ABP
Checked By:	CR

Revisions:

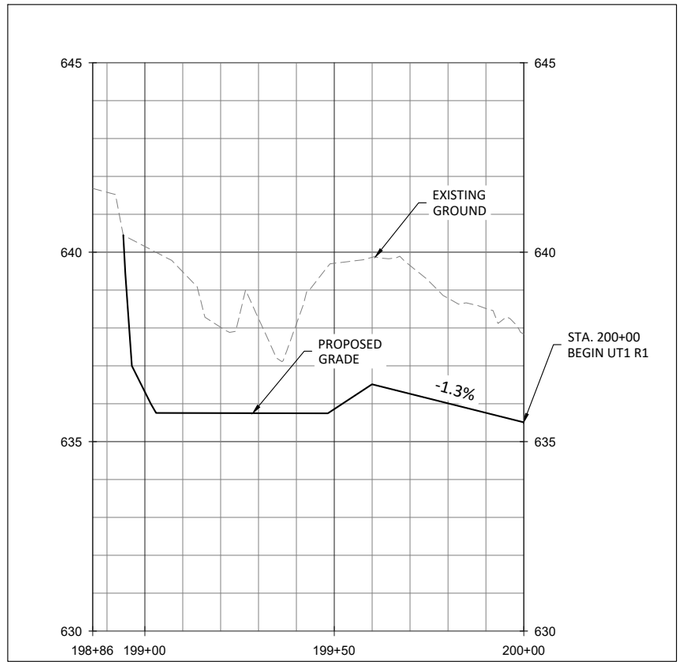
6.12

Sheet

August 3, 2020



Plan View



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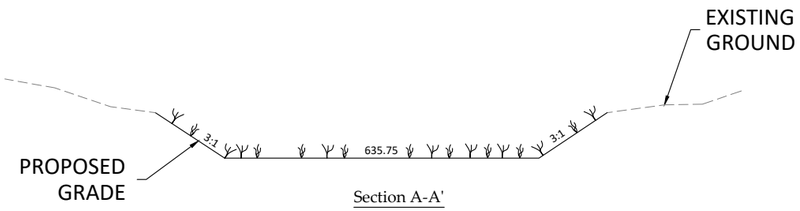
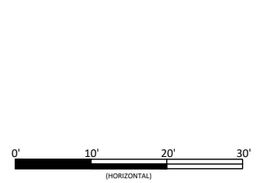


Section A-A'

1 / 6.13 Headwater Conveyance
Not to Scale



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Tel: 843.277.6221

NORTH CAROLINA PROFESSIONAL GEOLOGIST SEAL 048920 GEOFFREY L. HUNT 7/23/20

Perry Hill Mitigation Site
Orange County, North Carolina

Headwater Conveyance
Details

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: GLS
Drawn By: MC/ABP
Checked By: CR

Sheet 6.13

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August 3, 2020

GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

SECTION E: GROUND STABILIZATION

Required Ground Stabilization Timeframes

Site Area Description	Stabilize within this many calendar days after ceasing land disturbance	Timeframe variations
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

GROUND STABILIZATION SPECIFICATION

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
• Temporary grass seed covered with straw or other mulches and tackifiers • Hydroseeding • Rolled erosion control products with or without temporary grass seed • Appropriately applied straw or other mulch • Plastic sheeting	• Permanent grass seed covered with straw or other mulches and tackifiers • Geotextile fabrics such as permanent soil reinforcement matting • Hydroseeding • Shrubs or other permanent plantings covered with mulch • Uniform and evenly distributed ground cover sufficient to restrain erosion • Structural methods such as concrete, asphalt or retaining walls • Rolled erosion control products with grass seed

POLYACRYLAMIDES (PAMS) AND FLOCCULANTS

1. Select flocculants that are appropriate for the soils being exposed during construction, selecting from the *NC DWR List of Approved PAMS/Flocculants*.
2. Apply flocculants at or before the inlets to Erosion and Sediment Control Measures.
3. Apply flocculants at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.
4. Provide ponding area for containment of treated Stormwater before discharging offsite.
5. Store flocculants in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures.

EQUIPMENT AND VEHICLE MAINTENANCE

1. Maintain vehicles and equipment to prevent discharge of fluids.
2. Provide drip pans under any stored equipment.
3. Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
4. Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
5. Remove leaking vehicles and construction equipment from service until the problem has been corrected.
6. Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE

1. Never bury or burn waste. Place litter and debris in approved waste containers.
2. Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
3. Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
4. Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
5. Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
6. Anchor all lightweight items in waste containers during times of high winds.
7. Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
8. Dispose waste off-site at an approved disposal facility.
9. On business days, clean up and dispose of waste in designated waste containers.

