# LANDSFORD TRACT
# FINAL PERMITTEE-RESPONSIBLE MITIGATION PLAN

**PROJECT:**

**PROJECT INSPECTOR**
**YORK COUNTY, SOUTH CAROLINA**

**APPLICANT:**

**SOUTH CAROLINA DEPARTMENT OF COMMERCE**

**SUBMITTED TO:**

**UNITED STATES ARMY CORPS OF ENGINEERS**
**CHARLESTON DISTRICT, REGULATORY**

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## 1.0 Permittee-Responsible Mitigation

The South Carolina Department of Commerce (hereinafter "Applicant") is proposing a mixed-use, pedestrian-friendly development community anchored by the Carolina Panthers practice/training facilities and headquarters offices with emphasis on retail/entertainment, employment, research and development, residential dwellings, recreation and open space uses. This development is being referred to as Project Inspector (hereinafter "Impact Site"). Project Inspector is located approximately 3.1 miles northeast of Rock Hill in York County, South Carolina within the Lower Catawba River Watershed, Hydrologic Unit Code (hereinafter "HUC") 03050103.

Project Inspector will impact waters of the United States, to include streams and wetlands. Based on final design plans, 4,991 linear feet of stream and 0.87 acres of wetland will be impacted. An Individual Permit from the United States Army Corps of Engineers (hereinafter "USACE") will be required for the proposed impacts to aquatic resources; refer to SAC-2019-00924.

Project Inspector will require compensatory mitigation for unavoidable adverse impacts to waters of the United States that result from activities authorized under Sections 401 and 404 of the *Clean Water Act*, and Section 10 of the *Rivers and Harbors Act*, provided such activities have met all applicable requirements and are authorized by the appropriate authority. Specifically, Project Inspector will require 27,356.4 stream mitigation credits and 8.87 wetland mitigation credits. For reasons outlined below in Section 2.0, the Applicant is proposing to implement a permittee-responsible mitigation plan (hereinafter "PRM Plan") to offset unavoidable adverse impacts to waters of the United States associated with the Individual Permit.

The Applicant is proposing to implement a PRM Plan on a portion of a ±494.83-acre parcel located in Chester County, South Carolina (hereinafter "Landsford Tract"). The parcel was recently acquired by Open Space Institute Land Trust, Inc. (a qualified land trust) (hereinafter "Owner"). Streams, wetlands and aquatic resource buffers consisting of 109.48 acres (hereinafter "Mitigation Site") within the Landsford Tract will be permanently protected, preserved, enhanced and/or restored to satisfy the compensatory mitigation requirement associated with the Project Inspector Individual Permit. The Mitigation Site is located at latitude 34.797064° and longitude -80.897325°. Refer to Figure 1 for a vicinity map and to Figure 2 for a location map. Note, the Impact Site is located within HUC 03050103; likewise, the Mitigation Site is located within HUC 03050103. Refer to Figure 3 for an 8-Digit HUC map.

Stream resources located within the Mitigation Site are 1st and 2nd order relatively permanent waters. This stream type is similar to the impacted stream resources. Likewise, wetland resources located within the Mitigation Site are in-kind, meaning of a similar structural and functional type to the impacted aquatic resources.

Proposed mitigation activities described herein will provide watershed benefits by:

- Preserving and/or establishing natural hardwood communities in areas (to include wetlands and upland and riparian buffers) that have historically been managed for forestry;
- Preserving existing and intact aquatic resource communities;
- Preserving land in perpetuity, including land approximate to the Catawba River, and immediately adjacent to Landsford Canal Forest Legacy Area Wildlife Management Area (hereinafter "WMA") and Landsford Canal State Park;
- Reducing the land base available for activities detrimental to water quality;

- Limiting encroachments upon terrestrial, aquatic and State protected resources from development and/or forestry;
- Providing land for wildlife, including land approximate to the Catawba River, and immediately adjacent to Landsford Canal Forest Legacy Area WMA and Landsford Canal State Park;
- Providing shade to surface waters;
- Providing water quality benefits through hyporheic exchange;
- Decreasing on-site erosion and subsequent sedimentation, providing increased filtration of sediments and nutrients, and promoting sediment deposition;
- Providing flood attenuation, promoting the exchange of surface waters, and providing filtration of floodwaters;
- Establishing bankfull stage at floodplain elevations;
- Including bioengineering using natural material and vegetative cover;
- Including instream structures designed to provide grade control and reduce instream energy; and by
- Including instream habitat creation and increasing benthic habitat diversity.

Aquatic resources located within the Mitigation Site, and the mitigation activities described herein as occurring within the Mitigation Site, generate an excess of compensatory mitigation credits than are needed to offset adverse impacts associated with Project Inspector. Thus, the PRM Plan satisfies the compensatory mitigation requirement associated with the Project Inspector Individual Permit.

## 2.0 Available Mitigation Credits

The mitigation plan follows the hierarchy outlined in the 2008 Federal Compensatory Mitigation Rule (CFR 332.3 (b)(2 and 3)) (hereinafter "2008 Compensatory Mitigation Rule"). The hierarchy of mitigation preferences is as follows: (1) first seek suitable mitigation banks, (2) then in-lieu fee programs, and, if those are not available or appropriate, (3) develop a PRM Plan.

Following the USACE Charleston District 2010 *Guidelines for Preparing a Compensatory Mitigation Plan* (hereinafter "2010 mitigation guidelines") and the 2008 Compensatory Mitigation Rule, the Regulatory In-Lieu Fee and Bank Information Tracking System was used to locate available mitigation bank credits and in-lieu fee program credits in the Lower Catawba watershed. There are no mitigation banks with available credits located in the Lower Catawba 8-Digit HUC. Therefore, the Applicant is proposing a PRM Plan using a watershed approach for mitigating the project impacts.

## 3.0 Watershed Approach

The Landsford Tract and Mitigation Site were selected using a watershed approach. The goal of a watershed approach is to maintain and improve the quality and quantity of aquatic resources through the strategic selection of compensatory mitigation sites. It is preferable to have a mitigation site as close as possible to the proposed impacts. The Mitigation Site is located within the same 8-Digit HUC (03050103) and Level III (Piedmont: 45) and IV Ecoregion (Southern Outer Piedmont: 45b) as the Impact Site (Figure 3).

This section considers watershed needs within the 8-Digit HUC where the Impact Site and Mitigation Site are located. Multiple sources of information, including watershed management plans, local land use plans, property ownership and land use trends were examined to identify the overall aquatic resource needs and to assess the suitability of the selected mitigation site. Additionally, local land trusts and conservation

organizations were consulted to determine their conservation priorities in the watershed and the Landsford Tract and Mitigation Site were partly selected based on their preferences.

## 3.1 Watershed Description

### 3.1.1 Lower Catawba River Basin (8-Digit HUC 03050103)

The Mitigation Site is located in the Lower Catawba River basin (8-Digit HUC 03050103). The basin drains 927 square miles to the section of the Catawba River downstream of Lake Wylie and upstream of Wateree Lake. The lower portion of the Catawba River in this watershed consists of a series of impoundments, including Fishing Creek Reservoir, Great Falls Reservoir, and Cedar Creek Reservoir. Notable tributaries in the basin include Sugar Creek, Twelve Mile Creek, Cane Creek, Rocky Creek, Camp Creek and Beaver Dam Creek. The watershed drains from Mecklenburg County in North Carolina, as well as York, Lancaster, Chester and a small portion of Fairfield County in South Carolina.

The watershed is within the Piedmont United States Environmental Protection Agency (hereinafter "EPA") Level III Ecoregion (Figure 3). Level IV Ecoregions in the watershed include the Carolina Slate Belt in the eastern third and the Southern Outer Piedmont for the remainder of the watershed (Figure 3). Piedmont stream valleys are typically narrow and divided by rolling or steep hillslopes.

According to the United States Geological Survey (hereinafter "USGS") National Land Cover Dataset for 2011, approximately 28% of the watershed has been developed. The northern part of the watershed, east of the Catawba River, encompasses much of the Charlotte-Mecklenburg Metropolitan area in North Carolina, which extends into South Carolina. This area of the watershed is highly developed and continues to grow rapidly. The northwest portion of the watershed is also partially developed as the City of Rock Hill, South Carolina is growing as part of the greater Charlotte area. Forest, shrub/scrub and herbaceous vegetation together are the dominant land cover types, constituting 55% of the watershed. Agriculture makes up about 15% of the land cover and approximately 1% of the watershed is wetlands. Although much of the watershed is forested, managed pine plantations are a major land use in the watershed (NRCS 2010).

Recent changes in land cover from 1992 to 2011 were analyzed for the Lower Catawba River basin (8-Digit HUC 03050103). During this 19-year period, the developed area increased for the Lower Catawba River basin, from approximately 14% to 28%. As previously stated, the increase in developed areas during this time period has most likely been the result of expansion from areas such as the Cities of Charlotte, North Carolina and Rock Hill, South Carolina. As well, the "panhandle" of Lancaster County has grown and it is almost completely urbanized (NRCS 2010). Urban areas have the most potential to impact aquatic resources, including the endangered Carolina heelsplitter (*Lasmigona decorata*). The threat of impacts from these urbanized areas are only projected to increase.

## 3.2 Land Use and Potential for Growth

Land use surrounding the Mitigation Site is predominantly silviculture, rural single-family residential development, recreational and undisturbed forest. Landsford Canal State Park and Landsford Canal Forest Legacy Area WMA are located immediately south of the Mitigation Site and share a property line with the Mitigation Site; the Catawba River is located immediately east of the Landsford Tract and constitutes a property line of the Landsford Tract. The Mitigation Site is a top priority for protection due to its adjacency to

these resources. Further, the Mitigation Site is under threat from development from nearby municipalities such as Rock Hill.

Protecting lands and natural resources within the Mitigation Site will limit any commercial and/or industrial and/or residential and/or silvicultural encroachments, thereby preserving land and aquatic resources within the Lower Catawba River basin. Further, the Mitigation Site provides a unique opportunity to not only improve water quality and protect valuable habitat, but to also provide public benefit through expanding the acreage of a South Carolina Department of Natural Resources (hereinafter "SCDNR") WMA.

### 3.3 Watershed Needs and Threats

According to the SCDNR *Comprehensive Wildlife Conservation Strategy: 2005 – 2010*, loss and fragmentation of habitat have been identified as a major threat to many of the species listed as threatened and endangered in South Carolina. As a result, SCDNR biologists have identified habitat protection as one of the most important actions to ensure the protection of South Carolina priority species. The location of the Mitigation Site is ideal for land conservation efforts and the preservation and protection of habitat due to its connectivity to diverse terrestrial and aquatic habitats and other protected lands. If left unprotected, the Mitigation Site is in danger of continued loss and/or fragmentation and/or conversion of habitat.

Historically, the Piedmont Ecoregion plant community would have been dominated by oaks (*Quercus spp.*) and hickories (*Carya spp.*), with associated tree species varying by slope and soil moisture. However, a large portion of the forest cover within the Ecoregion is composed of planted pine (*Pinus spp.*) plantation which differs significantly in the diversity of plant and animal life it supports in comparison to native mixed hardwood forests. Erosion and subsequent sedimentation are significant and widespread non-point source pollution problems associated with forestry. The Mitigation Site will establish and/or protect natural hardwood communities in areas that have historically been managed for forestry.

Between the 1780s and the 1980s, South Carolina lost 27% of its wetlands to human activity (Dahl 1990). South Carolina is in the top six states for the most extensive wetlands losses in the United States since the 1970s (Mitsch and Gosselink 1993). Historically, in the Catawba River basin, many riparian areas were modified and hydrologic regimes have been altered due to land use practices.

Further, unintended long-term consequences of poor land use practices in the Piedmont have led to the degradation of stream valleys and aquatic resources. Diminished farmlands were abandoned and left susceptible to erosion, which has altered the geomorphology and hydrology regime (James 2011). Some of the impacts to streams and wetlands include severe erosion, excessive sediment loadings, lack of sufficient woody debris, stream channelization and channel/bank instability.

The Cecil sandy clay loam soil series located within the Mitigation Site is classified as eroded. Erosion within the Mitigation Site is associated with steep to moderate slopes on uplands and is directly associated with forestry. The Mitigation Site will promote the exchange of surface waters and provide filtration of floodwaters within the watershed and will enhance aquatic resource buffers by establishing natural hardwood communities in areas that have historically been managed for forestry. These activities should result in a reduction of on-site erosion.

### 3.4 Water Quality Issues and Needs

In 2013, the Catawba River was regarded as the fifth most endangered river in the United States and a significant portion of the surface water in the Catawba-Wateree basin does not meet basic water quality standards (Catawba Riverkeeper, 2014). The primary water quality concern in the Lower Catawba River basin (8-Digit HUC 03050103) is fecal coliform (hereinafter "FC"). The South Carolina Department of Health and Environmental Control (hereinafter "SCDHEC") monitors approximately 75 water quality stations (permanent and random) in the watershed. In North Carolina, the North Carolina Department of Environment and Natural Resources monitors approximately 64 water quality monitoring stations. Four of those water quality monitoring stations in the Lower Catawba River basin (8-Digit HUC 03050103) were on South Carolina's 2012 Section §303(d) list for impairment due to FC bacteria. However, twenty-one of the deficient stations are being addressed through eight approved FC Total Maximum Daily Loads (hereinafter "TMDL"), issued by the EPA. These South Carolina TMDLs include Camp Creek, Cane Creek, Catawba River Tributary, Catawba River-Rocky Creek, Fishing Creek, Grassy Run Branch, Steele Creek and Waxhaw Creek. As for North Carolina, ten monitoring stations were on the North Carolina 2012 Section §303(d) list for impairment due to FC bacteria and ten of these stations are incorporated in North Carolina's Irwin, Sugar, Little Sugar and McApline Creeks TMDL for FC.

Other concerns in the Catawba River basin include biological, nutrients (total phosphorus and total nitrogen), dissolved oxygen and turbidity impairments. Specifically, within South Carolina, twenty-two stations are impaired for total phosphorous, eleven stations have aquatic life impairments for macroinvertebrates, seven stations are impaired for dissolved oxygen, six stations are impaired for total nitrogen, five stations are impaired for turbidity, three stations are impaired for copper, and one station is impaired for chlorophyll-a. As of 2012, TMDLs had not been written for these impairments and thus remained impaired on South Carolina's 2012 303(d) list. In the North Carolina portion of the Catawba River basin, there is one TMDL developed for turbidity and one TMDL developed for dissolved oxygen. Additionally, there are seventeen monitoring stations that have aquatic life impairments for macroinvertebrates, five stations are impaired for copper, two stations are impaired for turbidity, one station is impaired for dissolved oxygen, and other stations are impaired for various aquatic life uses.

Altogether, there are a variety of causes for these water quality problems, as the impaired stations are spread throughout the basin. Some primary causes of these impairments are bad development practices and effects of population growth (Catawba Riverkeeper). One area of concern for water quality in the basin is the development around the City of Charlotte, North Carolina. The area is of particular concern because of the expansion throughout the headwaters of the basin, which has the potential to impact water quality (for example, dissolved oxygen demand, FC and sedimentation) downstream throughout the basin. This makes protection and restoration of streams in the headwaters of the basin a priority for maintaining downstream water quality. As well, agricultural and timbering practices are also significant causes of concern in the lower parts of the Catawba River basin (Catawba Riverkeeper).

## 4.0 Permittee-Responsible Mitigation Plan

### 4.1 Goals and Objectives

The goal of the Mitigation Site is to preserve, enhance and/or restore streams, wetlands and aquatic resource buffers associated with the Catawba River, unnamed tributaries of the Catawba River, and the Lower Catawba River watershed to provide compensatory mitigation for adverse impacts to wetlands, streams

and/or other aquatic resources authorized by the Department of the Army permit associated with Project Inspector. Specific goals of the Mitigation Site include:

- Preserve, enhance and/or restore stream channels, wetlands and aquatic resource buffers that connect hydrology and ecology within the Lower Catawba River watershed;
- Enhance impaired stream channels by implementing bioengineering techniques using natural material and vegetative cover;
- Utilize the natural channel design approach to replace impaired stream channels with stable stream channel geometry suitable for the valley type;
- Raise streambed elevations where appropriate, thereby establishing bankfull stage at, and providing regular access to, the historic floodplain and potentially raising water levels within the immediate adjacent landscape;
- Construct instream structures designed to provide grade control and reduce instream energy;
- Create instream habitat and increase benthic habitat diversity;
- Enhance the hydroperiod of a hydrologically impaired wetland;
- Preserve natural hardwood communities located within aquatic resource buffers;
- Enhance aquatic resource buffers by establishing natural hardwood communities in areas that have been managed for forestry;
- Manage invasive species within aquatic resources and aquatic resource buffers;
- Promote the exchange of surface waters and provide filtration of floodwaters within the Lower Catawba River watershed;
- Convert forestry land use to conservation land use; and
- Permanently protect 109.48 acres of land within the Lower Catawba River watershed and immediately adjacent to Landsford Canal Forest Legacy Area WMA and Landsford Canal State Park, and approximate to the Catawba River.

Table 1 provides a description of the mitigation activities. Figure 4 depicts the mitigation units for the Mitigation Site.

**Table 1. Mitigation Activities**

| Type of Mitigation | Amount (linear feet or acres) | Activity |
|---|---|---|
| **Unit 1: Stream Preservation**<br><br>UT 2 (Section 4), UT 3 (Section 2), UT 4 (Section 2) and UT 5 | 1,079 | Preserve functional channels<br><br>Note, 7,702 LF of UT 1 (Sections 1 and 2) will be protected as well; refer to Figure 4. However, these resources are being excluded from generating mitigation credit. Protection of these resources is therefore not considered a mitigation activity. |
| **Unit 2: Stream Enhancement**<br><br>UT 2 (Section 2) | 622 | Enhance hydrology along the reach; improve the longitudinal connectivity of the reach; promote the exchange of surface waters and provide filtration of floodwaters within the watershed; implement bioengineering techniques using natural material and vegetative cover where appropriate |
| **Unit 3: Stream Restoration**<br><br>UT 2 (Sections 1 and 3), UT 3 (Section 1) and UT 4 (Section 1) | 7,302 | Create stable stream channel geometry suitable for the valley type; raise streambed elevations where appropriate, thereby establishing bankfull stage at, and providing regular access to, the historic floodplain and potentially raising water levels within the immediate adjacent landscape; create instream habitat and increase benthic habitat diversity; promote the exchange of surface waters and provide filtration of floodwaters within the watershed |
| **Unit 4: Wetland Preservation** | 0.26 | Preserve functional wetland; remove pine from within upland buffer and plant native hardwood trees within upland buffer |
| **Unit 5: Wetland Enhancement (Hydrologic)** | 2.99 | Plug and/or fill a ditch; remove pine from within upland buffer and plant native hardwood trees within upland buffer |
| **Aquatic Resource Buffers** | Preservation = 32.70<br><br>Enhancement = 44.98 | Preserve intact native hardwood forest communities within aquatic resource buffers; remove pine from within aquatic resource buffers and plant native hardwood trees; manage invasive species within aquatic resource buffers; establish protected habitat within the watershed<br><br>Note, 28.43 acres of riparian area associated with UT 1 (Sections 1 and 2) are included within the conservation easement area and will thus be protected as well. However, these areas are being excluded from the mitigation work plan since UT 1 (Sections 1 and 2) are being excluded from generating mitigation credit. |

Approximately 0.12 acres of floodplain wetlands will be created as part of the PRM Plan. Note, however, that mitigation credits are not being requested for these areas. The wetlands will serve to improve surface and groundwater exchange, provide wildlife habitat, serve as a biological refugia and provide habitat heterogeneity that is not otherwise present within the Mitigation Site.

### 4.2 Site Selection

A detailed discussion of the criteria used to determine the suitability of the property as a mitigation site is provided below. A description of the factors considered, including aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, land use trends, ecological benefits and compatibility with

adjacent land uses is included in this discussion. In general, suitable mitigation sites meet the criteria listed below. Factors considered during the site selection process are included in *italics* following each listed criterion.

- Property Acreage – Mitigation sites are typically best suited for large parcels of land that contain a large quantity and variety of aquatic resources. *The Mitigation Site is 109.48 acres. The entire Landsford Tract is proposed for eventual protection and public use through other mechanisms.*
- Property Owners – Sites with one property owner, family, or corporation are ideal to minimize or avoid lengthy coordination with multiple property owners. *The rights necessary to own and operate the Mitigation Site are owned by one entity, which minimizes the extent of property owner coordination. The Mitigation Site will eventually be donated to SCDNR to be managed as a WMA.*
- Proximity to Proposed Impact Areas – Mitigation sites should be located within or adjacent to the 8-Digit HUC in which the anticipated impacts are expected to occur. *The Mitigation Site is located within the same 8-Digit HUC and Level III and IV Ecoregion as the Impact Site.*
- Land Use Trends – Sites adjacent to industrial, commercial, or high-density land uses are typically not suitable for mitigation. *Land use surrounding the Mitigation Site is predominantly silviculture, rural single-family residential development, recreational and undisturbed forest. Landsford Canal State Park and Landsford Canal Forest Legacy Area WMA are located immediately south of the Mitigation Site and share a property line with the Mitigation Site.*
- Preservation, Enhancement and Restoration Potential – Suitable mitigation sites typically have a combination of preservation, enhancement and/or restoration of streams and/or wetlands. Properties with historic alterations, such as agricultural ditches or silviculture, are generally the most appropriate for mitigation. *Sections of stream channel suitable for preservation exist on-site; one wetland suitable for preservation exists on-site as well. However, the Mitigation Site has historically been used, and is currently being used, for recreation and silviculture. Past land management practices and changes in the watershed have caused significant degradation of on-site streams and hydrologic impairment of an on-site wetland. Therefore, substantial opportunities for ecological uplift through stream and wetland enhancement and restoration activities are present on-site.*
- Ecological Benefit – Mitigation sites typically demonstrate an ecological benefit to the watershed. *Mitigation activities will preserve functional streams and a functional wetland, will enhance or restore impaired stream and wetland systems and will establish natural vegetative communities within protected buffers and upland habitat. Several tributaries to the Catawba River are wholly contained within the Mitigation Site and will be preserved, enhanced and/or restored and permanently protected.*
- Habitat Connectivity – Mitigation sites typically demonstrate a connection of aquatic and terrestrial habitat through protection of major wetland complexes, headwater tributaries and wide riparian corridors. *The Mitigation Site is directly connected to already conserved lands.*

The 109.48-acre Mitigation Site is located directly adjacent to Landsford Canal State Park and Landsford Canal Forest Legacy Area WMA to the south (refer to Figure 2) and is separated from the Catawba River to the east by a ±100-foot Duke Power easement (refer to Figure 4). Note, the Duke Power easement area and associated linear footage along the Catawba River are excluded from the Mitigation Site and credit calculations. Input from land trusts and conservation organizations was obtained during the site selection process and it was determined that the Mitigation Site is a top priority for protection due to adjacency to already protected lands and threat from development from nearby municipalities such as Rock Hill. The Mitigation Site provides a unique opportunity to not only improve water quality and protect valuable habitat, but to also provide public benefit through expanding the acreage of a WMA.

### 4.2.1 Hydrologic Sources and Water Rights

All on-site tributaries drain to UT 1 (Section 1); UT 1 (Section 1) drains to the Catawba River. Refer to Figure 5 for a depiction of the drainage area of each tributary located within the Mitigation Site boundary. UT 1 (Section 1) constitutes a property boundary. Therefore, channel alterations, instream work or streambank stabilization and/or grading are not being proposed for UT 1 (Section 1). All remaining on-site tributaries originate on-site and their respective subwatersheds are fully or primarily contained on-site. Further, proposed stream restoration and enhancement activities will provide regular access to the floodplain and will promote the exchange of surface waters within the Mitigation Site. Therefore, water rights and hydrologic trespass are not affected by the proposed mitigation activities and implementation of the mitigation activities will not adversely affect adjacent property owners.

### 4.2.2 Protected Species

Historic land use practices have modified vegetation types, habitats and aquatic resources that caused losses of wildlife in the Lower Catawba River basin, as in most of the South Carolina Piedmont. For example, the historic dominant vegetation type in the Southern Piedmont was likely oak and hickory dominated forest. Land use changes and disturbances have altered this forest type, and much of the remaining oak-hickory forest is now pine-dominated forest.

A list of wildlife, aquatic and plant species that are threatened or endangered in the watershed is found in Table 2. Table 2 was generated from publicly available lists provided by the United States Fish and Wildlife Service (hereinafter "USFWS") and the SCDNR. The USFWS list was last updated on September 9, 2019; the SCDNR list was queried on January 24, 2020.

A review of the Rare – Threatened – Endangered Species in South Carolina – June 2018 geographic database, maintained by the Heritage Trust Department of the SCDNR, indicates there are no recorded occurrences of federal and/or state threatened or endangered species within the Landsford Tract boundary or within close proximity to the Landsford Tract. Refer to Figure 6 for a protected species map.

The Lower Catawba River basin is host to the Carolina heelsplitter (*Lasmigona decorata*), a rare and federally endangered species that is listed as a G1 status by NatureServe, meaning that it is "Critically Imperiled". Much of the basin in South Carolina and North Carolina is thought to have been part of the mussel species' historic range. Water quality issues related to land-use change (for example, intense agricultural and silviculture, urban development, wastewater and stormwater discharge), watershed fragmentation by impoundments and eroded sediments have greatly diminished Carolina heelsplitter habitat. The surviving populations are now relegated to small, isolated tributaries where the habitat has not been severely degraded. Habitat conditions for Carolina heelsplitter are not present within the existing tributaries on the Landsford Tract.

**Table 2. Threatened or Endangered Species known to occur in Chester County, South Carolina**

| Species Common Name | Species Scientific Name | ESA Status |
|---|---|---|
| Bald eagle | *Haliaeetus leucocephalus* | BGEPA, ST |
| Red-cockaded woodpecker | *Picoides borealis* | FE, SE |
| Carolina heelsplitter | *Lasmigona decorata* | FE, SE, CH |

BGEPA = Bald and Golden Eagle Protection Act; ST= State Threatened; SE = State Endangered; FE = Federally Endangered; CH = Critical Habitat

The mitigation activities are anticipated to have no effect on the aforementioned species and may help to provide future habitat.

### 4.2.3 Cultural Resources

A review of the South Carolina Institute of Archaeology and Anthropology and the South Carolina Department of Archives and History ArchSite files disclosed no previously recorded architectural or archaeological sites within the Landsford Tract; refer to Figure 7.

S&ME, Inc. (hereinafter "S&ME") has completed cultural resource investigations of the Mitigation Site (refer to Appendix A). The Cultural Resource Investigations report included in Appendix A was provided by S&ME to the USACE on January 20, 2020 for coordination with the State Historic Preservation Office (hereinafter "SHPO"). Approximately 129.1 acres and 1.4 miles of proposed access roads make up the limits of disturbance (hereinafter "LOD") at the Mitigation Site. The LOD was surveyed during these investigations.

The purpose of the survey was to assess the Mitigation Site's potential for containing significant cultural resources and to make recommendations regarding additional work that may be required pursuant to Section 106 of the National Historic Preservation Act, as amended, and other pertinent federal, state, or local laws. This work was completed in anticipation of federal permitting by the USACE.

Fieldwork for the project was conducted from January 6th – 10th, 2020. This work included the excavation of 351 shovel tests within the Mitigation Site and an evaluation of effects on National Register of Historic Places (hereinafter "NRHP)-eligible and listed resources within or adjacent to the Mitigation Site.

As a result of the investigations, six archaeological sites (38CS425 through 38CS430) and eight isolated finds (IF-1 through IF-8) were recorded, the effects of the proposed activities on the NRHP-listed Landsford Canal (SHPO site number 0008) were assessed, and the NRHP-eligible Old Stone Graveyard (SHPO site number 0044) was revisited (Table 3). The archaeological sites and isolated finds are recommended as not eligible for inclusion in the NRHP. The portion of the NRHP-listed Landsford Canal within the LOD will not be adversely affected by the tree clearing, replanting of disturbed areas, or filling of the drainage ditch within the resource. The Old Stone Graveyard is located southwest of the mitigation site boundary and is roughly 330 feet from the closest LOD area; although no graves appear to be outside the stone wall surrounding the cemetery, a 25-ft buffer around the stone wall is recommended to avoid disturbing possible unmarked graves. The project as currently proposed will have no effect on the cemetery.

**Table 3. Cultural Resources**

| Resource # | Description | NRHP Eligibility | Recommendation |
|---|---|---|---|
| 38CS425 | Prehistoric lithic scatter | Not Eligible | No Further Work |
| 38CS426 | Prehistoric lithic scatter; Historic artifact scatter | Not Eligible | No Further Work |
| 38CS427 | Historic artifact scatter | Not Eligible | No Further Work |
| 38CS428 | Prehistoric lithic scatter | Not Eligible | No Further Work |
| 38CS429 | Prehistoric lithic scatter; Historic artifact scatter | Not Eligible | No Further Work |
| 38CS430 | Historic house site | Not Eligible | No Further Work |
| IF-1 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-2 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-3 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-4 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-5 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-6 | Historic glass isolate | Not Eligible | No Further Work |
| IF-7 | Historic glass isolate | Not Eligible | No Further Work |
| IF-8 | Historic glass isolate | Not Eligible | No Further Work |
| 0008 | Landsford Canal | Listed | No Adverse Effect |
| 0044 | Old Stone Graveyard | Eligible | No Effect |

Given the results of this survey, it is the opinion of S&ME that the Mitigation Site will have no adverse effect on significant resources, and no further cultural resources investigations should be required for the Mitigation Site. However, if project activities change within the NRHP-listed Landsford Canal, and/or the LOD shifts within the boundary proposed around NRHP-eligible Old Stone Graveyard, additional consultation with the State Historic Preservation Office and other consulting parties may be necessary to minimize or mitigate potential adverse effects.

### 4.3 Site Protection

Upon project approval, a conservation easement (hereinafter "CE") that closely follows the CE included in Appendix B will be placed on the Mitigation Site as shown in Figure 4. The CE will be recorded in the County land records. The CE will be reviewed and approved by the USACE prior to finalizing and recording. The purpose of the CE will be to ensure that Mitigation Site resources are protected in perpetuity. Katawba Valley Land Trust has agreed be the Easement Holder (i.e. Grantee). Following implementation of the mitigation activities and documentation of project success, the Mitigation Site will be donated to SCDNR, which would then assume long-term management and ownership obligations.

## 4.4 Permittee-Responsible Mitigation Site Baseline Conditions

Preliminary baseline data has been collected to determine the ecological suitability of the Mitigation Site to achieve the goals and objectives outlined in Section 4.1 above. The following presents a detailed description of the baseline conditions at the Mitigation Site.

### 4.4.1 Ecoregion

The Mitigation Site and the Impact Site are both located within the Piedmont, defined by the EPA as Level III Ecoregion 45. This Ecoregion comprises a transitional area between the mountainous Ecoregions of the Appalachians to the northwest and the relatively flat coastal plain to the southeast (Griffith et al., 2002). The Piedmont Ecoregion is considered to be the non-mountainous portion of the old Appalachians Highlands, consisting of dissected irregular plains and some hills (Griffith et al., 2002). Historically, the area was largely cultivated; however, now much of the region is planted pine or has reverted to successional pine and hardwood woodlands. Historic oak-hickory-pine forests were dominated by northern white oak (*Quercus alba*), southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), various species of hickory, shortleaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*) and Virginia pine (*Pinus virginiana*). Soils generally tend to be finer textured than in the adjacent coastal plain Ecoregion.

Manipulation of the landscape for forestry, agriculture and/or recreation is common in the Piedmont Ecoregion. While the altered ecological communities throughout the Piedmont Ecoregion are suitable for stream and wetland restoration and/or enhancement projects, the preservation of existing aquatic communities is also an ecological benefit for the Ecoregion. The preservation, enhancement and restoration of on-site resources will benefit the Ecoregion by providing filtration of sediments and nutrients, flood attenuation, shade to surface waters and riparian corridors for wildlife.

### 4.4.2 Historic Land Use

A qualitative assessment of historic land use within the Landsford Tract was primarily derived from an analysis of historic aerial photographs. Aerial photographs obtained for the years of 1941, 1949, 1954, 1959, 1964, 1969, 1981, 1994, 2005, 2011, 2013, and 2019 are included in Appendix C.

Land use practices on the Landsford Tract have remained fairly consistent since 1941. Land use appears to include open fields (presumably former or active agricultural fields) within valleys and floodplains, as well as along ridge tops; additional uses include silviculture and timber management. Silvicultural activities appear to increase in the 1964 and 1969 historic aerial photographs, at which time the valleys and floodplains were last harvested. Riparian buffer areas appear to have been harvested to the banks of on-site streams in the 1969 historic aerial image. Silvicultural activities appear to intensify even more between 1981 and 1994, at which time a majority of the ridges of the Landsford Tract were timbered. Based upon aerial photographs and site visits, it appears that timbered areas were re-planted in loblolly pine following the timber harvest. A ditch that was installed to drain the large wetland in the Catawba River floodplain is clearly visible in the 1954 historic aerial and likely existed prior to that time.

The quality and scale of the aerial photographs prevents a detailed quantitative analysis of stream conditions and vegetative communities. Based upon the aerial photographs, site visits, and field notes, on-site resources have been adversely affected by anthropogenic impacts. Poor land management practices have caused on-

site streams to downcut and become incised and/or entrenched.

### 4.4.3 Existing Wetlands and Waters

A delineation and GPS location of wetlands and other waters of the United States (i.e. tributaries) was conducted for the Mitigation Site by Palustrine Group, LLC personnel in accordance with the methodology outlined in the Eastern Mountains and Piedmont Regional Supplement to the 1987 Corps of Engineers Wetland Delineation Manual (hereinafter "Supplement"). The Supplement was used to collect baseline hydrology, vegetation and soils data. A Jurisdictional Determination (hereinafter "JD") letter was issued for the Mitigation Site on January 28, 2020; the issued JD letter is included in Appendix D. Verified aquatic feature boundaries are depicted on Figure 8; representative photographs of aquatic resources are included in Appendix E. Note, all information referenced in the PRM Plan described herein has been updated to reflect the verified aquatic feature boundaries and limits.

### 4.4.4 Topography

LiDAR data was obtained for the Mitigation Site (Figure 9); a USGS topographic map is included as Figure 10. Overall, the Mitigation Site ranges in elevation (according to available LiDAR information) from approximately 613 feet to approximately 446 feet. In general, the overall topography slopes away from the north and west and towards the south and east. Ultimately, all on-site floodplain valleys and associated streams drain east to the Catawba River.

Riparian buffer slopes are generally between 10 – 20% along stream reaches located outside of the Catawba River floodplain. Riparian and upland buffer slopes are generally between 0 – 5% along the Catawba River and stream reaches located within the Catawba River floodplain. The Mitigation Site generally exhibits a 1.3 – 1.4% grade within streams and floodplains.

### 4.4.5 Vegetative Conditions

John B. Nelson's February 1986 document *The Natural Communities of South Carolina* describes the natural community as primarily being a transitional oak-hickory forest located on upland slopes and dominated by a diverse assemblage of hardwoods (primarily oaks and hickories) in combination with pines. Best professional judgment was used to classify and describe on-site communities.

Existing vegetative communities within the Mitigation Site were assessed to understand existing impairments, to develop planting palettes for enhanced areas, and to establish performance standards. Refer to Figure 11 for a general depiction of existing vegetative communities. In general, an unnatural planted pine community consisting primarily of loblolly pine comprises approximately 51% of the Mitigation Site and is the primary vegetative community. This exists in two forms; intensively managed silviculture, and planted loblolly pine dominate mixed small stream forest. A natural mid to late-successional small stream mixed hardwood forest dominates approximately 42% of the land use. Palustrine forested floodplain wetland (relict and actively wetland) forest consisting of native hardwood wetland species comprises the remaining 7% of the land use. Dirt and gravel roads traverse the Landsford Tract and Mitigation Site and can be used to access portions of the Landsford Tract and Mitigation Site. Although not prevalent, minor localized occurrences of invasive species are located within the Landsford Tract and Mitigation Site. These species include, but may not be limited to, Chinese privet (*Ligustrum sinense*), Japanese silt grass (*Microstegium vimineum*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*).

While present, these species are not compromising natural forest composition or outcompeting native vegetation.

Following is a description of each existing vegetative community located on the Landsford Tract and/or within the Mitigation Site.

*Loblolly Pine (Silviculture) and Mixed Loblolly Pine / Small Stream Forest*

Loblolly pine has been planted extensively on upland hillsides and ridges throughout the Mitigation Site and encroaches into valleys and floodplains. The dominant tree species within this unnatural community is loblolly pine, with deciduous trees and other conifers as minor components of the tree canopy. The planted loblolly pine has replaced oak-hickory and chestnut oak forest communities within aquatic resource buffers within the Mitigation Site.

*Small Stream Forest (Hardwood)*

The main secondary vegetative community within the Mitigation Site consists of a mid to late-successional mixed hardwood forest. In general, this community is primarily dominated by mixed hardwoods consisting of various oaks including water oak (*Quercus nigra*), blackjack oak (*Quercus marilandica*), northern white oak, northern red oak (*Quercus rubra*), southern red oak, post oak, and pin oak (*Quercus palustris*); various hickories including pignut hickory (*Carya glabra*) and mockernut hickory (*Carya tomentosa*). Other canopy species include sweet-gum (*Liquidambar styraciflua*), tulip tree (*Liriodendron tulipifera*) and red maple (*Acer rubrum*). The sub-canopy generally consists of undeveloped canopy species, but also includes persimmon (*Diospyros virginiana*), black cherry (*Prunus serotina*) and eastern red-cedar (*Juniperus virginiana*). Shrubs include sparkleberry (*Vaccinium arboreum*), lowbush blueberry (*Vaccinium angustifolium*), winged sumac (*Rhus copallinum*), and Chinese privet. Herbaceous species include Christmas fern (*Polystichum acrostichoides*), ebony spleenwort (*Asplenium platyneuron*), Brazilian vervain (*Verbena brasiliensis*), and reindeer lichen (*Cladonia rangiferina*). Vines include muscadine (*Vitis rotundifolia*) and Japanese honeysuckle.

*Palustrine Forested Floodplain Wetland Hardwood Forest*

On-site palustrine forested floodplain wetlands are dominated by box elder (*Acer negundo*), cottonwood (*Populus deltoides*), red maple, sweet-gum, American sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*) and ironwood (*Carpinus caroliniana*). Shrubs include Chinese privet. Herbaceous species include Japanese stilt grass.

### 4.4.6 Soils

The Natural Resources Conservation Service (hereinafter “NRCS”) soil survey for Chester County indicates that six soil types occur within the Mitigation Site boundary; refer to Table 4 for the soil types and to Figure 12 for the NRCS soil map. As shown in Table 4, the Mitigation Site is dominated by loamy soil textures.

**Table 4. Soil Types within the Mitigation Site**

| Soil Code | Soil Name and Type[1] | % Slopes |
|---|---|---|
| ApB | Appling loamy sand | 2 – 6 |
| CeB | Cecil sandy loam | 2 – 6 |
| CnB2 | Cecil sandy clay loam | 2 – 6 |
| CnC2 | Cecil sandy clay loam | 6 – 10 |
| PaE | Pacolet sandy loam | 10 – 25 |
| To | Toccoa loam[2] | 0 – 2 |

[1] NRCS Official Soil Series Description
[2] Identified as hydric on NRCS hydric soils list

Toccoa loam is listed on the South Carolina Hydric Soils List provided by NRCS. As depicted in Figure 12, mapped hydric soils (Toccoa loam) are located adjacent to, and within the floodplain of, the Catawba River and the lower portions of UT 1 and UT 2.

### 4.4.7 Stream and Wetland Conditions

Reaches and wetlands are depicted on Figure 4. Refer to Appendix E for representative photographs of stream reaches and wetlands.

*Stream Conditions*

*Stream Protection – UT 1 (Sections 1 and 2)*

UT 1 (Section 1) is a 1st order perennial unnamed tributary at its upper extent and a 2nd order perennial unnamed tributary at its lower extent. UT 1 (Section 1) flows directly into the Catawba River. This 6,488 linear foot reach is approximately 5 – 8 feet deep on average (from the thalweg to the top of bank) with an average width of approximately 9 feet (from toe of slope to toe of slope) at its upper extent and approximately 18 feet (from toe of slope to toe of slope) at its lower extent. This reach is in the intermediate to latter stages of channel evolution, having adjusted vertically so that the bed elevation has been lowered and the historic floodplain has been abandoned, and having adjusted laterally resulting in widening. Portions of streambanks along the upper extent of the reach are experiencing bank instability and failure, bank erosion and scour, undercutting and tree loss. At the lower extent of the reach, the channel width appears to have stabilized and to have begun to decrease as bank material and sediment build bank toe benches and bars within the over widened floodplain. A 150-foot riparian area will be protected along the left streambank of this reach. This riparian area is currently comprised of approximately 50% small stream hardwood forest and 50% planted pine dominated small stream hardwood forest.

UT 1 (Section 2) is a 1st order seasonal unnamed tributary which flows directly into UT 1 (Section 1). This reach is approximately 5 – 8 feet deep on average (from the thalweg to the top of bank) with an average width of approximately 4 – 5 feet (from toe of slope to toe of slope). This reach is in the intermittent stages of channel evolution, having adjusted vertically so that the bed elevation has been lowered in response to vertical adjustments in UT 1 (Section 1); the historic floodplain has been abandoned. Lateral adjustments are currently resulting in portions of bank instability and failure and bank erosion and scour. This reach consists of 1,214 linear feet of stream channel. A 150-foot riparian area currently consisting of a diverse mixed upland forest will be protected around this reach.

*Stream Preservation – UT 2 (Section 4), UT 3 (Section 2), UT 4 (Section 2) and UT 5*

UT 2 (Section 4) is a 1st order seasonal unnamed tributary which flows into UT 2 (Section 3). This reach is approximately 1 – 2 feet deep on average with an average width of approximately 5 feet. This reach is stable and has a diverse substrate of bedrock, boulders and cobble. This reach consists of 158 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

UT 3 (Section 2) is a 1st order seasonal unnamed tributary which ultimately flows into UT 3 (Section 1). This reach is approximately 0.5 feet deep on average with an average width of approximately 3 feet. This reach is stable. This reach consists of 504 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

UT 4 (Section 2) is a 1st order seasonal unnamed tributary which flows into UT 4 (Section 1). This reach is approximately 0.5 feet deep on average with an average width of approximately 3 feet. This reach is stable. This reach consists of 306 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

UT 5 is a 1st order seasonal unnamed tributary which flows into UT 3 (Section 2). This reach is approximately 0.5 feet deep on average with an average width of approximately 3 feet. This reach is stable. This reach consists of 111 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

*Stream Enhancement – UT 2 (Section 2)*

UT 2 (Section 2) is a 1st order seasonal unnamed tributary which flows into UT 2 (Section 1). This reach is approximately 2 – 4 feet deep on average with an average width of approximately 9 – 10 feet. This reach consists of 622 linear feet of stream channel. This reach is experiencing moderate bank degradation and tree loss. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

*Stream Restoration – UT 2 (Sections 1 and 3), UT 3 (Section 1) and UT 4 (Section 1)*

UT 2 (Section 1) is a 1st order perennial unnamed tributary which flows into UT 1 (Section 1). At its downstream extent, this reach is incised approximately 6 – 7 feet on average with an average width of approximately 15 feet. At its midstream and upstream extents, this reach is incised approximately 4 – 7 feet on average with an average width of approximately 8 – 10 feet. As a whole, this reach is experiencing significant, active bank degradation and erosion, mass wasting, tree-fall and lateral expansion. Banks are typically vertical with minimal vegetative cover. This reach consists of 4,713 linear feet of stream channel. A 150-foot riparian buffer currently consisting predominantly of planted and naturally regenerating pine mixed with small stream hardwood forest is located around this reach.

UT 2 (Section 3) is a 1st order seasonal unnamed tributary which flows into UT 2 (Section 2). This reach is approximately 2 – 4 feet deep on average with an average width of approximately 5 – 7 feet. This reach is experiencing moderate bank degradation and tree loss. This reach consists of 746 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

UT 3 (Section 1) is a 1st order seasonal unnamed tributary which flows into UT 1 (Section 1). This reach is incised approximately 4 feet on average with an average width of approximately 4 – 5 feet. This reach is experiencing moderate bank degradation, with banks typically being vertical with minimal vegetative cover. This reach does not have any floodplain access. This reach consists of 1,782 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

UT 4 (Section 1) is a 1st order seasonal unnamed tributary which flows into UT 3 (Section 1). This reach is incised approximately 4 feet deep on average with an average width of approximately 4 – 5 feet. In response to UT 3 (Section 1) channel incision, this reach is experiencing moderate bank degradation, with banks typically being vertical with minimal vegetative cover. UT 4 (Section 1) is in jeopardy of headcutting and becoming further incised as UT 3 (Section 1) continues to make channel adjustments. This reach consists of 61 linear feet of stream channel. A 150-foot riparian buffer currently consisting of a diverse small stream hardwood forest will be established around this reach.

*Low Gradient Stream Assessment Data Sheet Scores*

Existing stream conditions were documented using the USACE Charleston District Low Gradient Stream Assessment Data Sheet. Results of the assessment are included in Table 5; the Low Gradient Stream Assessment Data Sheets are included in Appendix F. Reach locations are shown on Figure 4. Refer to Appendix E for representative photographs of on-site stream resources.

**Table 5. Existing Stream Conditions**

| Reach | Treatment | Score | Functional Assessment |
|---|---|---|---|
| UT 1 (Section 1)* | Protection | 14 | Partially Impaired |
| UT 1 (Section 2)* | Protection | 11.5 | Partially Impaired |
| UT 2 (Section 1) | Restoration | 7.5 | Impaired |
| UT 2 (Section 2) | Enhancement | 11.5 | Partially Impaired |
| UT 2 (Section 3) | Restoration | 11 | Partially Impaired |
| UT 2 (Section 4) | Preservation | 14.5 | Partially Impaired |
| UT 3 (Section 1) | Restoration | 8.5 | Impaired |
| UT 3 (Section 2)** | Preservation | 18.5 | Fully Functional |
| UT 4 (Section 1) | Restoration | 8.5 | Impaired |
| UT 4 (Section 2) | Preservation | 16 | Fully Functional |
| UT 5 | Preservation | 16 | Fully Functional |

*Excluded from generating mitigation credit
**Functional Reference Reach

The functional assessment forms were completed for compliance with the USACE Charleston District 2010 mitigation guidelines as well as to provide an indication of the quality and impairment in the streams. The results indicate that restoration reaches are impaired to partially impaired, whereas the enhancement reach is partially impaired with a higher functional score than the restoration reaches. Preservation reaches are fully functional or partially impaired with the highest functional scores. As indicated in Table 5 above, the UT

3 (Section 2) reference condition score of 18.5 indicates a fully functional stream. Note, UT 1 (Section 1) constitutes a property boundary. Therefore, channel alterations, instream work or streambank stabilization and/or grading are not being proposed for UT 1.