PAINT AND OTHER LIQUID WASTE

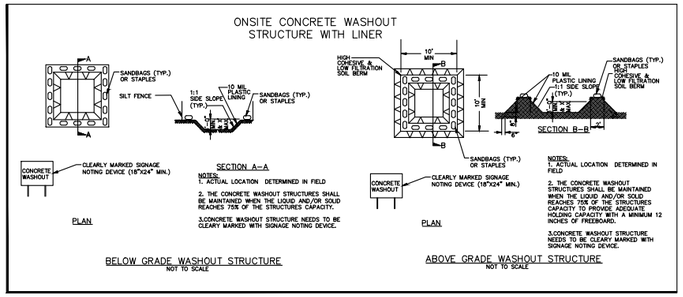
1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, sized and placed appropriately for the needs of site.
5. Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

PORTABLE TOILETS

1. Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
2. Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
3. Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

EARTHEN STOCKPILE MANAGEMENT

1. Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
2. Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
3. Provide stable stone access point when feasible.
4. Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

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Perry Hill Mitigation Site
Orange County, North Carolina

ESC Details
Details

Revisions:

Date:	07.23.2020
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Project Engineer:	GLS
Drawn By:	MC/ABT
Checked By:	CK

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August 3, 2020

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDOs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION B: RECORDKEEPING

1. E&SC Plan Documentation

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be documented in the manner described:

Item to Document	Documentation Requirements
(a) Each E&SC Measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC Plan.	Initial and date each E&SC Measure on a copy of the approved E&SC Plan or complete, date and sign an inspection report that lists each E&SC Measure shown on the approved E&SC Plan. This documentation is required upon the initial installation of the E&SC Measures or if the E&SC Measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC Plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC Plan.	Initial and date a copy of the approved E&SC Plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC Measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC Measures.	Initial and date a copy of the approved E&SC Plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

2. Additional Documentation

In addition to the E&SC Plan documents above, the following items shall be kept on the site

and available for agency inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

(a) This general permit as well as the certificate of coverage, after it is received.

(b) Records of inspections made during the previous 30 days. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

(c) All data used to complete the Notice of Intent and older inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION C: REPORTING

1. Occurrences that must be reported

Permittees shall report the following occurrences:

(a) Visible sediment deposition in a stream or wetland.

(b) Oil spills if:

- They are 25 gallons or more,
- They are less than 25 gallons but cannot be cleaned up within 24 hours,
- They cause sheen on surface waters (regardless of volume), or
- They are within 100 feet of surface waters (regardless of volume).

(a) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.

(b) Anticipated bypasses and unanticipated bypasses.

(c) Noncompliance with the conditions of this permit that may endanger health or the environment.

2. Reporting Timeframes and Other Requirements

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Division's Emergency Response personnel at (800) 662-7956, (800) 858-0368 or (919) 733-3300.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis. • If the stream is named on the NC 303(d) list as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	• ***Within 24 hours***, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	• ***A report at least ten days before the date of the bypass, if possible***. The report shall include an evaluation of the anticipated quality and effect of the bypass.
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days,*** a report that includes an evaluation of the quality and effect of the bypass.
(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6). • Division staff may waive the requirement for a written report on a case-by-case basis.

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

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Perry Hill Mitigation Site
Orange County, North Carolina

ESC Details
Details

Revisions:

Date: 07.23.2020
Job Number: 005-02180
Project Engineer: GLS
Drawn By: MC/ABP
Checked By: CR

Sheet 6.15

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Appendix 9

Maintenance Plan

Wildlands will visit the site semi-annually and conduct a physical inspection at least once per year during the post-construction monitoring period and until performance standards are achieved. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected, most frequently in the first two years following site construction. Routine maintenance may include the following:

Table 1. 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 – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water 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 community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species requiring treatment shall be treated 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.
Beaver/Wildlife Management	If beaver dams are observed on site, Wildlands will remove the dams and attempt to remove the beavers from the site. If wildlife herbivory becomes a problem for the plantings, Wildlands will take measures to manage wildlife on the site.

Appendix 10

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:

Credit Release Schedule Table – Stream Credits – *Perry Hill Mitigation Site*

Credit Release Milestone	Credit Release Activity	Interim Release	Total Released
1	Site Establishment (includes all required criteria)	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%*)
7	Year 5monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%*)
8	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%*)
9	Year 7 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	90% (100%*)

*10% reserve credits to be held back until the bankfull performance standard has been met.

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the Mitigation Plan can be released by DMS 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 DMS 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.

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 10% of a site's total stream credits shall be released after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull 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 DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report. The credits associated with the final credit release milestone will be released only upon a determination by the USACE, in consultation with the IRT, of functional success as defined in the Mitigation Plan.

Appendix 11

Financial Assurances

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