According to the 2010 mitigation guidelines, a score of "fully functional" indicates the physical geomorphology of the reach is stable and is representative of an appropriate stream hydrograph for the topographical setting. The biological community is diverse and unimpaired by excessive anthropogenic inputs; streams with listed species, primary trout streams, and streams identified as highly diverse are considered fully functional. According to the 2010 mitigation guidelines, "partially impaired" indicates stability and resilience of the stream reach has been compromised, to a limited degree, through partial loss of one or more of the integrity functions. Systems with partial impairment could recover naturally, particularly if the source of impairment is removed. According to the 2010 mitigation guidelines, "impaired" indicates that there is a moderate loss of stream stability and resilience characterized by loss of at least one integrity function. Recovery is unlikely to occur naturally for impaired stream systems, and further damage is likely unless restoration is undertaken.

Typical cross-sections have been collected to document representative channel dimensions; refer to Appendix G for the cross-sections and to Figure 13 for the cross-section locations. Significant breaks in slope, which include the top of bank, toe of bank, and thalweg, were surveyed at each cross-section. Bankfull elevations at these cross-sections was identified based on an observed point bar, ordinary high-water mark, and/or wrack line. Existing condition geomorphic data are listed in Table 6.

## Table 6. Existing Condition Geomorphic Data

| Geomorphic Variables | UT1 Mini Regional Curve Reference Cross Section 1 | UT1 Mini Regional Curve Reference Cross Section 2 | UT2 Upstream Impaired Reach | UT2 Middle Impaired Reach | UT2 Middle Reference Reach | UT2 Downstream Impaired Reach | UT3 Upstream Reference Reach Riffle 1 | UT3 Upstream Reference Reach Riffle 2 | UT3 Downstream Impaired Reach | UT 4 Upstream Reach | UT 4 Downstream Reach |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| Drainage Area (square miles) | 0.6 | 0.6 | 0.04 | 0.1 | 0.24 | 0.31 | 0.0548 | 0.0548 | 0.12 | 0.037 | 0.0372 |
| Stream Type (Rosgen) | E4 | B4 | B4/5c | G4c | E4/5 | G4c | E4 | E4 | G4 | B4 | G4 |
| **DIMENSION VARIABLES** | | | | | | | | | | | |
| Wbkf (Bankfull width in feet) | 12.4 | 11.3 | 3.6 | 6.0 | 11.9 | 6.9 | 5.7 | 7.1 | 6.3 | 6.3 | 3.1 |
| Dbkf (Bankfull mean depth in feet) | 1.31 | 1.09 | 0.93 | 0.96 | 1.07 | 1.29 | 1.03 | 0.79 | 0.95 | 0.54 | 1.12 |
| Wfpa (Width of floodprone area) | 36.8 | 19.7 | 6.2 | 8.1 | 80.6 | 10.6 | 26.9 | 24.7 | 7.7 | 33.7 | 5.1 |
| Abkf (Cross-sectional Area) | 16.27 | 12.30 | 3.37 | 5.80 | 12.80 | 8.90 | 5.93 | 5.62 | 5.99 | 3.42 | 3.41 |
| Wbkf / Dbkf ratio | 9.5 | 10.3 | 3.9 | 6.3 | 11.1 | 5.4 | 5.6 | 9.0 | 6.6 | 11.7 | 2.7 |
| Wfpa/Wbkf (Entrenchment ratio) | 3.0 | 1.7 | 1.7 | 1.3 | 6.8 | 1.5 | 4.7 | 3.5 | 1.2 | 5.3 | 1.7 |
| Dmax (Max. depth at bankfull) | 1.7 | 1.6 | 1.5 | 1.5 | 2.0 | 1.9 | 1.8 | 1.5 | 1.3 | 1.0 | 1.7 |
| Dmaxtob (Max depth at top of bank) | 1.7 | 1.6 | 5.5 | 5.4 | 2.0 | 4.3 | 1.8 | 1.5 | 6.1 | 1.0 | 3.4 |
| Dmax/Dbkf (Max depth ratio) | 1.3 | 1.4 | 1.6 | 1.6 | 1.9 | 1.5 | 1.7 | 1.9 | 1.4 | 1.8 | 1.5 |
| Dmaxtob/Dmax (Bank ht ratio) | 1.0 | 1.0 | 3.7 | 3.5 | 1.0 | 2.3 | 1.0 | 1.0 | 4.7 | 1.1 | 2.0 |
| **PATTERN VARIABLES** | | | | | | | | | | | |
| Lm (Meander length in feet) | 168 | 168 | 20 | 112 | 52 | 112 | 49 | 49 | 58 | 46 | 26 |
| Lw(Linear Wave length in feet) | 132 | 132 | 18 | 109 | 44 | 109 | 39 | 39 | 52 | 44 | 25 |
| Rc (Radius of Curvature in feet) | 31.4 | 31.4 | 4.5 | 12.5 | 59.8 | 33.9 | 5.6 | 5.6 | 22.5 | 8.6 | 10.2 |
| Larc(Arc length in feet) | 47.8 | 47.8 | 4.6 | 20.3 | 20.5 | 16.6 | 10.4 | 10.4 | 19.4 | 11.5 | 8.3 |
| Wblt (Belt width in feet) | 50.8 | 50.8 | 6.8 | 18.9 | 22.8 | 40.5 | 14.8 | 14.8 | 17.5 | 9.4 | 7.7 |
| K (Sinuosity) | 1.28 | 1.28 | 1.42 | 1.23 | 1.17 | 1.09 | 1.23 | 1.23 | 1.06 | 1.15 | 1.08 |
| Lm/Wbkf (Meander length ratio) | 13.52 | 14.89 | 5.47 | 18.64 | 4.36 | 16.21 | 8.50 | 6.84 | 9.22 | 7.27 | 8.59 |
| Lw/Wbkf (Linear wave length ratio) | 10.60 | 11.67 | 4.91 | 18.11 | 3.73 | 15.75 | 6.84 | 5.50 | 8.26 | 6.95 | 8.09 |
| Rc/Wbkf (Radius of Curve ratio) | 2.53 | 2.79 | 1.23 | 2.07 | 5.02 | 4.90 | 0.98 | 0.79 | 3.58 | 1.36 | 3.34 |
| Larc/Wbkf (Arc length ratio) | 3.85 | 4.24 | 1.27 | 3.37 | 1.72 | 2.40 | 1.82 | 1.46 | 3.10 | 1.82 | 2.72 |
| Wblt/Wbkf (Meander width ratio) | 4.09 | 4.51 | 1.87 | 3.14 | 1.91 | 5.85 | 2.57 | 2.07 | 2.79 | 1.48 | 2.54 |
| **PROFILE VARIABLES** | | | | | | | | | | | |
| Sval (Valley slope, ft/ft)) | 0.024 | 0.242 | 0.027 | 0.019 | 0.009 | 0.009 | 0.015 | 0.015 | 0.025 | 0.032 | 0.036 |
| Schan (Channel slope, ft/ft) | 0.019 | 0.190 | 0.019 | 0.016 | 0.004 | 0.008 | 0.012 | 0.012 | 0.023 | 0.028 | 0.033 |
| Srif (Riffle slope, ft/ft) | 0.015 | 0.015 | 0.025 | 0.018 | 0.008 | 0.012 | 0.065 | 0.065 | 0.056 | 0.069 | 0.092 |
| Spool (Pool slope, ft/ft) | | 0.002 | 0.008 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.008 | 0.008 |
| Srif/Schan (Riffle slope ratio) | 0.8 | 0.1 | 1.3 | 1.1 | 2.1 | 1.5 | 5.5 | 5.5 | 2.4 | 2.5 | 2.8 |
| Spool/Schan (Pool slope ratio) | 0.00 | 0.12 | 0.31 | 0.13 | 0.10 | 0.12 | 0.03 | 0.03 | 0.03 | 0.11 | 0.09 |
| Dmaxpool (Max Pool depth in feet) | | | 2.4 | 2.0 | 1.9 | 2.2 | 4.8 | 4.8 | 2.4 | 1.7 | 1.8 |
| Wpool (Width of pool in feet) | | | 8.1 | 9.9 | 9.8 | 9.8 | 5.6 | 5.6 | 5.8 | 4.1 | 6.2 |
| Lriffle (Length of riffle in feet) | 40.7 | 36.6 | 5.4 | 26.3 | 10.3 | 16.3 | | | 8.9 | 13.4 | 6.4 |
| Lpool (Length of pool in feet) | 19.9 | 17.0 | 6.1 | 9.9 | 13.6 | 24.3 | 17.2 | 17.2 | 17.4 | 6.4 | 13.4 |
| Lglide (Length of glide in feet) | | | 1.7 | 2.5 | 5.6 | 10.6 | | | 3.2 | 2.3 | 1.3 |
| Lps (Pool-pool spacing in feet) | 50.5 | 65.6 | 14.5 | 41.3 | 30.9 | 37.9 | 22.2 | 22.2 | 25.1 | 28.3 | 18.6 |
| Dmaxpool/Dbkf (Max pool depth ratio) | 0.0 | 0.0 | 2.6 | 2.1 | 1.8 | 1.7 | 4.7 | 6.1 | 2.5 | 3.1 | 1.6 |
| Wpool/Wbkf (Pool width ratio) | | | 2.2 | 1.6 | 0.8 | 1.4 | | | 0.9 | 0.6 | 2.0 |
| Lriffle/Wbkf (Riffle length ratio) | 3.3 | 3.2 | 1.5 | 4.4 | 0.9 | 2.4 | | | 1.4 | 2.1 | 2.1 |
| Lpool/Wbkf (Pool length ratio) | 1.6 | 1.5 | 1.7 | 1.6 | 1.1 | 3.5 | 3.0 | 2.4 | 2.8 | 1.0 | 4.4 |
| Lglide/Wbkf (Glide length ratio) | | | 0.5 | 0.4 | 0.5 | 1.5 | | | 0.5 | 0.4 | 0.4 |
| Lps/Wbkf (Pool-pool spacing ratio) | 4.1 | 5.8 | 4.0 | 6.9 | 2.6 | 5.5 | 3.9 | 3.1 | 4.0 | 4.5 | 6.1 |

The primary driving factor in channel degradation on the Mitigation Site is flood flows are contained in the bankfull channel. Containing flood flows in the bankfull channel produces symptoms of channel degradation which include bank erosion and copious volumes of fine sediment (sand and very fine gravel) that smother out bed forms and degrade in channel aquatic habitats. Fine sediment intrusion to the channel is evident in measured particle size distributions and lack of pool depth. It is important to note that geomorphic surveys on pool cross-sections were conducted in pools with deep, slow-moving water. However, most of the pools encountered were partially smothered with fine sediment and lacked sufficient depth to create slow water habitats.

The primary expression of geomorphic degradation is evident in existing stream flood prone area described by the entrenchment and bank height ratios. The entrenchment ratio, defined as the width of flood prone area divided by bankfull width, for impaired reaches ranges between 1.2 and 1.7. Streams with entrenchment ratio less than 1.4 are considered entrenched such that even moderate to large floods are mostly contained within the bankfull channel. The bank height ratio represents the degree of channel incision or floodplain connectivity, and is expressed by the ratio between maximum depth at top of bank and maximum bankfull depth. Morphological surveys on existing channels shows the top of bank is between 2.3 and 4.7 times greater than the bankfull depth. Containing flood flows to the bankfull channel creates high shear stress during large runoff events and erodes channel bed and banks leading to channel enlargement which exacerbates sediment supply in downstream reaches. Particle size distributions collected during geomorphic assessments classify on-site streams as gravel bed streams; however, reaches such as UT2 Upstream Impaired and UT2 Middle References reaches obtained the 4/5 designation indicating greater than 20% sand content.

Channels in degradation initially erode the bed causing vertical displacement and incision as indicated by high bank height ratio. Stream channels are typically narrow while in the process of down cutting. During channel incision, and immediately following, flood flows are contained within the bankfull channel as indicated by low entrenchment ratio. While the entrenchment ratio is low, flood flows are contained in the channel such that shear stress increases greatly for floods larger than bankfull. Once the channel is no longer able to vertically incise, high shear stress acts on the banks to widen the channel and subsequently reduce shear stress to obtain equilibrium. Channels that are in the process of channel widening have high width depth ratios and will classify as Rosgen F or D channels. The prevalence of narrow channels, and a width to depth ratio less than 12.4, indicates the system is early in the degradation process.

Despite currently having desirable entrenchment and bank height ratios, UT2 Middle Reference reach displays a high probability of becoming impaired in the near future. The low point is the center of the valley on UT2 Middle Reference reach between station 28+00 and 34+00 of the existing alignment. This reach is perched along the river right valley and has a bankfull slope (0.004 ft/ft) that is significantly less than the valley slope (0.009 ft/ft), when valley slope is measured along the fall line of the valley. The valley slope being steeper offers less resistance to flow as compared to the channel which increases the probability of channel avulsion to the more favorable flow path.

In summary the predominance of entrenched, low width to depth ratio channels, with high bank height ratios indicates channels are actively down cutting and eroding banks. This degradation processes releases sediment to downstream reaches such as UT2 Section Reference Reach that was recently aggrading. Reference reach surveys suggest the streams in this region should have entrenchment ratios greater than 2.2 (SCDNR, 2020) and bank height ratios less than 1.1 (Harman and Starr, 2011). Based on reference reach surveys in North Carolina (Harmon and Starr, 2011) and surveys performed by CEC on this project and at other locations, more ecologically functional and stable streams would exhibit characteristics of a C4 stream

type.

*Description of Appendix R Supplementary Existing Conditions Analyses*

Appendix R shows shear stress in pounds per square foot (psf) output from 2-dimensional hydraulic modelling performed for the 2-year recurrence interval flow. The 2-year recurrence interval flow was selected to represent an approximation to the bankfull water surface elevation. The profile in Appendix R shows the existing LiDAR elevation, 2-year water surface elevation (hereinafter "WSE"), and the left and right top of banks. At the upstream end of the figure at STA 25+00 the left and right banks are about twice as high as the 2-year WSE, indicating a bank height ratio of 2. Bank heights and 2-year WSE merge around station 27+00 and remain approximately equal until STA 30+00 where the right top of bank increases in elevation. The right top of bank reached maximum elevation relative to WSE around STA 31+00 where the stream is against the right valley wall. Both the left and right banks are approximately the same elevation from STA 31+50 to STA 33+50, where a small head cut was observed at the downstream end of the UT2 Middle Reference Reach. From STA 33+50 to STA 36+00, the left and right top of banks are only slightly higher in elevation than WSE. A head cut of approximately 2.5 ft exists at station 36+0. Downstream of the head cut located at STA 36+00 left and right bank heights are approximately 2 ft above the 2-year WSE.

The planform view of shear stress during the 2-year recurrence interval flow through UT 2 displays a few interesting highlights. UT 2 makes a 90-degree right hand turn around STA 30+50, causing water to exit the channel and flow down the center of the valley. As flow exits the channel at STA 30+50 shear stress is in excess of 0.8 psf, which is capable of mobilizing 5-inch diameter particles. Appendix G UT2 Middle Reference Cross Section Riffle shows the low point of the valley located in the center of the valley. Streams typically follow the valley fall line, and, based on the hydraulic model outputs, it appears UT 2 is attempting to relocate to the center of the valley.

Shear stress on the head cut located at STA 36+00 produces shear stress in excess of 2 psf, which is capable of mobilizing 10-inch particles. Particle size distributions collected across the project site concluded the streams were predominantly gravel bedded. This head cut has enough shear stress to propagate upstream through the existing gravel bed stream.

Based on the high shear stress through the center of the valley and the presence of head cuts located immediately downstream of the UT2 Middle Reference reach, it was concluded that this reach exists in an unstable condition and is likely to undergo geomorphic adjustments.

*Wetland Conditions*

*Wetland Preservation*

The on-site wetland being proposed for preservation exhibits hydric soils, unimpaired hydrology, and contains a hydrophytic vegetative community comprised of diverse native hardwood canopy and understory species. A 150-foot upland buffer currently consisting predominantly of planted loblolly pine is located around the wetland.

*Wetland Enhancement*

The on-site wetland being proposed for enhancement exhibits hydric soils and contains a hydrophytic vegetative community comprised of diverse native hardwood canopy and understory species. However, the

hydroperiod of the on-site wetland is being impaired by a ditch that is partially excavated within the wetland and that drains to the Catawba River. Refer to Appendix C for historic aerial photographs depicting the ditch. A 150-foot upland buffer currently consisting of planted loblolly pine is located around the wetland.

### 4.4.8 Hydrology

On January 6th and 7th, 2020, four water level (i.e. stream) gauges (HOBO Onset loggers) and two groundwater wells (HOBO Onset loggers) were installed within stream channels to monitor stream surface water levels and within the on-site wetland enhancement area to monitor surface and sub-surface water levels, respectively. A rain gauge was installed on-site as well; rain data has been correlated to stream and wetland hydrograph data and can be found in Appendix I. Refer to Figure 14 for the locations of the stream gauges, groundwater wells, and the rain gauge. Groundwater well Installation Data Sheets are included in Appendix J.

### 4.4.9 Water Quality

On January 22, 2020, turbidity and fecal coliform were sampled within UT 2 (Section 1), UT 2 (Section 3), and UT 3 (Section 1). Refer to Figure 14 for the sampling locations and to Appendix K for the sampling results. Turbidity at the UT 2 (Section 1) sampling locations was 6.0 NTUs, UT 2 (Section 3) turbidity was found to be 11 NTUs, and UT 3 (Section 1) resulted in 8.6 NTUs. All sample results are well below the SCDHEC water quality standard for freshwater, which is not to exceed 50 NTUs. Lab tests for fecal coliform concentrations at the same locations resulted in 220/100 mL at UT 2 (Section 1), 82/100 mL in UT 2 (Section 3), and 20,920/100 mL at UT 3 (Section 1). The SCDHEC water quality standard for freshwater is 349/100 mL for a single sample. Lab results at both stations located in UT 2 are well below the SCDHEC threshold. Fecal coliform concentrations within UT 3 (Section 1) far exceeded the SCDHEC water quality standard. This, however, could be an anomaly and trends will be noted in annual monitoring reports.

On January 21, 2020, in-situ water quality measurements for pH, conductivity, dissolved oxygen, and temperature were taken within UT 2 (Section 1), UT 2 (Section 3) and UT 3 (Section 1) with a YSI meter as part of the benthic macroinvertebrate sampling efforts. Refer to Appendix L for the benthic macroinvertebrate sampling report, and specifically to Table 1 of the report for the water quality sampling results. All monitored parameters were within water quality standards for Class FW waters.

### 4.4.10 Benthic Macroinvertebrates

On January 21, 2019, benthic macroinvertebrates were collected within UT 2 (Section 1), UT 2 (Section 3) and UT 3 (Section 1). Refer to Figure 14 for the benthic macroinvertebrate sampling locations and refer to Appendix L for the benthic macroinvertebrate sampling results.

All three sampling locations exhibit North Carolina biotic index values indicating an “excellent” score. UT 2 (Section 3) sampling station has a SCDHEC biological classification of “good” while UT 2 (Section 1) and UT 3 (Section 1) have scores of “good-fair”.

UT 2 (Section 1) sampling results include the presence of six Ephemeroptera, Plecoptera, and Trichoptera (hereinafter “EPT”) taxon individuals. UT 2 (Section 3) results include the presence of sixteen EPT taxon individuals. UT 3 (Section 1) results include the presence of six EPT taxon individuals. Based on these sampling results, the EPT index value at UT 2 (Section 3) is average, while UT 2 (Section 1) and UT 3

(Section 1) are low.

#### 4.4.11 Woody Debris

In January 2020, a qualitative evaluation of the frequency and size distribution of woody debris within UT 2 (Section 1), UT 2 (Section 3), UT 3 (Section 1) and UT 3 (Section 2) was conducted. The results of the evaluation, which took place over 100-meter lengths within each reach, are included in Appendix M. The large woody debris that was found includes submersed and buried logs, as well as ramps and bridges. Despite there being a relatively abundance source of large woody debris adjacent to the evaluated reaches, very little large woody debris occurs within the bankfull areas of each of the sampled stream sections, possibly due to incision and channel instability.

### 4.5 Determination of Credits

Mitigation activities are outlined in Section 4.6. The number of credits generated by the mitigation activities is listed in Table 7; the number of credits generated by the mitigation activities is based on the USACE 2010 mitigation guidelines. Mitigation worksheets for all stream reaches are included in Appendix N.

**Table 7. Credit Production**

| Mitigation Activity | Credits Generated |
|---|---|
| Stream Preservation | 1,230 |
| Stream Enhancement | 1,966 |
| Stream Restoration | 31,172 |
| **Total Stream Credits** | **34,368** |
| Wetland Preservation | 0.47 |
| Wetland Enhancement | 11.36 |
| **Total Wetland Credits** | **11.83** |

Stream compensatory mitigation factors are outlined in Table 8.

**Table 8. Stream Compensatory Mitigation Factors**

| Factor | Unit 1 | Unit 2 | Unit 3 | | |
|---|---|---|---|---|---|
| | UT 2 (Section 4), UT 3 (Section 2), UT 4 (Section 2) and UT 5 | UT 2 (Section 2) | UT 2 (Section 1) | UT 2 (Section 3) and UT 4 (Section 1) | UT 3 (Section 1) |
| Stream Type | 1st & 2nd Order RPW | 1st & 2nd Order RPW | 1st & 2nd Order RPW | 1st & 2nd Order RPW | 1st & 2nd Order RPW |
| Priority Category | Primary | Primary | Primary | Primary | Primary |
| Net Improvement | Not Applicable | Significant | Maximum | Significant | Maximum |
| Credit Schedule | Not Applicable | After | After | After | After |
| Location | 8-Digit HUC | 8-Digit HUC | 8-Digit HUC | 8-Digit HUC | 8-Digit HUC |
| Riparian Buffer | 150-ft. (2x Minimum) Both Banks Preservation | 150-ft. (2x Minimum) Both Banks Preservation | 150-ft. (2x Minimum) Both Banks Enhancement | 150-ft. (2x Minimum) Both Banks Preservation | 150-ft. (2x Minimum) Both Banks Preservation |

Wetland compensatory mitigation factors are outlined in Table 9.

**Table 9. Wetland Compensatory Mitigation Factors**

| Factor | Enhancement | Preservation |
|---|---|---|
| Net Improvement | 2.0 | 0.0 |
| Upland Buffer | 150-ft. (3:1 Ratio) | 150-ft. (3:1 Ratio) |
| Credit Schedule | After | Not Applicable |
| Temporal Loss | 0 to 5 Years | Not Applicable |
| Kind | In-Kind | In-Kind |
| Location | 8-Digit HUC | 8-Digit HUC |

### 4.6 Mitigation Work Plan

Resources within the Mitigation Site have been divided into mitigation units to address existing conditions, proposed activities and target conditions. The mitigation units included in the Mitigation Site are depicted on Figure 4 and are included in Table 1. Representative photographs of resources and existing impairments are included in Appendix E. Hydrologic and hydraulic modeling have been used to support design of the stream restoration and enhancement reaches.

Mitigation work plan exhibits are included in Appendix O. A Joint Permit Application detailing impacts to Mitigation Site aquatic resources will be submitted to the USACE and SCDHEC following approval of the PRM Plan and prior to construction, if necessary.

### 4.6.1 Mitigation Units

The following provides a description of the proposed work to occur in each mitigation unit and/or stream reach.

*Unit 1: Stream Preservation – UT 2 (Section 4), UT 3 (Section 2), UT 4 (Section 2) and UT 5*

Stream preservation is proposed for UT 2 (Section 4), UT 3 (Section 2), UT 4 (Section 2) and UT 5, as these are fully functional or partially impaired channels with minimal or no anthropogenic impacts. A 150-foot riparian buffer (twice the minimum required buffer) will be established around these reaches. The buffer currently consists of a diverse mixed upland forest that will be preserved.

Note, UT 2 (Section 4) is stable and functioning, despite being categorized as partially impaired in Table 5. Pool substrate characterization and pool variability are impaired within UT 2 (Section 4) due to sedimentation primarily originating and resulting from adjacent land use (i.e. silviculture). In addition, channel sinuosity is naturally somewhat constrained due to the reach's landscape position as a headwater reach located within the head of the down-gradient valley. UT 2 (Section 4) would be considered fully functional but for these conditions. A 150-foot riparian buffer will be preserved along this reach, thus removing the sediment source (i.e. silviculture, timber management and incompatible land use within riparian buffers) and allowing the headwater reach to efficiently transport sediment.

*Unit 2: Stream Enhancement – UT 2 (Section 2)*

Stream enhancement is being proposed for UT 2 (Section 2), as this reach is partially impaired with a functional score of 11.5. In general, the impairments include a lack of floodplain access, segments of bank instability and a lack of bank vegetation. Various forms of modification will be used to address these impairments, and may include installation of instream structures and/or minor modification of channel dimension and/or profile based on reference reach data. However, it is anticipated that the majority of the enhancement work will entail streambank stabilization and/or grading, widening portions of the floodplain at the existing channel elevation and bankfull stage to reduce shear stress, and/or streambank plantings. Floodplain benches may be excavated along the streambanks of the existing channel at the elevation of the existing bankfull stage. Bioengineering techniques using natural material and vegetative cover may be implemented, and may include any combination of live stakes, brush mattresses, vegetated geogrids and/or soil lifts with plantings and/or brush toe wood.

A 150-foot riparian buffer (twice the minimum required buffer) will be established around this reach. The buffer currently consists of a diverse mixed upland forest that will be preserved.

*Unit 3: Stream Restoration – UT 2 (Sections 1 and 3), UT 3 (Section 1) and UT 4 (Section 1)*

*Design Process*

Unit 3 stream channels are proposed for restoration of pattern, profile and dimension to provide floodplain connectivity and functional uplift to the instream aquatic communities. Detailed geomorphic survey and hydraulic analysis of each restored stream channel has been completed in an effort to design new channels that transport their water and sediment flows without degrading or aggrading and that are suitable for the valley type. Most of these channels are currently in a state of flux, displaying evidence of

significantly entrenched flows and degraded channel banks. Generally, these channels will be restored so that bankfull and higher discharges are able to access adjacent floodplains that, in their current state, are rarely utilized due to channel incision. Excavated material from newly restored channels, as well as adjacent spoil material, will be placed in the abandoned channels or used to raise channel bed elevations. Instream structures designed to provide grade control and reduce instream energy will be constructed, and instream habitat will be created in an effort to increase benthic habitat diversity.

The proposed channel morphology displayed within the mitigation work plan drawings (Appendix O) have been prepared using published reference conditions by Harman and Star 2011, USGS stream gage data, a site specific mini regional curve, on-site reference data from the geomorphic survey, and professional experience. Dimensionless ratios for existing conditions, proposed conditions, and reference conditions were compiled in order to design functional streams that can evolve with the natural evolution of streams within the Piedmont Physiographic Province of South Carolina. This information was used to establish geomorphic ratios and design metrics for the restoration reaches, to verify the proposed monitoring plan and performance standards, and to facilitate documentation of functional lift for the restored stream systems.

Published regional curves of stream bankfull discharges and cross-sectional dimensions were also used to predict relationships between bankfull discharge, channel dimensions, and drainage area. Geomorphic ratios between surveyed on-site reaches and the reference reach were established based on bankfull discharge and the scaled geometry was used for design of each reach (Table 10). For on-site restoration streams, the 1-, 2-, 5-, 10-, and 100-year discharges were evaluated. The proposed stone ford crossing (refer to Figure 4) was evaluated for stability under the 100-year discharge.

Based on the metrics derived from the design effort, channel sections, plans, and profiles were developed to support restoration. The physical dimensions of the channel (section, plan, and profile) were further refined via analytical and computational methods to ensure each stream is stable and has the capacity to transport the sediment load supplied to it without degrading.

Two-Dimensional (2D) hydraulic modeling was used to aid in the analysis of the existing streams and to optimize the design of the proposed streams. The existing stream hydraulic models show evidence that flows up the 50-year recurrence interval are contained within the top of banks and have limited floodplain connectivity. In addition to the level of entrenchment of the existing channels, the 2D models represented high levels of shear stress causing vertical and lateral instabilities as visually observed in head cuts and bank erosion. Bank height ratios were measured at impaired reaches up to approximately 4 times the bankfull depth.

The proposed stream hydraulic models were used to optimize the design by identifying locations of higher shear stress in the proposed conditions in order to: (1) balance the energy throughout the channel and floodplain to transport bedload and suspended loads of sediment, (2) to optimize the grading plan to reduce areas of potential erosion, and (3) prioritize locations for instream structures and bio-engineering techniques. The combination of geomorphic design and 2D hydraulic modeling address the form and function components of this stream restoration project.

## Table 10. Reference and Proposed Stream Metrics

| | *Reference* | | | | | | *Proposed* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Geomorphic Variables** | **Harman and Starr 2011** | **Harman and Starr 2011** | **Harman and Starr 2011** | **Harman and Starr 2011** | **Harman and Starr 2011** | **Harman and Starr 2011** | **UT2 Section 1 Reach 1** | **UT2 Section 1 Reach 2** | **UT2 Section 1 Reach 3** | **UT2 Section 1 Reach 4** | **UT2 Section 1 Reach 5** | **UT2 Section 3 Reach 1** | **UT2 Section 3 Reach 2** | **UT3 Section 1 Reach 1** | **UT3 Section 1 Reach 2** | **UT3 Section 2 Reach 1** | **UT4 Section 1** |
| Drainage Area (square miles) | | | | | | | 0.1 | 0.17 | 0.24 | 0.31 | 0.31 | 0.04 | 0.063 | 0.12 | 0.12 | 0.0548 | 0.0372 |
| Stream Type (Rosgen) | C4 (Min) | C4 (Max) | B4c (Min) | B4c (Max) | B4c (Min) | B4c (Max) | C4 | C4 | C4 | C4 | C4 | B4c | B4 | C4 | B4 | B4 | B4a |
| **DIMENSION VARIABLES** | | | | | | | | | | | | | | | | | |
| Wbkf (Bankfull width in feet) | | | | | | | 8.9 | 10.5 | 11.6 | 12.6 | 12.6 | 6.7 | 7.7 | 9.1 | 9.5 | 7.1 | 6.0 |
| Dbkf (Bankfull mean depth in feet) | | | | | | | 0.59 | 0.70 | 0.78 | 0.84 | 0.84 | 0.45 | 0.52 | 0.65 | 0.68 | 0.42 | 0.50 |
| Wfpa (Width of floodprone area) | | | | | | | 97.0 | 46.3 | 54.5 | 33.4 | 97.0 | 17.8 | 19.5 | 30.1 | 30.8 | 18.4 | 13.5 |
| Abkf (Cross-sectional Area) | | | | | | | 5.30 | 7.30 | 9.00 | 10.60 | 10.60 | 3.00 | 4.00 | 5.90 | 6.50 | 3.00 | 3.00 |
| Wbkf / Dbkf ratio | 10.0 | 15.0 | 12.0 | 18.0 | 12.0 | 18.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 14.0 | 14.0 | 17.0 | 12.0 |
| Wfpa/Wbkf (Entrenchment ratio) | | | | | | | 10.9 | 4.4 | 4.7 | 2.6 | 7.7 | 2.7 | 2.5 | 3.3 | 3.2 | 2.6 | 2.3 |
| Dmax (Max. depth at bankfull) | | | | | | | 0.9 | 1.0 | 1.1 | 1.2 | 1.2 | 0.5 | 0.6 | 1.0 | 0.9 | 0.5 | 0.6 |
| Dmaxtob (Max depth at top of bank) | | | | | | | 0.9 | 1.0 | 1.1 | 1.2 | 1.2 | 0.5 | 0.6 | 1.0 | 0.9 | 0.5 | 0.6 |
| Dmax/Dbkf (Max depth ratio) | 1.2 | 1.5 | 1.2 | 1.4 | 1.2 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.2 | 1.2 | 1.5 | 1.3 | 1.2 | 1.3 |
| Dmaxtob/Dmax (Bank ht ratio) | 1.0 | 1.1 | 1.0 | 1.1 | 1.0 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| **PATTERN VARIABLES** | | | | | | | | | | | | | | | | | |
| Lm (Meander length in feet) | | | | | | | 79 | 124 | 129 | 125 | 142 | 51 | 48 | 91 | 51 | 51 | NA |
| Lw(Linear Wave length in feet) | | | | | | | 62 | 109 | 100 | 108 | 126 | 49 | 45 | 81 | 49 | 49 | NA |
| Rc (Radius of Curvature in feet) | | | | | | | 19.7 | 22.0 | 25.8 | 25.3 | 30.2 | 16.5 | 17.0 | 27.0 | 25.6 | 19.3 | 22.1 |
| Larc(Arc length in feet) | | | | | | | 18.7 | 25.7 | 26.7 | 27.5 | 28.8 | 13.4 | 13.2 | 20.1 | 15.4 | 13.9 | 9.2 |
| Wblt (Belt width in feet) | | | | | | | 22.6 | 31.3 | 30.9 | 31.8 | 36.5 | 12.5 | 12.5 | 35.0 | 12.5 | 13.7 | 13.7 |
| K (Sinuosity) | 1.20 | 1.40 | 1.10 | 1.30 | 1.10 | 1.20 | 1.2 | 1.1 | 1.5 | 1.1 | 1.2 | 1.4 | 1.1 | 1.2 | 1.1 | 1.1 | 1.1 |
| Lm/Wbkf (Meander length ratio) | 7.00 | 14.00 | | | | | 8.86 | 11.85 | 11.10 | 9.91 | 11.26 | 7.65 | 6.20 | 10.01 | 5.38 | 7.19 | |
| Lw/Wbkf (Linear wave length ratio) | | | | | | | 6.90 | 10.42 | 8.57 | 8.55 | 10.02 | 7.36 | 5.77 | 8.90 | 5.18 | 6.92 | |
| Rc/Wbkf (Radius of Curve ratio) | 2.00 | 3.00 | NA | NA | NA | NA | 2.21 | 2.10 | 2.22 | 2.00 | 2.40 | 2.45 | 2.19 | 2.97 | 2.68 | 2.70 | 3.69 |
| Larc/Wbkf (Arc length ratio) | | | | | | | 2.10 | 2.46 | 2.30 | 2.18 | 2.28 | 2.00 | 1.71 | 2.21 | 1.61 | 1.95 | 1.53 |
| Wblt/Wbkf (Meander width ratio) | 3.00 | 8.00 | NA | NA | NA | NA | 2.54 | 2.99 | 2.66 | 2.52 | 2.89 | 1.87 | 1.62 | 3.85 | 1.31 | 1.92 | 2.28 |
| **PROFILE VARIABLES** | | | | | | | | | | | | | | | | | |
| Sval (Valley slope, ft/ft)) | 0.005 | 0.015 | 0.005 | 0.010 | 0.020 | 0.030 | 0.019 | 0.011 | 0.016 | 0.012 | 0.009 | 0.027 | 0.034 | 0.021 | 0.025 | 0.025 | 0.039 |
| Schan (Channel slope, ft/ft) | | | | | | | 0.016 | 0.010 | 0.011 | 0.011 | 0.008 | 0.019 | 0.032 | 0.018 | 0.024 | 0.023 | 0.037 |
| Srif (Riffle slope, ft/ft) | | | | | | | 0.021 | 0.017 | 0.019 | 0.049 | 0.014 | 0.054 | 0.082 | 0.045 | 0.052 | 0.039 | 0.057 |
| Spool (Pool slope, ft/ft) | | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Srif/Schan (Riffle slope ratio) | 1.2 | 1.5 | 1.1 | 1.8 | 1.1 | 1.8 | 1.3 | 1.7 | 1.8 | 4.5 | 1.7 | 2.8 | 2.2 | 2.5 | 2.4 | 1.7 | 1.6 |
| Spool/Schan (Pool slope ratio) | 0.00 | 0.20 | 0.00 | 0.40 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dmaxpool (Max Pool depth in feet) | | | | | | | 1.5 | 1.7 | 1.9 | 2.1 | 2.1 | 1.7 | 1.9 | 1.8 | 2.0 | 2.6 | 1.5 |
| Wpool (Width of pool in feet) | | | | | | | 11.6 | 13.6 | 15.1 | 17.7 | 17.7 | 6.7 | 7.7 | 12.7 | 10.5 | 7.9 | 6.0 |
| Lriffle (Length of riffle in feet) | | | | | | | 21.6 | 30.1 | 32.7 | 32.9 | 40.5 | 10.9 | 9.2 | 22.7 | 18.7 | 13.1 | 11.1 |
| Lpool (Length of pool in feet) | | | | | | | 18.7 | 25.7 | 26.7 | 27.5 | 28.8 | 7.1 | 7.1 | 20.1 | 15.4 | 13.9 | 9.2 |
| Lglide (Length of glide in feet) | | | | | | | 15.1 | 13.7 | 15.1 | 14.5 | 15.1 | 2.6 | 4.5 | 13.0 | 3.3 | 0.0 | |
| Lps (Pool-pool spacing in feet) | | | | | | | 36.6 | 43.4 | 49.1 | 52.2 | 58.6 | 24.4 | 24.4 | 40.1 | 31.6 | 25.7 | 9.6 |
| Dmaxpool/Dbkf (Max pool depth ratio) | 1.5 | 3.5 | 2.0 | 3.5 | 2.0 | 3.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.8 | 3.8 | 2.8 | 3.0 | 3.5 | 3.0 |
| Wpool/Wbkf (Pool width ratio) | 1.0 | 1.7 | 1.1 | 1.5 | 1.1 | 1.5 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 | 1.0 | 1.0 | 1.4 | 1.1 | 1.1 | 1.0 |
| Lriffle/Wbkf (Riffle length ratio) | | | | | | | 2.4 | 2.9 | 2.8 | 2.6 | 3.2 | 1.6 | 1.2 | 2.5 | 2.0 | 1.8 | 1.8 |
| Lpool/Wbkf (Pool length ratio) | | | | | | | 2.1 | 2.5 | 2.3 | 2.2 | 2.3 | 1.1 | 0.9 | 2.2 | 1.6 | 2.0 | 1.5 |
| Lglide/Wbkf (Glide length ratio) | | | | | | | 1.7 | 1.3 | 1.3 | 1.1 | 1.2 | 0.4 | 0.6 | 1.4 | 0.3 | 0.0 | 0.0 |
| Lps/Wbkf (Pool-pool spacing ratio) | 3.0 | 7.0 | 1.2 | 6.0 | 0.5 | 5.0 | 4.1 | 4.1 | 4.2 | 4.1 | 4.6 | 3.6 | 3.1 | 4.4 | 3.3 | 3.6 | 1.6 |

*Site Specific Restoration Plan*

The restoration plan includes the design of three streams referred to as UT 2, UT 3 and UT 4. The specific aspects of the design are displayed in the mitigation work plan drawings located in Appendix O. The following summaries describe the restoration plan by stream reach.

UT2 (Section 3) – The restoration of UT 2 (Section 3) starts near the headwaters of UT 2 in an incised colluvial valley. The existing stream type is an unstable Rosgen G4 with high shear stress. The restoration design converts the stream type into a B4 with a larger floodplain. The step pool morphology has been designed to increase the instream habitat and reduce shear stress. This reach of restoration is considered a Priority 2 incised river restoration technique.

UT2 (Section 1) – UT 2 (Section1) is the longest reach of restoration within this mitigation plan. The entire length has been designed to maintain a Rosgen C4 steam type through Priority 1 and 2 restoration techniques. Most of the valley bottom has been utilized to extend flood flows to the toe of the valley beyond the 1.5-year recurrence interval. The channel pattern is designed to fit into the low point in the valley for long-term stability and hydraulic performance. Vernal pools and wetland habitat have been designed in abandoned areas of the existing channel to increase the functional uplift of the riparian area. This reach of stream contains riffle pool morphology with designed stream facets such as riffle, runs, pools, glides, point bars and inner berms. The instream log and boulder structures have been designed to maintain the riffle pool morphology while providing increased aquatic habitat.

UT 3 (Section 1) - The restoration of UT 3 (Section 1) starts just upstream of the confluence between UT 3 and UT 4. At this location, an approximate 4-foot head cut was observed in the existing channel. The design ties in upstream of the head cut in a stable Rosgen E4 stream type. The proposed grading plan transitions from the Rosgen E4 stream into a Rosgen B4 stream type through a Priority 2 restoration technique with a transitional grading ratio greater than 10:1. The design then transitions into a Rosgen C4 stream type and Priority 1 restoration technique using the entire valley bottom as floodplain. Priority 1 restoration reduces the footprint of construction, saving existing vegetation, and providing the maximum capability for functional improvement. The downstream most extent of UT 3 transitions back in to a Rosgen B4 stream type and Priority 2 restoration in order to reach the base flow elevation of the receiving stream UT 1.

UT4 (Section 1) – A short section of UT 4 was designed to tie into the restoration of UT 3. A large head cut located on UT 4 was observed near the confluence with UT 3, which is temporarily controlled by a large rootmass crossing the stream channel. Approximately 75 feet of UT 4 has been designed to arrest the head cut and to transition into the Priority 2 restoration section of UT 3.

A stone ford crossing will be constructed where a proposed new road will cross the restored UT 2 (Section 1) stream channel to maintain site access. Refer to Figure 4 for the proposed new road and stone ford crossing to be constructed. Note, the exact location and configuration of the proposed new road and stone ford crossing will be determined at a later date and coordinated with SCDNR prior to construction.

The riparian buffer consisting predominantly of planted and naturally regenerating pine along UT 2 (Section 1) will be enhanced by removing and/or thinning pine from within the buffer and replanting the cleared area with a diverse mix of native hardwood upland species as needed. The riparian buffer consisting of a diverse mix of native hardwoods along UT 2 (Section 3), UT 3 (Section 1) and UT 4 (Section 1) will be preserved. Refer to Section 4.6.2 for proposed riparian buffer activities.

*Reference Reach and/or Survey*

On-site reference reach(s) were identified to aid with stream enhancement and restoration design and metrics; refer to Figure 13 for the reference reach location. A geomorphic assessment, hydrological modeling and hydraulic analysis was performed for the on-site reference reach. In addition, applicable regional curve data and reference reach ratios were compiled. This information was used to establish geomorphic ratios and design metrics for the enhancement and restoration reaches, to determine final performance standards, and to facilitate documentation of functional lift for the enhanced and restored stream systems.

*Unit 4: Wetland Preservation*

The wetland being proposed for preservation exhibits hydric soils, unimpaired hydrology, and contains a hydrophytic vegetative community comprised of diverse native hardwood canopy and understory species. A 150-foot upland buffer currently consisting predominantly of planted loblolly pine is located around the wetland. The planted pine will be removed and the cleared area will be replanted with a diverse mix of native hardwood upland species. Refer to Section 4.6.2 for proposed riparian buffer activities.

*Unit 5: Wetland Enhancement (Hydrologic)*

The wetland proposed for enhancement exhibits hydric soils and hydrophytic vegetation comprised of diverse native hardwood canopy and subcanopy species. However, a ditch is affecting the hydrology of the wetland. The hydroperiod will be naturalized by plugging and/or filling the ditch. Wetland areas disturbed by construction will be planted if needed. A 150-foot upland buffer currently consisting predominantly of planted loblolly pine is located around the wetland. The planted pine will be removed and the cleared area will be replanted with a diverse mix of native hardwood upland species. Refer to Section 4.6.2 for proposed riparian buffer activities.

*Floodplain Wetlands*

Approximately 0.12 acres of floodplain wetlands will be created as part of the PRM Plan. Note, however, that mitigation credits are not being requested for these areas. The wetlands will serve to improve surface and groundwater exchange, provide wildlife habitat, serve as a biological refugia and provide habitat heterogeneity that is not otherwise present within the Mitigation Site.

*UT 1 (Sections 1 and 2)*

Note, 7,702 LF of UT 1 (Sections 1 and 2) will be protected; refer to Figure 4. However, these resources are not included in the mitigation units as they are being excluded from generating mitigation credit for reasons outlined below. Protection of these resources is therefore not considered a mitigation activity.

UT 1 (Sections 1 and 2) are partially impaired channels with minimal anthropogenic impacts. Streambank stability has been compromised, to a limited degree, along portions of these reaches. According to the 2010 mitigation guidelines, “partially impaired” indicates stability and resilience of the stream reach has been compromised, to a limited degree, through partial loss of one or more of the integrity functions; systems with partial impairment could recover naturally, particularly if the source of impairment is removed. UT 1 (Section 1) is in the intermediate to latter stages of channel evolution and recovery is occurring naturally. Channel alterations, instream work or streambank stabilization and/or grading are not being proposed for UT 1

(Section 1) due to it being a property boundary. UT 1 (Section 2) ties directly into UT 1 (Section 1). Channel alterations, instream work or streambank stabilization and/or grading are not being proposed for UT 1 (Section 2) due to natural channel adjustments that are expected to occur to UT 1 (Section 1) over time that may indirectly affect UT 1 (Section 2). Further, UT 1 (Section 2) is in the intermittent stages of channel evolution and recovery is occurring naturally.

UT 1 (Section 1) constitutes a property boundary. Therefore, a 150-foot riparian area will be protected along the left streambank of this reach. The riparian area along the right streambank of UT 1 (Section 1) is located within the Landsford Canal Forest Legacy Area WMA. A 150-foot riparian area will be protected along both streambanks of UT 1 (Section 2). Protecting the UT 1 (Sections 1 and 2) riparian areas with a conservation easement will remove the source of impairment (i.e. silviculture, timber management and incompatible land use within riparian buffers), thus aiding in natural recovery of these stream systems over time.

*Construction Documents*

Prior to commencing work, construction documents will be prepared for the Mitigation Site and mitigation activities. The construction documents may include information on the following:

- Construction methods, timing and sequence;
- Source(s) of water, including connections to existing waters and uplands;
- Methods for establishing the desired plant community and planting details;
- Plans to control invasive plant species;
- Grading and soil management plans;
- Stream channel plan(s), profile(s) and representative cross-section(s);
- Representative details for stream structures;
- Access road plans;
- Coordination with, and approval from, the Federal Emergency Management Agency, if necessary; and
- Erosion control and maintenance of streamflow measures.

During the construction phase of the proposed mitigation activities, appropriate measures will be taken to minimize or avoid impacts to aquatic resources and fauna. Measures may include, but may not be limited to, the following:

- Prior to beginning any land disturbing activity, appropriate erosion and siltation control measures (i.e. silt fences or barriers) must be in place and maintained in a functioning capacity until the area is permanently stabilized.
- Inspections of temporary erosion control measures should occur on a regular basis to safeguard against failures.
- All necessary measures must be taken to prevent oil, tar, trash and other pollutants from entering rivers, creeks, streams, wetlands or other waters.
- Once the project is initiated, it must be carried to completion in an expeditious manner to minimize the period of disturbance to the environment.
- Upon project completion, all disturbed areas must be permanently stabilized with vegetative cover or other erosion control methods as appropriate.

### 4.6.2 Riparian and Upland Buffers

A 150-foot riparian or upland buffer will be placed around all stream reaches and wetlands, respectively. Buffer areas that are being proposed for preservation and that are located along stream reaches that are generating mitigation credit consist of intact, native, hardwood dominated forest communities. The vegetative community within multiple areas of the buffered aquatic resources that are generating mitigation credit has been altered, and either consists of a predominant planted pine overstory or a successional forest community dominated by a naturally recruited pine overstory with a mixed hardwood understory. These portions of the riparian and upland buffers will be improved by removing and/or thinning the pine and planting the areas with native hardwood upland species. Refer to Figure 4 for a depiction of buffer enhancement areas. Native hardwood bare-root seedlings will be planted within the riparian and upland buffers depicted on Figure 4 during the dormant season (winter months, outside of the growing season) to maximize survival. Seedlings will be planted on ten-foot by ten-foot spacing at a density of approximately 450 stems per acre. Refer to Section 4.6.3 and Appendix O for planting methods and proposed planting palettes. Prior to planting, site preparation will be performed, and may include herbicide application, root rake and removal (or piling) of woody debris and/or burning. Pine stumps will be left in place; however, it may be necessary to use a shear blade in some areas to increase the chance of seedling survival. Enhancement activities along stream reaches that are generating mitigation credit will also include monitoring and managing invasive species within the buffers in a manner that will support the continued functions and values for which the Mitigation Site was established.

Note, 28.43 acres of riparian area associated with UT 1 (Sections 1 and 2) are included within the conservation easement area and will thus be protected as well. However, these areas are being excluded from the mitigation work plan since UT 1 (Sections 1 and 2) are being excluded from generating mitigation credit.

All timber operations will cease within the Mitigation Site, except for those activities outlined in Section 4.6.5, Section 4.7, Section 4.10.3 or in Appendix B. Activities described herein will enhance aquatic resources and buffers by establishing natural hardwood communities in areas that have historically been converted to other uses.

*Reference Upland Vegetative Data*

On-site native hardwood upland forest communities were utilized as reference uplands for developing proposed planting palettes. Refer to Figure 4 for areas of buffer preservation, to Figure 14 for monitoring locations and to Appendix O for planting methods and proposed planting palettes. In addition, reference species for riparian and upland buffer plantings were taken from species known to persist throughout these habitat types in the South Carolina Piedmont.

### 4.6.3 Planting Methods and Palettes

Given that most vegetative communities within the Mitigation Site have been impacted to some extent over time by silvicultural activities (e.g., timber harvesting, abandonment, and reforestation), a literature review of natural communities was conducted to develop the species lists included below. The species lists were refined based on baseline data collection and observations of vegetation within the Mitigation Site to account for a range of natural habitats and vegetative composition.

Plants will be installed as bare-root seedlings during the dormant season (winter months, outside of the growing season) to maximize survival. Species will be planted on ten-foot by ten-foot spacing at a density of approximately 450 stems per acre. All planted trees within vegetation quadrats will be tagged and labeled with an identification number and the species. Refer to Appendix O for planting zones, planting methods and proposed planting palettes. Note, species that will be planted will be based on market availability. Natural elevations and contours will be restored by leveling existing ground levels to the maximum extent practicable. Site preparation (tilling, herbicide application, etc.) will be conducted prior to planting if determined to be necessary.

Applicable native seed mixes will be obtained from a certified local supplier, as available, to assure that seeding activities are not promoting the spread of invasive plant species. The seed mixes will be applied at an appropriate pounds per acre (to be specified by the supplier) immediately following construction.

Riparian and upland buffers located along stream reaches that are generating mitigation credit will be improved by removing and/or thinning pine and planting the areas with native hardwood upland species. Refer to Figure 4 for a depiction of buffer enhancement areas. Riparian and upland buffer areas located along stream reaches that are generating mitigation credit and not depicted in the mitigation work plan exhibits included in Appendix O will be planted according to Table 11 below.

**Table 11. Riparian and Upland Buffer Planting Plan**

| Common Name | Scientific Name |
|---|---|
| Ironwood | *Carpinus caroliniana* |
| Yellow Poplar | *Liriodendron tulipifera* |
| Black Gum | *Nyssa sylvatica* |
| White Oak | *Quercus alba* |
| Southern Red Oak | *Quercus falcata* |
| Northern Red Oak | *Quercus rubra* |

*Acceptable Volunteer Species*

Table 12 shows the list of acceptable volunteer species that will be factored into vegetative performance standards for all planting zones. This list was refined based on baseline data collection and observations of vegetation within the Mitigation Site as well as from natural plant community descriptions found in the literature review. Native species that are not listed in Appendix O, Table 11 or Table 12 may be factored into vegetative performance standards if determined to be appropriate for the region and approved.

**Table 12. Acceptable Volunteer Species**

| Common Name | Scientific Name | Indicator Status |
|---|---|---|
| Boxelder | *Acer negundo* | FAC |
| Red Maple | *Acer rubrum* | FAC |
| River Birch | *Betula nigra* | FACW |
| Ironwood | *Carpinus caroliniana* | FAC |
| Bitter-Nut Hickory | *Carya cordiformis* | FACU |
| Pignut Hickory | *Carya glabra* | FACU |
| Shag-Bark Hickory | *Carya ovata* | FACU |
| Mockernut Hickory | *Carya tomentosa* | Undefined |
| Hackberry | *Celtis laevigata* | FACW |
| Flowering Dogwood | *Cornus florida* | FACU |
| American Beech | *Fagus grandifolia* | FACU |
| Green Ash | *Fraxinus pennsylvanica* | FACW |
| American Holly | *Ilex opaca* | FACU |
| Eastern Red-Cedar | *Juniperus virginiana* | FACU |
| Sweet-Gum | *Liquidambar styraciflua* | FAC |
| Tulip Poplar | *Liriodendron tulipifera* | FACU |
| American Sycamore | *Platanus occidentalis* | FACW |
| Northern White Oak | *Quercus alba* | FACU |
| Southern Red Oak | *Quercus falcata* | FACU |
| Laurel Oak | *Quercus laurifolia* | FACW |
| Blackjack Oak | *Quercus marilandica* | Undefined |
| Swamp Chestnut Oak | *Quercus michauxii* | FACW |
| Chestnut Oak | *Quercus montana* | UPL |
| Water Oak | *Quercus nigra* | FAC |
| Cherrybark Oak | *Quercus pagoda* | FACW |
| Pin Oak | *Quercus palustris* | FACW |
| Willow Oak | *Quercus phellos* | FAC |
| Northern Red Oak | *Quercus rubra* | FACU |
| Post Oak | *Quercus stellata* | UPL |
| Black Willow | *Salix nigra* | OBL |
| American Elm | *Ulmus americana* | FACW |

### 4.6.4 Access Roads and Pedestrian Bridge

Access to and within the Mitigation Site is necessary for purposes of construction, long-term management and monitoring. The existing road network within the Landsford Tract will be utilized to the maximum extent practicable to minimize land disturbance while facilitating site access. However, new roads are required to link the existing road network together. Specifically, a new gated access road from Landsford Road will be constructed, as well as a new road and stone ford crossing over the restored UT 2 (Section 1) stream channel. Refer to Figure 4 for existing roads to be maintained and/or improved and proposed new roads to be constructed. Note, the exact locations and configurations of the proposed new roads and stone ford crossing will be determined at a later date and coordinated with SCDNR prior to construction. Site contours and slopes will be considered when determining final road placement and Best Management Practices will be followed. Road placement, construction methods and sediment and erosion control measures will be fully documented

in the construction documents. Once constructed, the access roads will be maintained and improved as needed, and monitored. Existing roads that provide access within the Landsford Tract will remain, and will be maintained, improved, and monitored as well. A trail and pedestrian bridge crossing over UT 1 (Section 1) may be added and maintained as necessary to facilitate site access as well. The exact location and configuration of the trail and pedestrian bridge will be determined at a later date.

### 4.6.5 Invasive Species Management

As stated in Section 4.4.5, although not prevalent, minor localized occurrences of invasive species are located within the Landsford Tract and Mitigation Site. These species include, but may not be limited to, Chinese privet (*Ligustrum sinense*), Japanese silt grass (*Microstegium vimineum*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*). While present, these species are currently not compromising natural forest composition or outcompeting native vegetation. However, invasive species do have the potential to threaten the diversity and abundance of native species populations through competition for resources, predation, parasitism, interbreeding with native populations, transmission of diseases and introduction of physical or chemical alterations to the invaded habitat. As a result, invasive species (specifically Chinese privet) will be monitored and managed during the monitoring period in a manner that will support the continued functions and values for which the Mitigation Site was established. Chinese privet management may include prescribed herbicide applications, following label recommendations, and/or stem treatments and/or mechanical cutting or hand labor clearing, as needed. The location and approximate coverage of invasive species will be generally documented during walk-through surveys. Additional actions to control invasive species will be evaluated and prioritized in coordination with the regulatory agencies if needed.

## 4.7 Maintenance Plan

The following maintenance will be required to ensure the continued viability of the Mitigation Site. Until success has been documented, the regulatory agencies will be notified if any issues develop on the Mitigation Site that requires maintenance. The extent of the issue, measures taken to correct the issue, and whether the issue has been resolved will be documented in an annual monitoring report.

*Access Road and Gate*

Access to the Mitigation Site is necessary for purposes of long-term management and monitoring. Therefore, as outlined in Section 4.6.4, existing roads within the Landsford Tract will be maintained and/or improved as needed and new roads will be constructed within the Landsford Tract, to include an access gate at Landsford Road. Once constructed, the new access roads will be maintained and improved as needed, and monitored. The condition of the roads and access gate will be documented in annual monitoring reports. Recommendations will be provided for correcting all identified deficiencies including, but not limited to, repairing or replacing the gate and/or repairing roadway water control features such as broad-based dips, turnouts and turn ups and/or rolling dips. Vehicular travel (including off-road motorcycles and all-terrain vehicles) within the Landsford Tract will be strictly prohibited except along approved access roads.

*Signage*

Signs stating that the Mitigation Site is a protected natural area will be posted and maintained at regular intervals (approximately every 200 feet) on trees along the conservation easement boundary to closely

coincide with established PVC witness posts and rebar. Posted signs will be inspected during walk-through assessments. Damaged signs will be repaired or replaced on an as-needed basis. Further, trees along the conservation easement boundary and located between posted signs will be marked with paint at regular intervals.

*Hardwood Planting Zones*

Volunteer species will be documented in planting zones. Maintenance may include removing or thinning unacceptable volunteers with the use of herbicide treatments and/or small mechanical equipment. Refer to Section 4.6.3, Appendix O, Table 11 and Table 12 for proposed planting zones, planting methods and palettes, and a list of acceptable volunteer species.

*Supplemental Plantings*

Potential maintenance measures may include supplemental plantings within planting zones. If a planting area does not meet vegetative performance standards, the reason for plant mortality will be identified and supplemental plantings will be added based on the specified density and palette.

*Wildlife Management*

On-going site maintenance may include wildlife management (specifically for beavers and hogs). If any beaver, hog or other animal or activity detrimental to mitigation areas is found, an adaptive management plan will be provided that ensures management/removal throughout the monitoring period. All adaptive management activities will be documented and discussed in each monitoring report.

*Events Beyond Owner's Control (Force Majeure)*

The Owner will notify the USACE should changes to the Mitigation Site result from causes or circumstances determined to have been beyond the Owner's control, or from any prudent action taken in good faith by the Owner under emergency conditions to prevent, abate or mitigation significant injury to life, damage to property or harm to the Mitigation Site resulting from such causes.

## 4.8 Performance Standards

Ecologically-based performance standards are used to determine whether the Mitigation Site is achieving its objectives. In general, performance standards are developed with a goal of maintaining or improving post-construction site conditions over baseline conditions, thereby restoring or enhancing an ecosystem. The performance standards identified in Tables 13, 14 and 15 have been developed for each stream restoration reach, wetland enhancement unit and buffer enhancement area using the degree of existing impairment.

When measuring performance of vegetation, desirable volunteer species will be factored into target density. Changes in the vegetative community, such as a transition to more or less water tolerant species due to increased or decreased hydrology, will not be considered an indication of vegetative failure.

*Stream Performance Standards*

As stated in Section 4.6.1, an on-site reach is being used as a reference for stream design metrics and performance standards.

The performance standards identified in Table 13 for the restoration reaches reflect ratios typically associated with stable, functioning Rosgen "B" or "C" channels, depending on the chosen design and appropriate valley type. The Rosgen "B" stream types exist on steep to moderately steep terrain and are commonly found in the transitional zones between steeply sloping uplands and moderately to gently sloping valley bottoms. The Rosgen "C" types exist primarily on moderately steep to gently sloped terrain, with the prominent morphological units being the riffle/pool or alternating bar sequence. Streams UT 2 and UT 3 exist in valleys with the potential to naturally form B and C type streams. Valley slopes on UT 2 and UT 3 are such that they transition from the steeper B type in the headwaters to the C type in the lower reaches. Transitional reaches between B and C type streams are designed as Rosgen "Bc" and will exhibit characteristics of both, including point bars and steps leading into pools. UT 4 (Section 1) has slope at the upper extents of the B classification and will display characteristics of Rosgen "A" type streams.

Stream performance metrics were developed from regional reference streams, but were also developed from characteristics generally found in all regional relationships. Regardless of geomorphic province, increasing stream slope tends to cause a decrease in sinuosity, pool-to-pool spacing, and riffle length ratio. Stable functioning streams will have low bank height ratios (< 1.2) and relatively wide floodplains, and an entrenchment ratio greater than 1.4 or 2.2 on B and C streams, respectively. Regional reference relationships from Harman and Starr (2011) form the basis of certain stream performance standards, while others are selected based on the design to identify instabilities.

The stream performance standards are categorized by pattern, profile, and dimension such that changes outside the range of performance standards will indicate stream instabilities. While in reality a change in any of the variables will consequently be reflected the other variables, each category is selected to identify specific symptoms characteristic of channel instability. Pattern variables represent the planform of the stream as seen from above. Changes outside of the specified range indicate lateral instabilities as may occur due to channel avulsion or down valley channel migration. Profile variables are designated to indicate vertical instabilities as would occur during head cut propagation upstream or excessive in-channel sediment deposition. Dimension variables characterize the channel cross-section and would be expected to remain relatively constant under stable conditions. Variables are unique to each stream type, consequently the stream performance standards are specified by stream type. The stream performance standards in Table 13 represent the expected range of variable for each unique stream type.

**Table 13. Stream Performance Standards**

| **STREAM MITIGATION** [Restoration Reaches] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Physical Characteristics (Geomorphology) | During 5 years of monitoring and through 2 bankfull events, data demonstrate restored streams are stable: restoration reaches will meet the following performance standards for floodplain connectivity, bank migration/lateral stability and bedform diversity: | | | | | | | |
| | Category | Dimensionless Ratio | B/Ba | | Bc | | C | |
| | | | Min | Max | Min | Max | Min | Max |
| | Pattern | Sinuosity, k = SL/VL (ft./ft.) | 1.05 | 1.2 | 1.1 | 1.25 | 1.1 | 1.4 |
| | | Radius of curvature ratio [Rc/Wbkf] | 2.2 | 5 | 2.1 | 4 | 2 | 4 |
| | | Meander width ratio [Wblt/Wbkf] | 1.1 | 3.2 | 1.3 | 3.5 | 2 | 4 |
| | Profile | Riffle length ratio, [Lrif/Wbkf] | 0.5 | 3 | 1 | 3.5 | 1.2 | 4 |
| | | Pool length ratio [Lp/Wbkf] | 0.5 | 3.2 | 0.8 | 3.5 | 2 | 4 |
| | | Pool-to-pool spacing ratio, [p-p/Wbkf] | 1 | 4 | 1 | 5 | 4 | 7 |
| | Dimension | Entrenchment ratio, ER [Wfpa/Wbkf] | > 1.4 | | > 1.4 | | > 2.2 | |
| | | Width-to-depth ratio, [Wbkf/dbkf] | 12 | 17 | 12 | 16 | 12 | 16 |
| | | Max riffle depth ratio, [dmbkf/dbkf] | 1 | 2 | 1 | 1.7 | 1 | 1.6 |
| | | Low bank height ratio, [LBH/dmbkf] | 0.9 | 1.1 | 0.9 | 1.1 | 0.9 | 1.1 |
| | | Max pool depth ratio, [dmbkfp/dbkf] | 2 | 4 | 2 | 3.8 | 2 | 3 |
| | | Pool width ratio, [Wbkfp/Wbkf] | 1 | 1.5 | 1 | 1.6 | 1 | 1.7 |
| | | Pfankuch Channel Stability Rating | Good | | Good | | Good | |
| | • Stream parameters will be comparable to the regional curve and/or the reference reach.<br>• The channel exhibits no headcuts or bank failures.<br>• All instream structures are intact and functioning as documented by annual representative photographs.<br>• Documentation of flow and ordinary high-water mark and representative photographs taken quarterly.<br>• At end of 5-year monitoring period, reach exhibits an improved score over baseline on the High Gradient Stream Assessment Data Sheet.<br>• Qualitative evaluation of woody debris performed annually. | | | | | | | |
| Biological Characteristics | For interim and final performance standards (following 5 years of monitoring and through 2 bankfull events): maintenance or improvement of macroinvertebrate communities over baseline | | | | | | | |
| Chemical Characteristics | For interim and final performance standards (following 5 years of monitoring and through 2 bankfull events): maintenance or improvement of water quality over baseline | | | | | | | |

*Wetland Performance Standards*

Two groundwater wells (HOBO Onset loggers) were installed within the on-site wetland enhancement area to monitor surface and sub-surface water levels (refer to Figure 14). One groundwater well is installed within the northernmost extent of the wetland enhancement area, far away from the influence of the ditch; this well will be utilized as a reference for performance standards. The other groundwater well is installed within the wetland enhancement area adjacent to the upper extent of the ditch and within the zone of influence of the ditch.

**Table 14. Wetland Performance Standards**

| WETLAND MITIGATION | Hydrology | | |
|---|---|---|---|
| | Degree, duration and periodicity comparable (within 25%) to reference | Over a 5-year monitoring period, area shows a 15% hydrologic improvement in degree, duration and/or frequency as compared to baseline data | Soil saturation in the root zone for 14 consecutive days during the growing season |
| Enhancement (Hydrologic) | ✓ | ✓ | ✓ |

The hydrologic wetland enhancement area currently has hydrophytic vegetation (i.e. native hardwood species), wetland hydrology, and hydric soils. However, ditching is affecting the hydrology of the area. The wetland will be enhanced by plugging and/or filling the ditch. As indicated in Table 14, the hydrologic wetland enhancement unit will be monitored pre- and post-construction and mitigation activities will be considered successful if the degree, duration, and periodicity of wetland hydrology is comparable to the reference wetland; and/or if, over the standard 5-year monitoring period, the wetland area shows a 15% hydrologic improvement in degree, duration and/or frequency as compared to baseline data; and/or if soil saturation is documented within the root zone for 14 consecutive days during the growing season.

*Riparian and Upland Buffer Performance Standards*

Proposed riparian and upland buffer enhancement performance standards for those areas identified on Figure 4 are outlined in Table 15.

**Table 15. Riparian and Upland Buffer Performance Standards**

| RIPARIAN AND UPLAND BUFFER ENHANCEMENT | Vegetation | | | | |
|---|---|---|---|---|---|
| | Monitoring Years 1 – 4 | By the 5th Monitoring Year | | | |
| | Consistent increase in height, lateral growth & root collar diameter | Density of 260 trees/acre | < 1% non-native or invasive species | < 25% of a single species | Trees must average 5'-7' in height |
| Enhancement (Planting) | ✓ | ✓ | ✓ | ✓ | ✓ |

When measuring performance of vegetation, desirable volunteer species will be factored into target density. Refer to Table 12 for a list of acceptable volunteer species.

## 4.9 Monitoring Requirements

### 4.9.1 Monitoring Reports

An annual monitoring report will be submitted prior to March 1st of each year for a period of five years. If success has not been achieved after five years, reporting will be continued at an interval to be determined by the regulatory agencies until all performance standards have been met. The report will include a narrative

that provides an overview of site conditions and function, maps and photographs to illustrate site conditions, collected data and functional assessments used to provide quantitative and qualitative measures of functions provided by the mitigation project. Photographs will be included with dates and clear labels with the direction from which the photo was taken. Maps will show the location of the Mitigation Site, mitigation units, and the locations of photographic reference points and quadrats. The following components will be included in each monitoring report submitted after construction:

1. Name of party responsible for conducting the monitoring and the date(s) of the inspection.
2. A brief description of the approved mitigation plan and the dates when specific mitigation activities were commenced and/or completed.
3. A paragraph describing whether the Mitigation Site is developing as expected. This summary will be supported by a detailed description of each mitigation unit and an explanation of whether or not each mitigation unit is developing as expected and meeting the necessary performance standards.
4. If one or more mitigation units are not meeting the necessary performance standards, a description of the existing condition will be submitted, the reason(s) that the mitigation unit is not meeting performance standards will be identified, and a proposal to conduct remedial actions and bring the management unit into compliance with the approved mitigation plan will be submitted.
5. Dates of any corrective or maintenance activities conducted since the previous report submission.

The regulatory agencies will review the monitoring report and conduct a site inspection to determine whether or not the mitigation site is meeting the performance standards.

### 4.9.2 Monitoring Parameters

*Baseline Data Collection Plan*

The Baseline Data Collection Plan (Figure 14) identifies the chemical, physical and biological data that have been collected to establish the existing degree of impairment on the Mitigation Site. Detailed baseline data (collected per the Baseline Data Collection Plan) has been used to describe the ecological characteristics of the Mitigation Site and the reference reach or site, as well as to develop the performance criteria. Table 16 summarizes the baseline data that have been collected on the Mitigation Site. Refer to Section 4.4 for additional discussion about baseline conditions.

**Table 16. Baseline Data Collection Plan**

| | Resource Type | Treatment | Gauge or Well | Cross-Section(s) and/or Profile(s) | Vegetative Quadrat | Water Quality | Biological Monitoring | Woody Debris |
|---|---|---|---|---|---|---|---|---|
| **Reach** | **Stream Mitigation** | | | | | | | |
| UT 1 (Section 1) | 1st and 2nd Order Tributary | Protection | | X | | | | |
| UT 1 (Section 2) | 1st and 2nd Order Tributary | Protection | | | | | | |
| UT 2 (Section 1) | 1st Order Tributary | Restoration | X | X | X | X | X | X |
| UT 2 (Section 2) | 1st Order Tributary | Enhancement | | X | | | | |
| UT 2 (Section 3) | 1st Order Tributary | Restoration | | X | | X | X | X |
| UT 2 (Section 4) | 1st Order Tributary | Preservation | | | | | | |
| UT 3 (Section 1) | 2nd Order Tributary | Restoration | X | X | X | X | X | X |
| UT 3 (Section 2) | 1st Order Tributary | Preservation | | X | | | | |
| UT 4 (Section 1) | 1st Order Tributary | Restoration | | X | | | | |
| UT 4 (Section 2) | 1st Order Tributary | Preservation | | X | | | | |
| UT 5 | 1st Order Tributary | Preservation | | | | | | |
| **Wetland Unit** | **Wetland Mitigation** | | | | | | | |
| Unit 5 | Palustrine Forested | Enhancement | X | | | | | |
| **Riparian and Upland Buffer** | **Buffer Enhancement** | | | | | | | |
| Enhancement (Planting) | Mixed Forested, Pine Dominated | Enhancement | | | X | | | |
| Preservation | Diverse Mixed Upland Forest | Preservation | | | X | | | |

Water level (i.e. stream) gauges (HOBO Onset loggers) and groundwater wells (HOBO Onset logger) have been installed to monitor surface and sub-surface water levels associated with on-site streams and the on-site wetland, respectively. Water profile measurements will be utilized to develop hydrographs. A rain gauge has been installed on-site as well; rain data will be correlated to stream and wetland data.

Cross-sections and longitudinal profiles have been surveyed to document existing cross-sectional area and other geomorphic metrics. Cross-sections and a longitudinal profile were surveyed within an on-site preservation reach for use as a reference for restoration reaches. Refer to Appendix G for the cross-sections and to Figure 13 for the cross-section locations. A detailed topographic survey of the floodplain associated with the enhancement and restoration reaches was performed. Slope breaks within close proximity to stream channels were identified, as well as channel inverts, channel banks and toe of slope, and water depths where present. This information assisted with hydrologic and hydraulic modeling of the restoration project. Collected

survey data has been tied to appropriate benchmark locations.

Vegetative monitoring quadrats (10-meter x 10-meter) have been established within the riparian and upland buffer vegetative enhancement and preservation areas. Within each quadrat, baseline vegetative monitoring documents species composition, Diameter at Breast Height. Photographs have been taken at two corners of each quadrat, facing towards the interior of the quadrat. Refer to Appendix Q for vegetation data and photographs.

Hydric soil indicators have been documented during installation of the groundwater wells in accordance with USACE Technical Report ERDC TN-WRAP-05-2 and the most recent version of the Field Indicators of Hydric Soils in the United States field guide (USDA, NRCS. 2010). The soil borings are approximately 48+ inches deep to document the soil conditions. Documentation at the soil boring includes soil color, redoximorphic features, and texture.

In-situ water quality measurements for pH, conductivity, dissolved oxygen and temperature were taken with a YSI meter. Turbidity and fecal coliform were sampled as well. Samples will be collected two times per year during the pre-construction monitoring period.

Benthic macroinvertebrates were collected and will be sampled annually. Macroinvertebrate sampling was, and will continue to be, based on the South Carolina Department of Health and Environmental Control's sampling protocol. Macroinvertebrates were, and will continue to be, identified to genus, where practicable. Monitoring reports will include biotic indices for each station and a species list.

### 4.9.3 Monitoring Plan

To evaluate the long-term success of the Mitigation Site, annual monitoring and reporting will be performed for five years. It is anticipated that all performance standards will be met after five years; however, if specific standards are not met after five years, reporting will be continued at an interval to be determined until all performance standards have been met.

Post-construction monitoring will document the same parameters as the baseline data collection plan outlined above in Section 4.9.2 and in Section 4.4. Preservation areas will be monitored through annual inspections. Restoration and/or enhancement areas will be visually inspected bi-annually during the first year after construction, at a minimum. Inspections will occur annually at a minimum for the remainder of the monitoring period.

An as-built survey will be conducted on the enhancement reaches (as needed) and on the restoration reaches. The as-built survey will document locations in which stream elevations have significantly changed. Cross-section data will be collected annually on the stream restoration reaches to document changes in the channels after construction. Longitudinal profiles within restoration reaches will be surveyed post-construction as needed to document success criteria. A minimum of one representative longitudinal profile per restoration reach will be surveyed for comparison to the as-built survey. Visual inspections of all structures and the ditch plug(s) will be conducted twice during the first year of monitoring and annually thereafter. Photographs will be used to document significant or adverse changes.

All stream gauge and groundwater well monitoring locations will remain in the same locations as baseline monitoring to the extent practicable. The loggers will be used to track frequency and duration of flow events

and surface and sub-surface water levels. Post-construction water quality data will be collected at the same locations as baseline monitoring at a frequency of four times per year (one sample per season). Post-construction benthic macroinvertebrate sampling will be performed annually using the same locations and methods as outlined in the Baseline Data Collection Plan (Section 4.9.2).

Vegetation quadrats will remain in the same locations as pre-construction. All stems or trees planted within the vegetation quadrats, along with preferred volunteer species, will be tagged, numbered, and species noted. Vegetative monitoring will occur annually between July 1st and leaf drop/end of the growing season. Data collected will include count, height, root collar diameter and lateral growth. The tag number and species will be noted. Presence and location of invasive species will be reported.

## 4.10 Long-Term Management Plan

The primary goal of the Mitigation Site is to create a self-sustaining natural aquatic system that achieves the intended level of aquatic ecosystem functionality with minimal human intervention, including long-term maintenance. Natural changes to the vegetative community that occur after all Mitigation Site performance standards have been met, other than changes caused by non-native/invasive weeds, are not expected to require remediation. The Long-Term Management Plan (hereinafter "Management Plan") establishes objectives, priorities and tasks to manage, monitor, maintain and report on the status of streams and wetlands and their associated buffers after all performance standards and mitigation requirements have been met.

### 4.10.1 Transfer of Ownership

The 494.83-acre parcel on which the 109.48-acre Mitigation Site is contained (refer to Figure 4) is owned by Owner. All property rights, including water, timber, mineral and hunting rights, are held by Owner. After approval of the PRM Plan, Owner will subdivide the 494.83-acre parcel; said subdivision will include the 109.48-acre Mitigation Site. Owner will retain ownership of the subdivided land (including the Mitigation Site) during the implementation phase of the mitigation plan. After all performance standards and mitigation requirements have been met, Owner will then donate the subdivided land (including the Mitigation Site) to SCDNR for incorporation into the WMA program. SCDNR, who has reviewed and agreed to the contents of the PRM Plan, will then become the Long-Term Steward (hereinafter "Steward") of the Mitigation Site. The remaining acreage is planned for a conservation buyer; the SCDNR has expressed interest in pursuing.

SCDNR owned and managed WMAs are protected areas that play a critical role in conserving fish, wildlife and other natural resources, and as such serve a different purpose than state park lands. Appropriate and compatible uses of SCDNR managed lands are hunting, fishing, wildlife or other natural resource observation, wildlife or other natural resource photography, environmental education, and environmental interpretation.

### 4.10.2 Long-Term Steward Responsibilities

The Steward is solely responsible for managing the Mitigation Site in perpetuity after all performance standards and mitigation requirements have been met in accordance with the terms of the site protection instrument. The Steward shall preserve the Mitigation Site's habitat and conservation values in perpetuity in accordance with the terms of the site protection instrument. The Steward will be responsible, at its sole cost and expense, for all long-term management tasks and funding required to maintain the aquatic resources on the Mitigation Site in perpetuity.

SCDNR is the principal advocate for the stewardship of the natural resources of South Carolina. Further, SCDNR holds ownership in tracts of land throughout the State. Each land acquisition has been based upon some intended purpose of the occurrence of some significant plant, animal, ecosystem, physical feature and/or cultural resource or to provide recreational hunting and fishing opportunities for the public. Resource protection and management are the primary purpose for these landholdings. As the human population of South Carolina continues to grow at a rapid rate, outdoor space will diminish and large outdoor areas suitable for recreation are not likely to be well distributed or readily available. Publicly available land for traditional activities like hunting, fishing, bird watching, and others are important. Public agencies that own land must exercise care in providing recreational activities that are compatible with the resources for which the lands are valued; therefore, SCDNR has a policy established that provides an evaluation process by which all recreational activities and uses of SCDNR lands are determined first to be "appropriate" and second the be "compatible."

### 4.10.3 Identification of Long-Term Management Activities

As the Steward, SCDNR will ensure that signs demarcating the Mitigation Site remain intact. Further, SCDNR will manage the Mitigation Site for trespass and litter, monitor boundary encroachments, maintain access roads, maintain gates, maintain signage and manage the Mitigation Site in accordance with a typical SCDNR-WMA plan.

Typical SCDNR management involves the protection of natural resources in addition to management. Harvesting and management of timber within the Mitigation Site will be limited to the extent necessary to protect the natural environment in areas where the forest is damaged by natural forces such as fire, flood, storm, insects or infectious organisms. Such timber harvesting and management shall be carried out in accordance with a Forest Management Plan and Best Management Practices approved by the South Carolina Forestry Commission or successor agency.

The use of prescribed fire may also be implemented within the Mitigation Site to restore and maintain fire-dependent ecosystems, promoting both species and habitat diversity. Prescribed fire, in addition to other appropriate control measures, such as the use of herbicides or mechanical means (i.e. mowing or Gyro trac), may be implemented within the Mitigation Site to control exotic and invasive species. Other management activities within the Mitigation Site may include research studies or the maintenance of roads for public and management access. Long-term management may also include additional restoration and enhancement activities on waters on the site if future site and environmental conditions need it.

### 4.10.4 Funding Mechanism

Any management activities following completion of the monitoring period and achievement of all performance standards and mitigation requirements as specified in this PRM Plan will be funded through monetary appropriations by SCDNR.

### 4.10.5 Justification for Level of Funding

The level of funding will be determined by the Steward on an annual basis. The amount of funding will be sufficient to manage the Mitigation Site in a manner that is consistent with the Management Plan.

### 4.11 Adaptive Management

In the event one or more of the mitigation activities fails to achieve the approved performance standards, the USACE will be notified immediately. Adaptive management activities may consist of corrective actions and additional monitoring of the Mitigation Site, implementation of an alternate PRM Plan, or the purchase of mitigation credits from an approved mitigation bank or in-lieu fee program, if available. Failure to actively pursue and implement the approved mitigation plan or to develop and implement an adaptive management plan may be grounds for modification, suspension or revocation of the associated Department of the Army authorization.

### 4.12 Financial Assurances

Financial assurances will be provided in the form of a construction phase performance bond (the "Construction Bond") and a separate monitoring and maintenance phase performance bond (the "Monitoring Bond") for the mitigation activities. The initial Construction Bond amount will be sufficient to cover all construction, maintenance and monitoring activities. Following approval of the as-built report, the initial Construction Bond will be retired and replaced with the Monitoring Bond to cover all maintenance and monitoring costs. Bonding amounts and reduction schedules are specified in Exhibits A and B, respectively. The bonds will assure performance of construction and monitoring work to preserve, enhance and/or restore the aquatic resources.

The land/easement acquisition, legal fees, topographic and boundary surveys and design for the Mitigation Site have been completed. Therefore, the penal sum amount of the Construction Bond will be sufficient to assure the completion of all mitigation construction work, including site preparation, herbicide treatment, planting and maintenance. The estimated cost to construct the mitigation project is $880,000. The total bonded amount for the Construction Bond must cover all construction, maintenance and monitoring activities; therefore, the total bonded amount will be $1,148,800. The Construction Bond is to be retired with the approval of the USACE following submittal of the as-built report for the mitigation project. The Construction Bond will immediately be replaced with the Monitoring Bond.

The penal sum of the Monitoring Bond must be sufficient to assure the completion of all monitoring and maintenance that may be required through the completion of the monitoring period. Based on the current estimated cost to monitor and maintain the mitigation project, the penal sum amount of the Monitoring Bond is $268,000. This amount is based on our standard anticipated maintenance and adaptive management costs equal to 10% of the construction cost ($88,000) plus the cost to prepare yearly monitoring reports ($180,000). The amount of the Monitoring Bond will be reduced following each successful year of monitoring according to Exhibit B. All requested bond reductions must be approved in writing by the USACE.

The performance bonds will be underwritten by a surety company licensed to do business in South Carolina and rated no less than an "A-" by A.M. Best. Performance bonds are to be approved by the USACE District Engineer and in compliance with current USACE policy, guidance documents and the requirements of the PRM Plan.

Any financial assurance must ensure that the USACE District Engineer receives notification at least 120 days in advance of any termination or revocation. The CE for the Mitigation Sites designates the USACE as a party enabled to access the site, and also requires all project-specific reports and records to be provided to the USACE. Therefore, the USACE is enabled to determine the status of the mitigation project and to determine

the occurrence of any default regarding the mitigation. Prior to a determination of default by the USACE, the Applicant will be given a full opportunity to remedy the default to the satisfaction of the USACE. The Applicant must keep the USACE District Engineer apprised of any issues that may affect the financial assurances for the mitigation project.

**Exhibit A: Bond Amount Calculation**

| Construction Phase | |
|---|---|
| **Projected Construction Costs** | **Total Bonded Amount** |
| $880,000 | $1,148,800 |
| **Monitoring Phase** | |
| **Projected Monitoring and Maintenance Costs** | **Total Bonded Amount** |
| $268,000 | $268,000 |

**Exhibit B: Reductions to Bond Amount**

| | Event | Reduction |
|---|---|---|
| **Construction Phase** | USACE Approval of As-Built Report | 100% |
| **Monitoring Phase** | USACE Approval of Year 1 Report | 20% |
| | USACE Approval of Year 2 Report | 20% |
| | USACE Approval of Year 3 Report | 20% |
| | USACE Approval of Year 4 Report | 20% |
| | USACE Approval of Year 5 Report | 20% |

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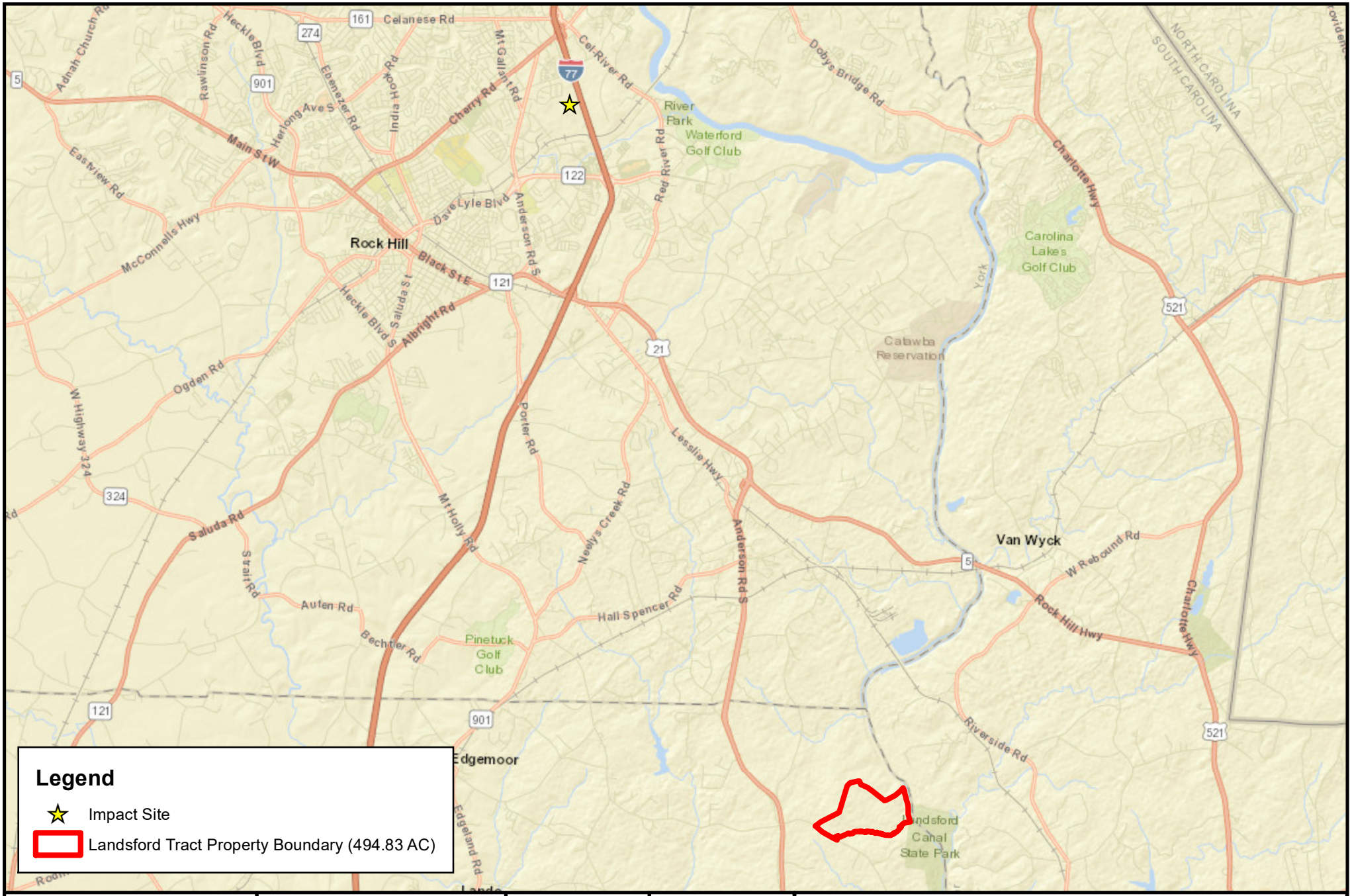
# FIGURES




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 2 miles

0 0.5 1 2 Miles

**Figure 1: Vicinity Map**

Project Inspector
Sources: ESRI
Date: January 2020

Palustrine Group

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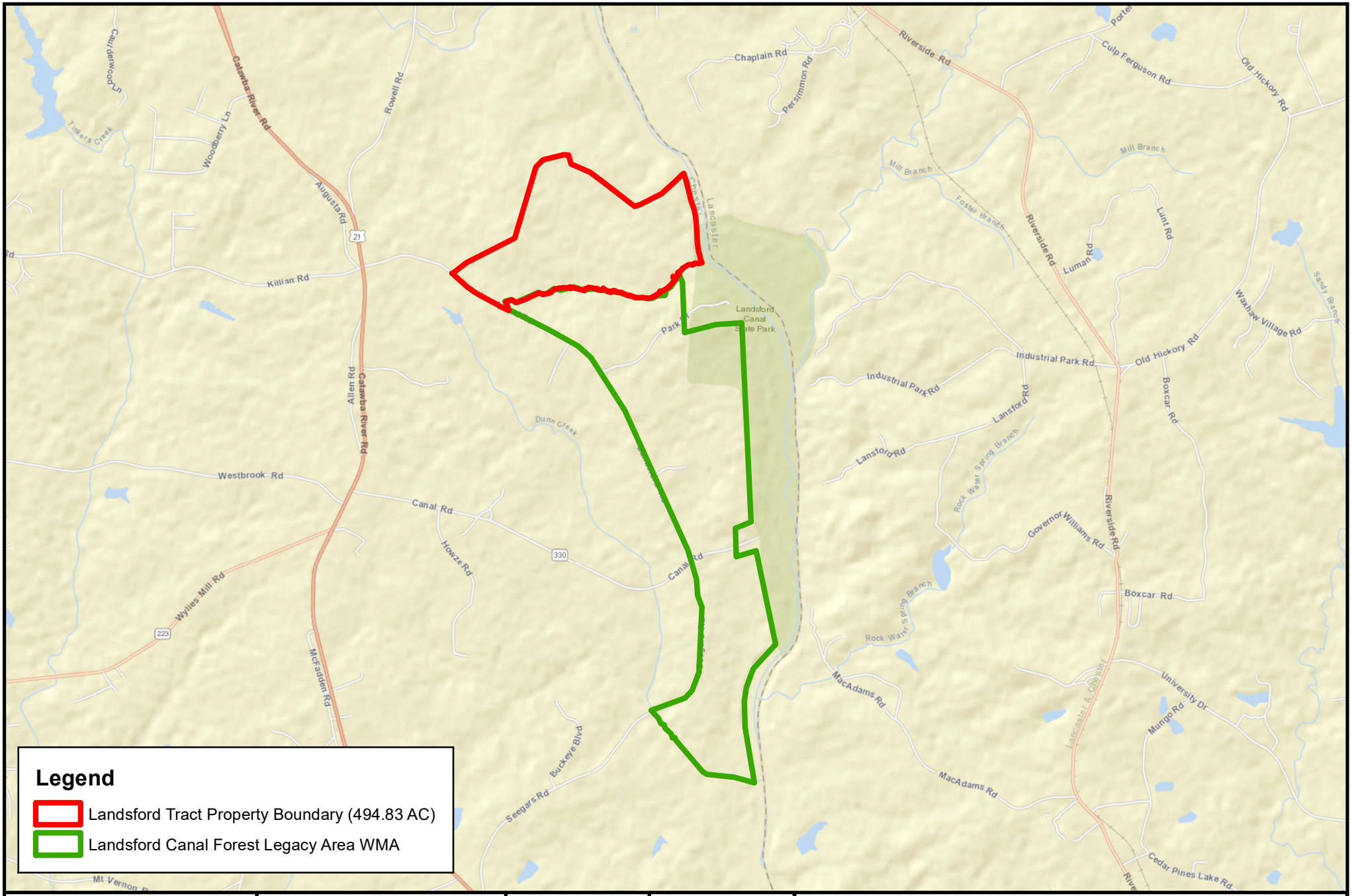
Notes:




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 4,000 feet

0 1,000 2,000 4,000 Feet

**Figure 2: Location Map**

Project Inspector
Sources: ESRI, SCDNR
Date: January 2020

Palustrine Group

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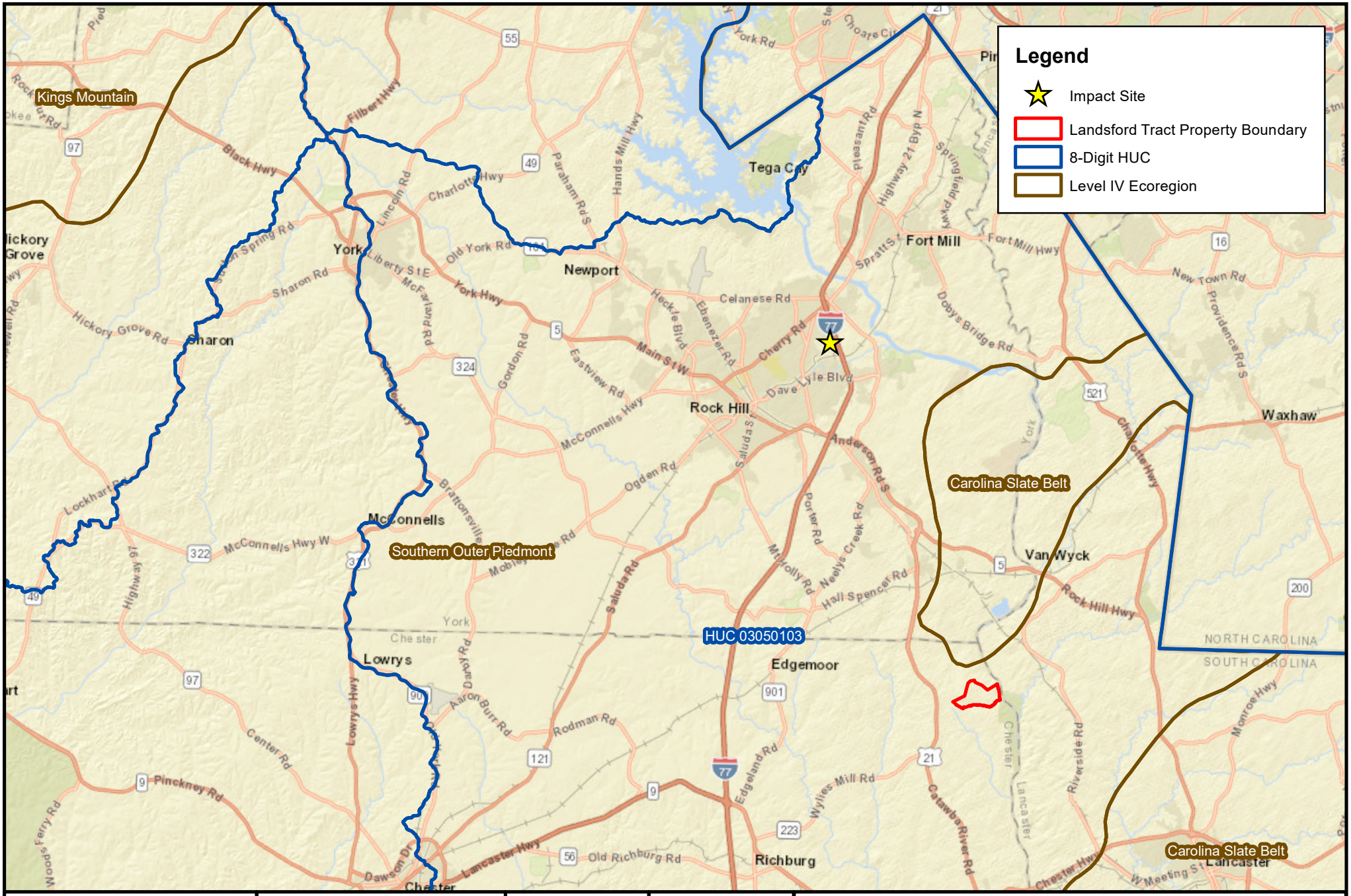



**Landsford Tract**
Chester County
South Carolina

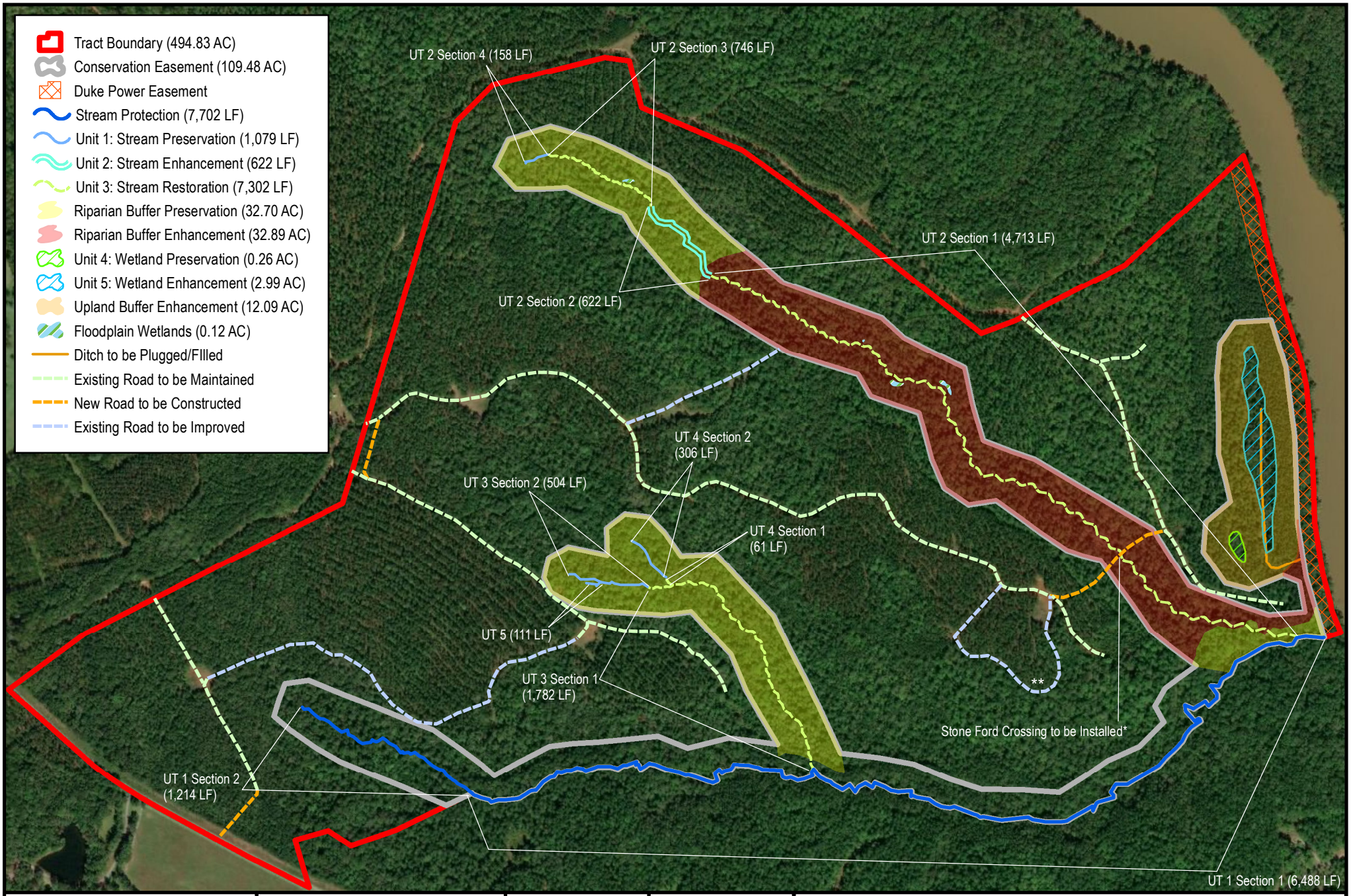
1 inch = 4 miles

0 1 2 4 Miles

**Figure 3: 8-Digit HUC/ Level IV Ecoregion Map**

Project Inspector
Sources: ESRI, SCDNR
Date: January 2020

Notes:




# Landsford Tract

**Chester County**
**South Carolina**

1 inch = 750 feet

0 187.5 375 750 Feet

**Figure 4: Mitigation Unit Map**

Project Inspector
Sources: ESRI
Date: April 2020

Palustrine Group

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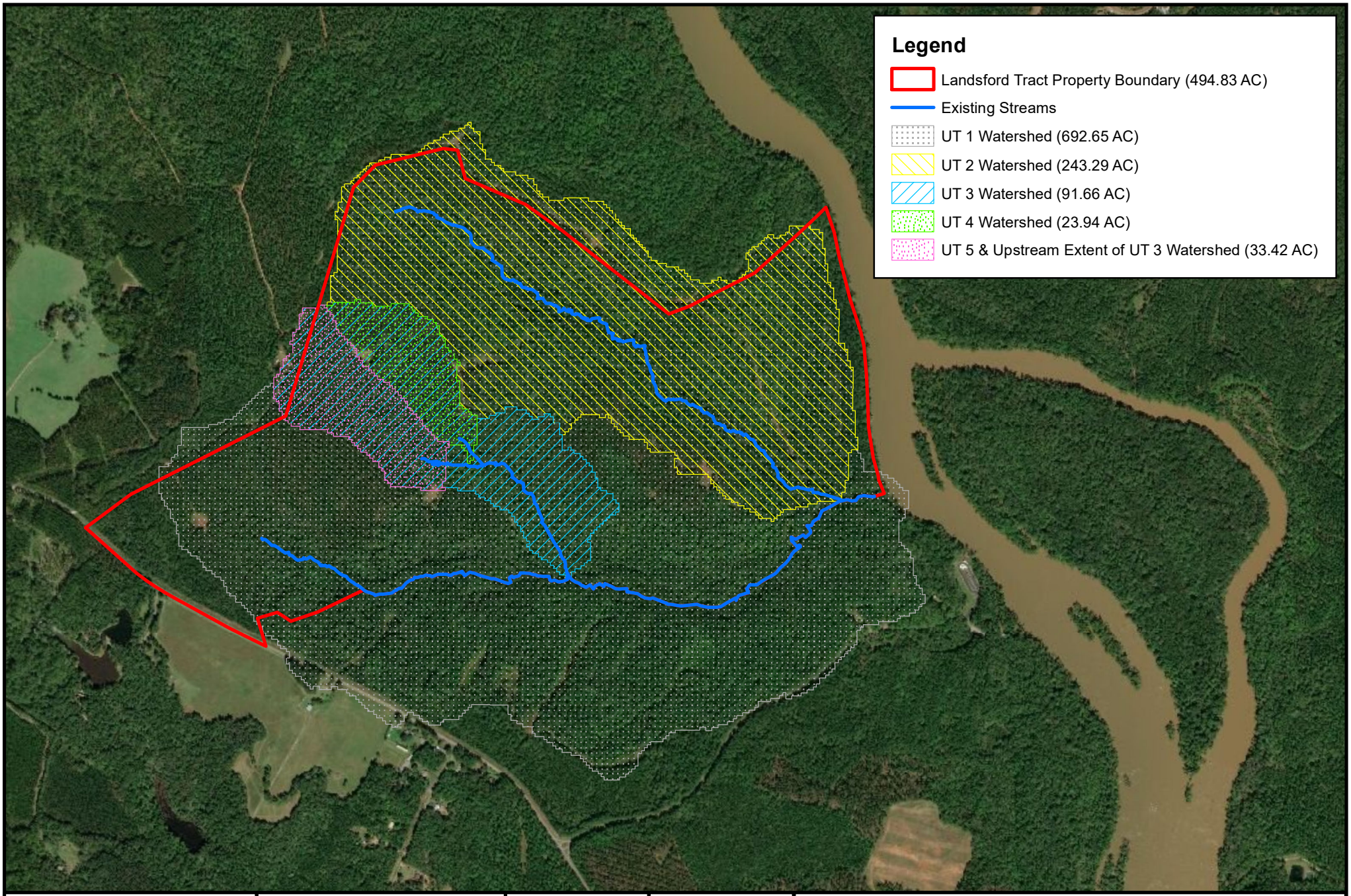
Notes:

1) Trail and pedestrian bridge to be installed over UT 1 (Section 1). Exact location and configuration to be determined at a later date.

*Exact location and configuration of access road to be determined at a later date and coordinated with SCDNR prior to construction.

**Road to be improved as needed during construction to facilitate site access.




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,250 feet

0 312.5 625 1,250 Feet

**Figure 5: Drainage Area Map**

Project Inspector
Sources: ESRI, USGS
Date: January 2020

Palustrine Group

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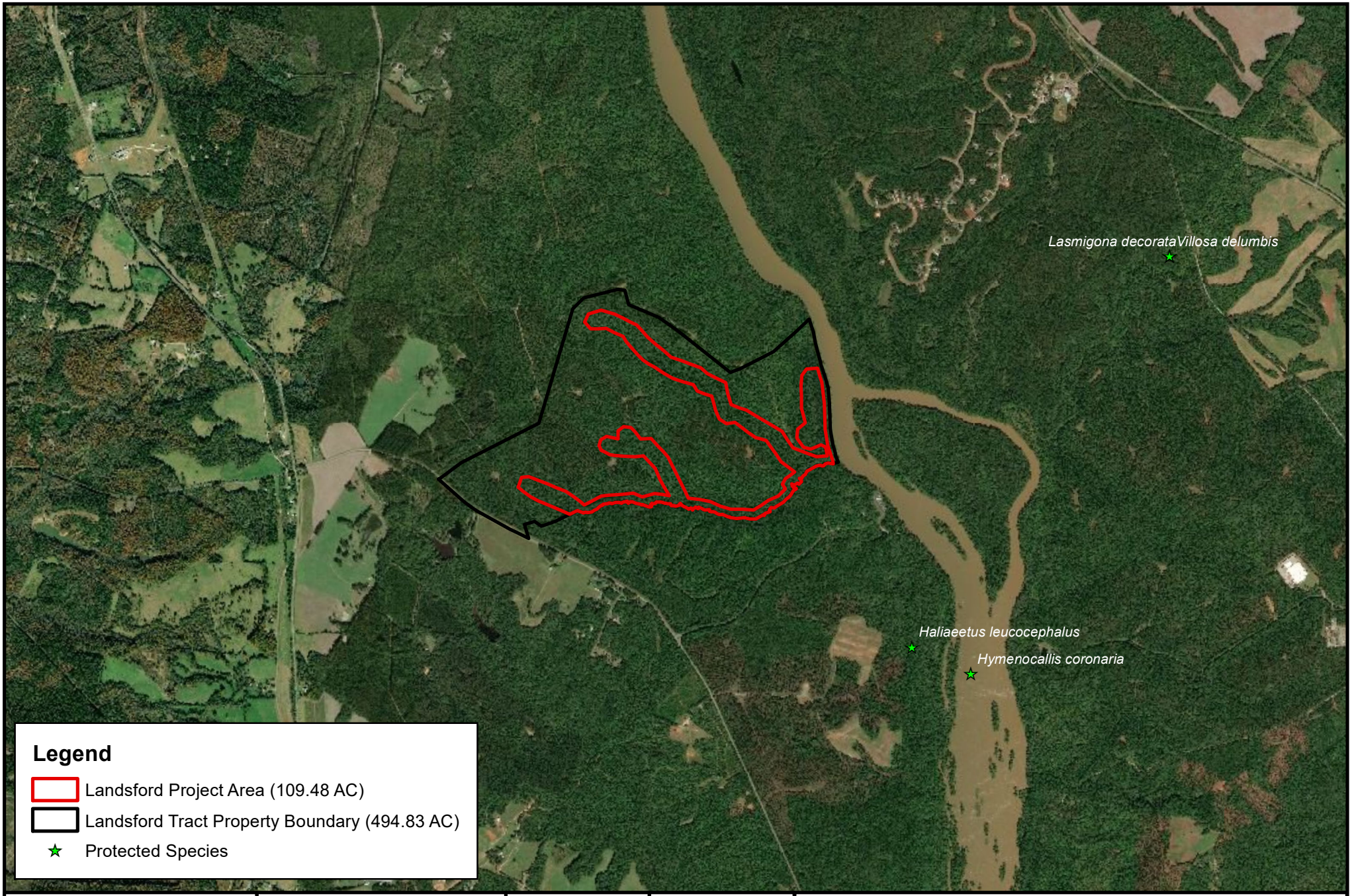


**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 2,500 feet

0 625 1,250 2,500 Feet

**Figure 6: South Carolina Protected Species Map**

Sources: ESRI, SCDNR Heritage Trust
Date: January 2020

Palustrine Group

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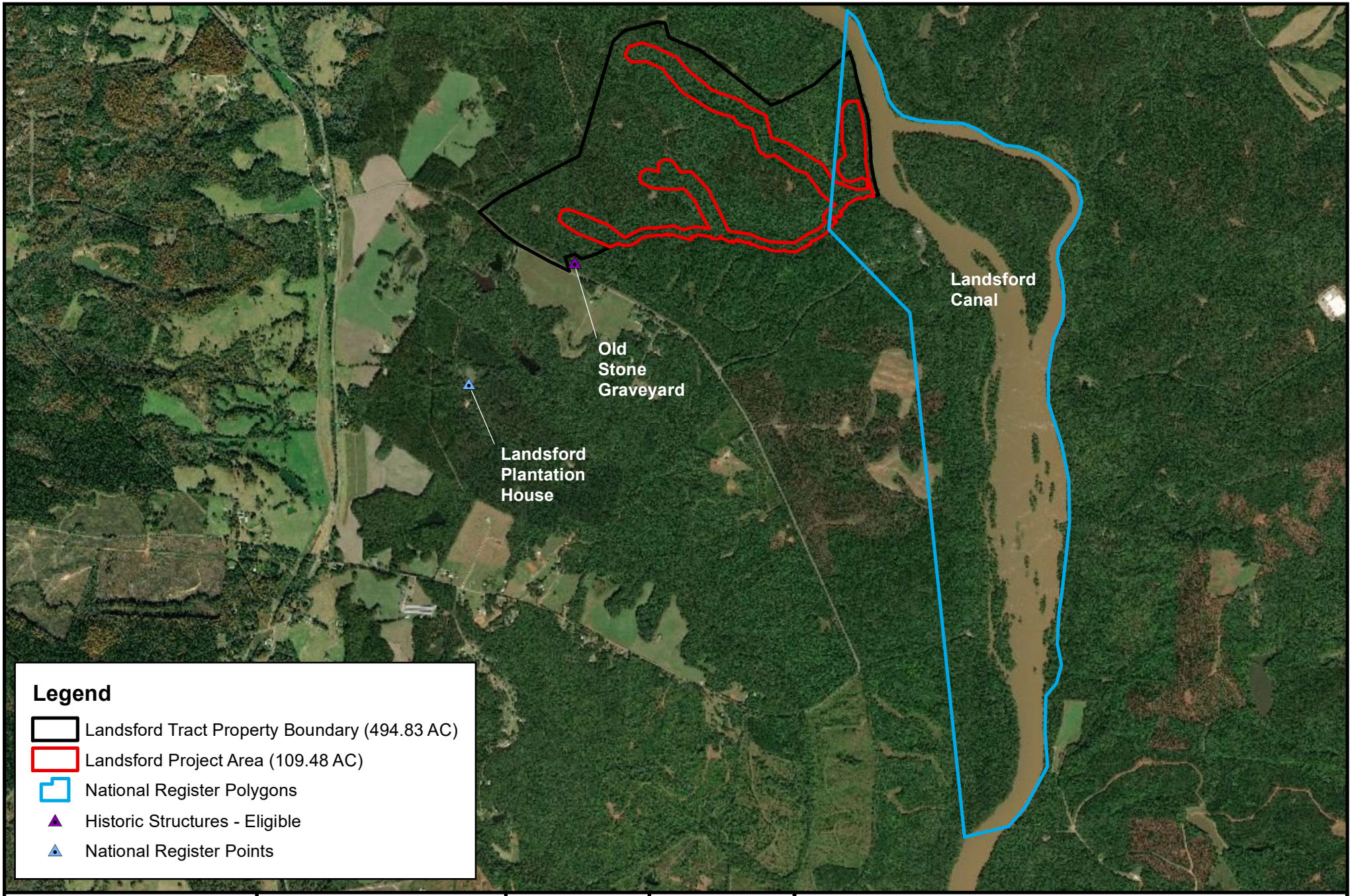


**Landsford Tract**
Chester County
South Carolina

1 inch = 2,500 feet

0 625 1,250 2,500 Feet

**Figure 7: ArchSite Historic Resource Map**

Sources: ESRI, ArchSite
Date: January 2020

Palustrine Group

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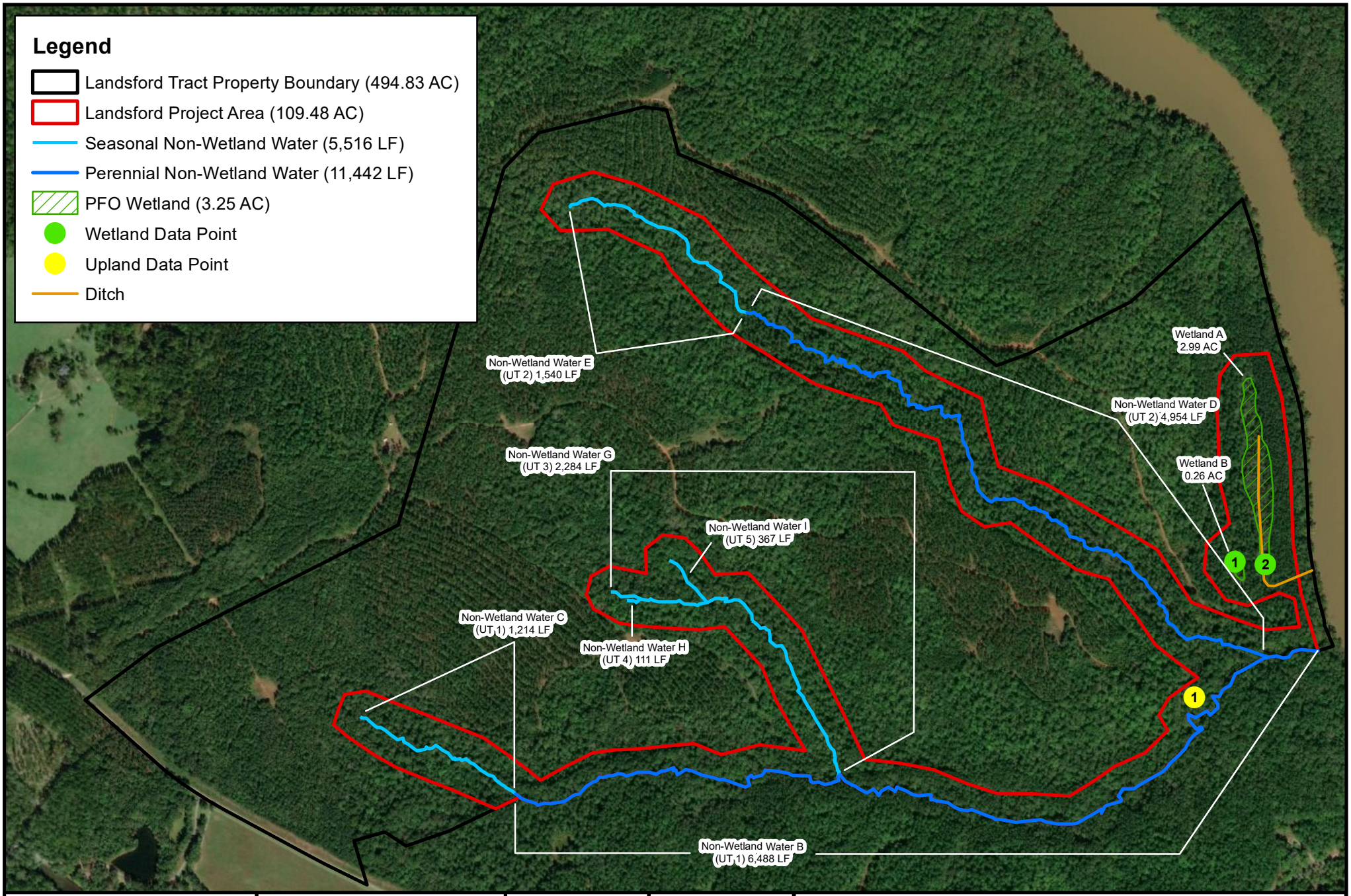
Notes:




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 800 feet

0 400 800 Feet

**Figure 8: Waters of the United States Map**

Sources: ESRI
Date: January 2020

Palustrine Group

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Notes:

**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 800 feet

0 200 400 800 Feet

**Figure 9: LiDAR Digital Elevation Model**

Project Inspector
Sources: ESRI, SCDNR
Date: January 2020

Palustrine Group

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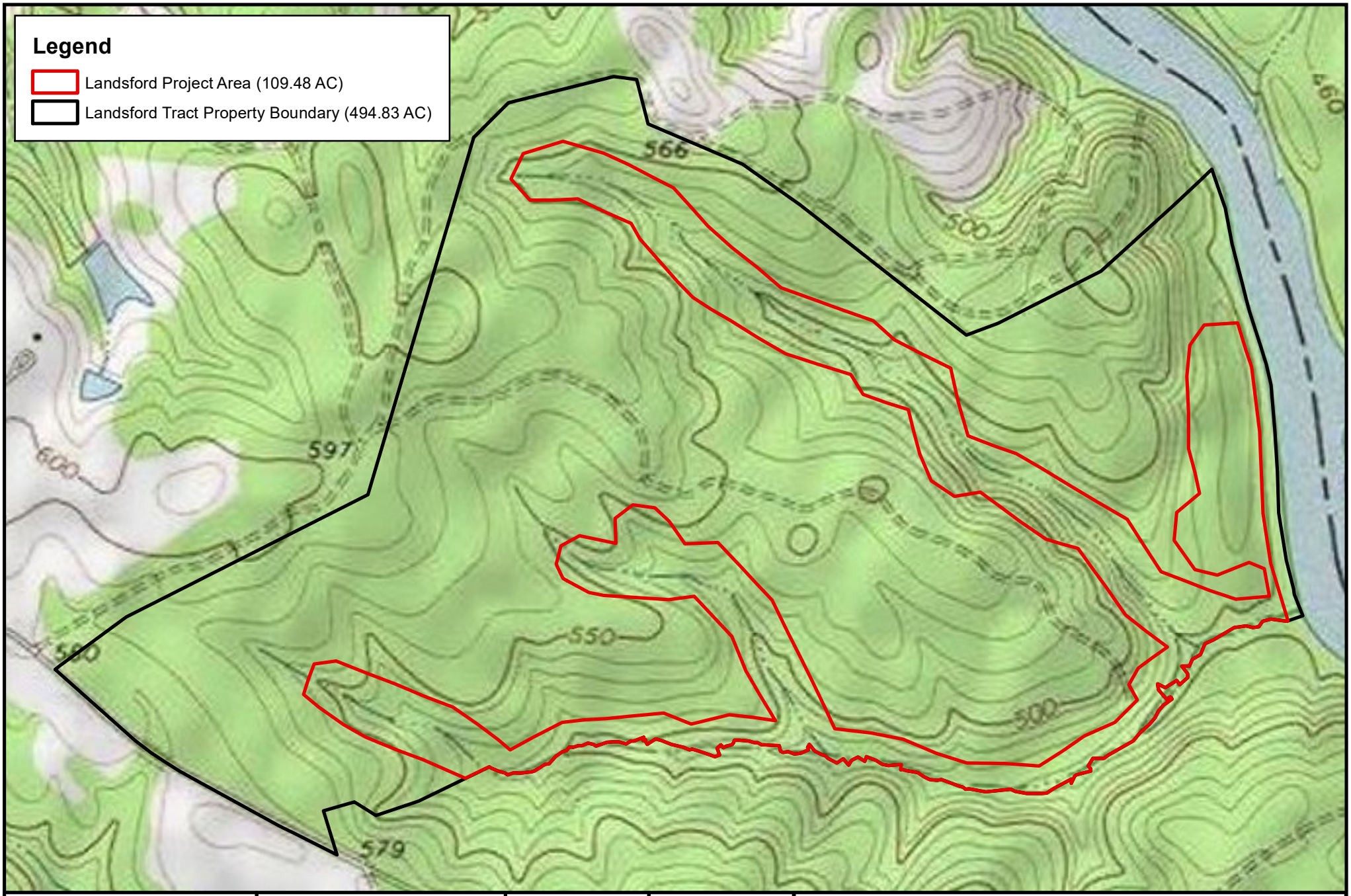
Notes:




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 800 feet

0 400 800 Feet

**Figure 10: USGS Topographic Map**

Project Inspector
Sources: ESRI,
USGS "Catawba" 7.5-min quad
Date: January 2020

Palustrine Group

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Notes:

**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 750 feet

0 375 750 Feet

**Figure 11: Vegetative Conditions Map**

Project Inspector
Sources: ESRI
Date: January 2020

Palustrine Group

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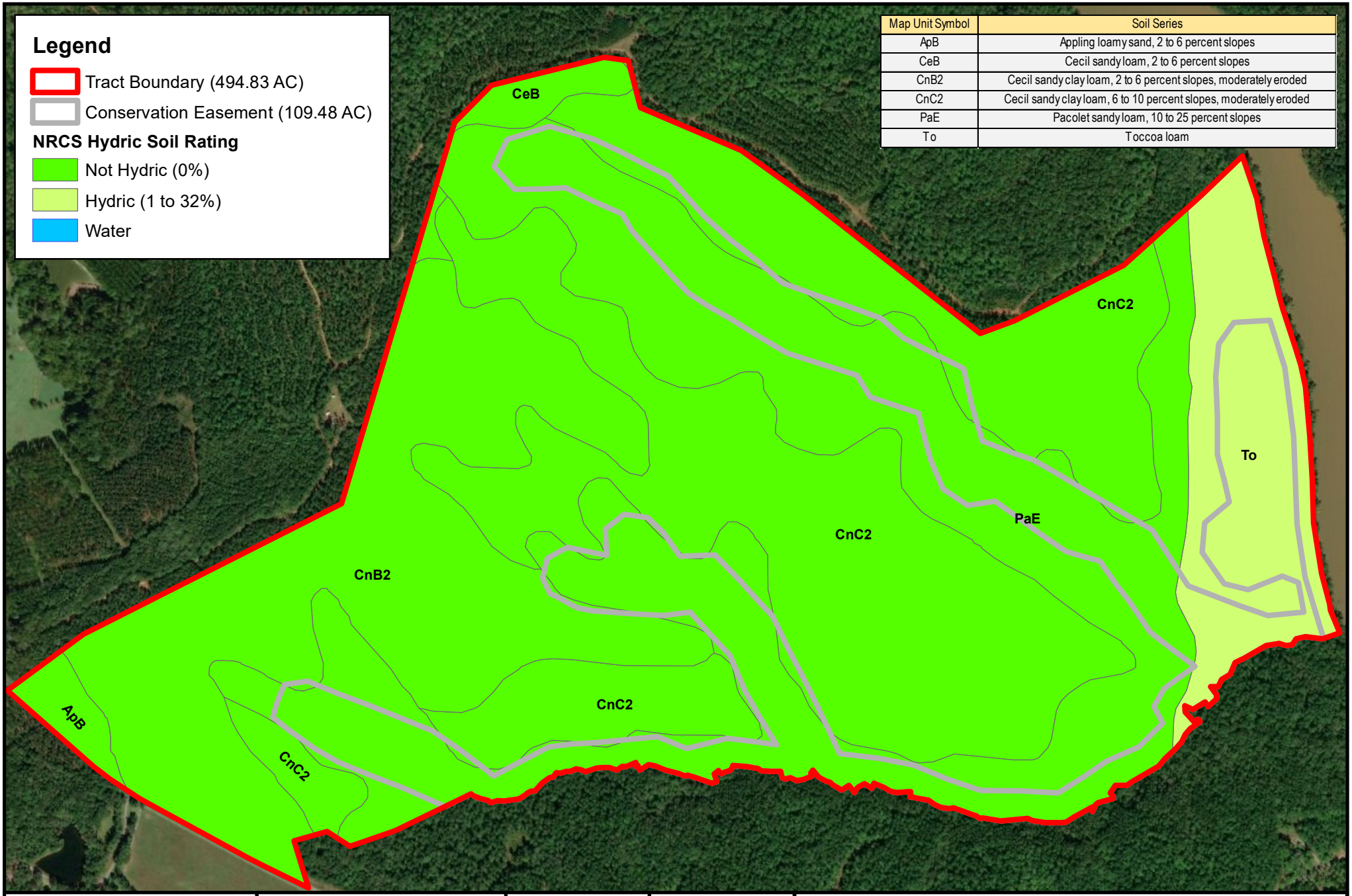
Notes:




| Map Unit Symbol | Soil Series |
|---|---|
| ApB | Appling loamy sand, 2 to 6 percent slopes |
| CeB | Cecil sandy loam, 2 to 6 percent slopes |
| CnB2 | Cecil sandy clay loam, 2 to 6 percent slopes, moderately eroded |
| CnC2 | Cecil sandy clay loam, 6 to 10 percent slopes, moderately eroded |
| PaE | Pacolet sandy loam, 10 to 25 percent slopes |
| To | Toccoa loam |

**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 750 feet

0 375 750 Feet

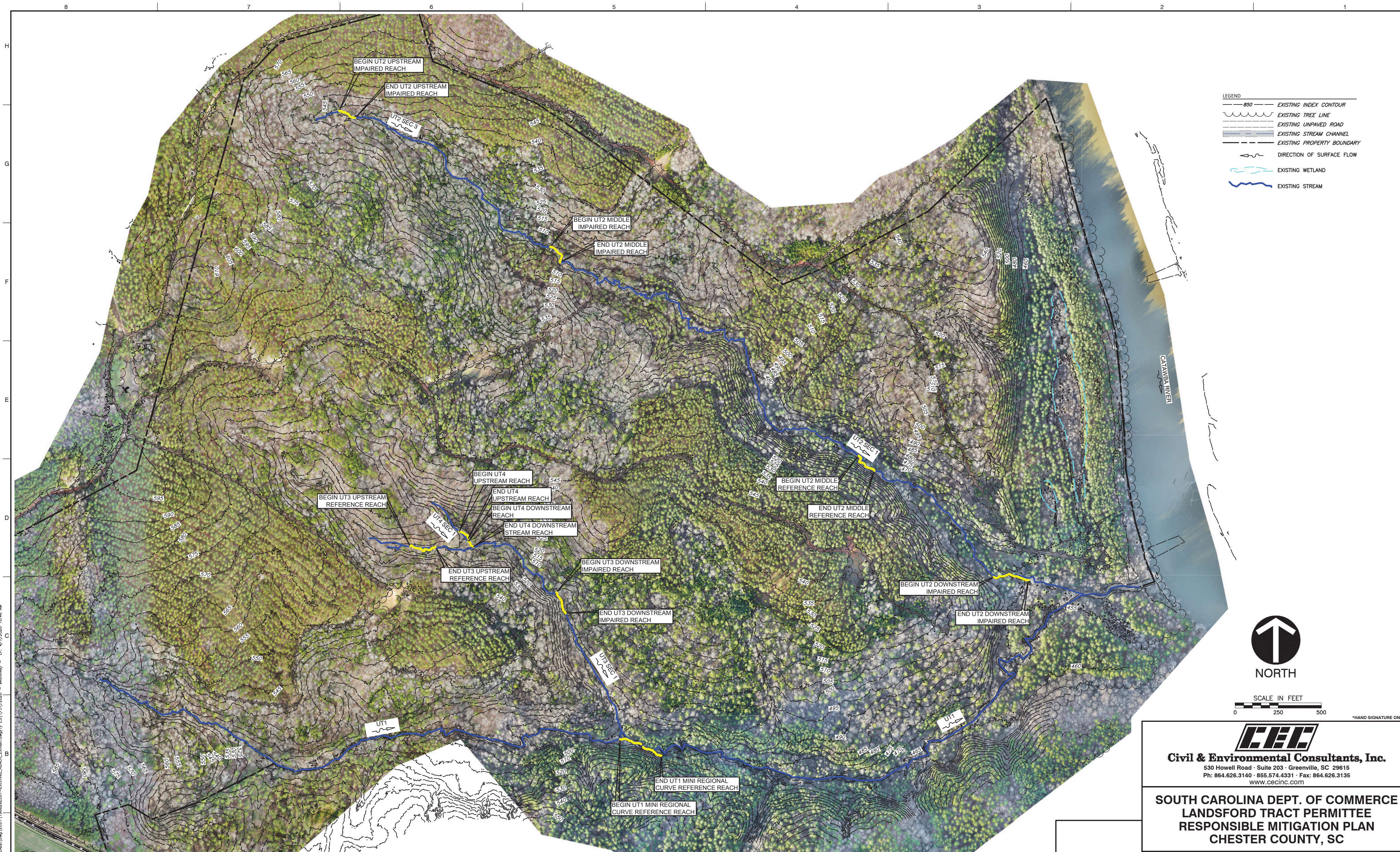
**Figure 12: NRCS Soil Map**

Project Inspector
Sources: ESRI, NRCS
Date: January 2020

Palustrine Group

N
W E
S

Notes:




*HAND SIGNATURE ON FILE

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www.cecinc.com

## SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

EXISTING STREAM REACH SURVEY

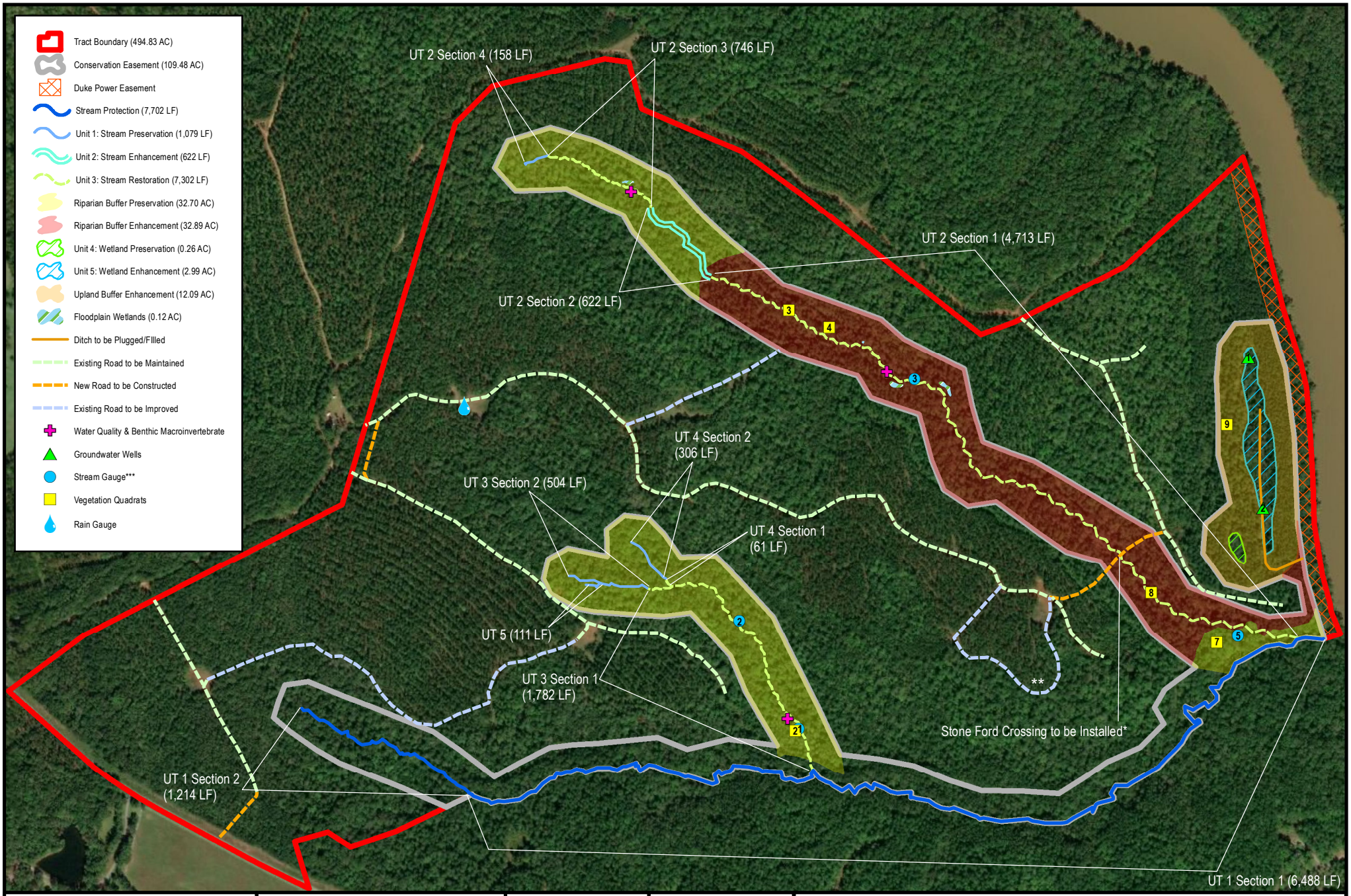
FIGURE NO.: 13

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

**REFERENCE**
1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS NAD83 SC STATE PLANE, INTERNATIONAL FOOT (2011).
4. VERTICAL DATUM IS NAVD88 (GEOID12B).

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-EXISTING_REACH_EXHIBIT.dwg




# Landsford Tract

**Chester County**
**South Carolina**

1 inch = 750 feet

0 187.5 375 750 Feet

## Figure 14: Baseline Monitoring Map

Project Inspector
Sources: ESRI
Date: April 2020

Palustrine Group

N
W E
S

Notes:

*Exact location and configuration of access road to be determined at a later date and coordinated with SCDNR prior to construction.

**Road to be improved as needed during construction to facilitate site access.

***Stream gauges are located in existing channels

# APPENDIX A

# CULTURAL RESOURCE INVESTIGATIONS REPORT

# Cultural Resource Investigations
# Project Inspector Project Area and Mitigation Site
# Chester and York Counties, South Carolina
# S&ME Project No. 4261-19-077
# SHPO Project No. 19-KL0350

PREPARED FOR:

**South Carolina Department of Commerce**
**1201 Main Street Suite 1600**
**Columbia, South Carolina 29201**

PREPARED BY:

**S&ME, Inc.**
**134 Suber Road**
**Columbia, SC 29210**

**January 2020**

# Cultural Resource Investigations
# Project Inspector Project Area and Mitigation Site
# Chester and York Counties, South Carolina

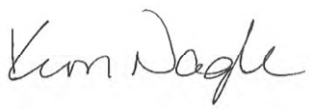
Prepared for:

South Carolina Department of Commerce
1201 Main Street Suite 1600
Columbia, South Carolina 29201

Prepared by:

S&ME, Inc.
134 Suber Road
Columbia, South Carolina 29210

S&ME Project No. 4261-19-077
SHPO Project No. 19-KL0350



Kimberly Nagle, M.S., RPA
Principal Investigator

Authors: Kimberly Nagle and Heather Carpini, M.A.

January 2020

# Management Summary

On behalf of South Carolina Department of Commerce (SCDOC), S&ME, Inc. (S&ME) has completed cultural resource investigations of the proposed project area associated with Project Inspector in York County, South Carolina and of the proposed Project Inspector mitigation site in Chester County, South Carolina (Figures 1.1 through 1.5). The project area spans the east and west sides of Interstate 77 (I-77), with the east side consisting of a proposed interchange at I-77 and associated road infrastructure (turn lanes, on/off ramps, existing road widening, land acquisition, etc.) with access to the interchange; the western portion of the project area is comprised of approximately 256 acres of wooded property that extends between Eden Terrace to the north and the Norfolk Southern railroad to the south (Figures 1.2, 1.3, and 1.6). The mitigation site is approximately 484 acres in size and is located between Landsford Road and the Catawba River (Figures 1.4 and 1.5); approximately 129.1 acres and 1.4 miles of proposed access roads make up the limits of disturbance (LOD) at the mitigation site. The LOD was surveyed during these investigations, the remaining portion of the mitigation site will remain unmodified.

The purpose of the survey was to assess the project area's and mitigation site's potential for containing significant cultural resources and to make recommendations regarding additional work that may be required pursuant to Section 106 of the National Historic Preservation Act, as amended, and other pertinent federal, state, or local laws. This work was done in anticipation of federal permitting by the United State Army Corps of Engineers (USACE), as well as funding from the United State Federal Highway Administration (FHWA), and was carried out in general accordance with S&ME Proposal Number 42-1900437, dated May 31, 2019, and Change Order 2, dated December 18, 2019.

Fieldwork for the project was conducted from July 8 through 12, 2019, October 15, 2019, and January 6 through 10, 2020. This work included the excavation of 672 shovel tests within the project area, 351 shovel tests within the mitigation site, an architectural survey of structures within the project area and within a 0.5-mile search radius, an evaluation of effects on NRHP-eligible and listed resources, and a balloon/drone survey to assess effects on the NRHP-eligible Arrowhead Dairy.

### *Project Area Results of Investigations*

As a result of the investigations, six archaeological sites (38YK607 through 38YK612), three isolated finds (IF-1 through IF-3), one previously evaluated aboveground resource (SHPO site number 3919 – Arrowhead Dairy) was revisited, three newly recorded aboveground resources (SHPO site numbers 3920 through 3922), and one previously unrecorded cemetery (SHPO site number 3889) were identified (Figures 1.2 and 1.3; Table 1.1). The archaeological sites, isolated finds, newly recorded aboveground resources, and the cemetery are recommended as not eligible for the inclusion in the National Register of Historic Places (NRHP).

Arrowhead Dairy (SHPO site number 3919) is a circa 1920s dairy, including three barns of stone construction, that are located adjacent to and within the northwest corner of the proposed project area. The 1927 milk barn (SHPO site number 3919.04 and 1931 hay barn (SHPO site number 3919.05) have been determined eligible for inclusion in the National Register under Criterion A, for their association with the dairy farming industry in South Carolina, and under Criterion C, for the architecture of the barns. Although the Arrowhead Dairy house (SHPO site number 3919.01) has been significantly altered since its original nineteenth century construction and is recommended as ineligible for the NRHP, three additional outbuildings associated with the Arrowhead Dairy, a nineteenth-century brick shed (SHPO site number 3919.03), a circa 1930s metal silo (SHPO site number 3919.06), and a 1935 storage barn (SHPO site number 3919.07) are also recommended eligible for the NRHP under Criterion A and C.

A balloon/drone survey indicated that the project, as currently planned will not have an adverse effect on the viewshed of the NRHP-eligible structures. However, based on the location of the NRHP-eligible Arrowhead Dairy structures, which includes the 1935 storage barn located on the proposed project are and the remaining structures located less than 150 feet from the boundary of the proposed project area, construction on the proposed site has the potential to adversely affect the NRHP-eligible Arrowhead Dairy structures. S&ME recommends avoidance of the 1935 storage barn, use of an access route for construction traffic that is away from the Arrowhead Dairy property, and the use of low-vibration construction methods.

**Table 1.1. Cultural resources identified or revisited during the survey of the project area.**

| Resource # | Description | NRHP Eligibility | Recommendation |
|---|---|---|---|
| 38YK607 | Prehistoric lithic isolate; 19th/20th century artifact scatter | Not Eligible | No Further Work |
| 38YK608 | 20th century house site | Not Eligible | No Further Work |
| 38YK609 | Prehistoric lithic isolate; 19th/20th century artifact scatter | Not Eligible | No Further Work |
| 38YK610 | Prehistoric lithic scatter; historic glass isolate | Not Eligible | No Further Work |
| 38YK611 | Prehistoric lithic scatter; historic glass isolate | Not Eligible | No Further Work |
| 38YK612 | Early to mid-20th century house site | Not Eligible | No Further Work |
| IF-1 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-2 | Prehistoric lithic isolate; historic glass isolate | Not Eligible | No Further Work |
| IF-3 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| 3889 | Cross Roads Baptist Church Cemetery | Not Eligible | No Further Work |
| 3919 | Arrowhead Dairy | See Individual Resources | See Individual Resources |
| 3919.01 | Arrowhead Dairy, house | Not Eligible | No Further Work |
| 3919.02 | Arrowhead Dairy, well | Not Eligible | No Further Work |
| 3919.03 | Arrowhead Dairy, shed | Eligible (A, C) | Traffic and Vibration minimization; Viewshed screening |
| 3919.04 | Arrowhead Dairy, milk barn | Eligible (A, C) | Traffic and Vibration minimization; Viewshed screening |
| 3919.05 | Arrowhead Dairy, hay barn | Eligible (A, C) | Traffic and Vibration minimization; Viewshed screening |
| 3919.06 | Arrowhead Dairy, silo | Eligible (A, C) | Traffic and Vibration minimization; Viewshed screening |
| 3919.07 | Arrowhead Dairy, storage barn | Eligible (A, C) | Avoidance; Traffic and Vibration minimization; Viewshed screening |
| 3920 | Hutchinson Place | Not Eligible | No Further Work |
| 3921 | Commercial Building | Not Eligible | No Further Work |
| 3922 | Southern Railroad Corridor | Not Eligible | No Further Work |

There are NRHP-eligible aboveground resources located to the southeast of the project area, associated with the community of Red River; they are located roughly 0.35-mile from the Celriver Road and Paragon Way intersection. This portion of the proposed project area follows Paragon Way, an existing roadway that provides access to an existing industrial park. Interchange improvements may take place at the intersection; however, the area has already been developed and new roadway improvements will have no adverse effect on these.

### *Mitigation Site Results of Investigations*

As a result of the investigations, six archaeological sites (38CS425 through 38CS430) and eight isolated finds (IF-1 through IF-8) were recorded, the effects of the proposed activities on the NRHP-listed Landsford Canal (SHPO site number 0008) were assessed, and the NRHP-eligible Old Stone Graveyard (SHPO site number 0044) was revisited (Figures 1.4 and 1.5; Table 1.2). The archaeological sites and isolated finds are recommended as not eligible for inclusion in the NRHP. The portion of the NRHP-listed Landsford Canal within the LOD will not be adversely affected by the tree clearing, replanting of disturbed areas, or filling of the drainage ditch within the resource. The Old Stone Graveyard is located southwest of the mitigation site boundary and is roughly 330 feet from the closest LOD area; although no graves appear to be outside the stone wall surrounding the cemetery, a 25-ft buffer around the stone wall is recommended to avoid disturbing possible unmarked graves (Figure 1.7). The project as currently proposed will have no effect on the cemetery.

**Table 1.2. Cultural resources identified or revisited during the survey of the mitigation site.**

| Resource # | Description | NRHP Eligibility | Recommendation |
|---|---|---|---|
| 38CS425 | Prehistoric lithic scatter | Not Eligible | No Further Work |
| 38CS426 | Prehistoric lithic scatter; Historic artifact scatter | Not Eligible | No Further Work |
| 38CS427 | Historic artifact scatter | Not Eligible | No Further Work |
| 38CS428 | Prehistoric lithic scatter | Not Eligible | No Further Work |
| 38CS429 | Prehistoric lithic scatter; Historic artifact scatter | Not Eligible | No Further Work |
| 38CS430 | Historic house site | Not Eligible | No Further Work |
| IF-1 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-2 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-3 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-4 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-5 | Prehistoric lithic isolate | Not Eligible | No Further Work |
| IF-6 | Historic glass isolate | Not Eligible | No Further Work |
| IF-7 | Historic glass isolate | Not Eligible | No Further Work |
| IF-8 | Historic glass isolate | Not Eligible | No Further Work |
| 0008 | Landsford Canal | Listed | No Adverse Effect |
| 0044 | Old Stone Graveyard | Eligible | No Effect |

### *Overall Conclusions and Recommendations*

Given the results of this survey, it is the opinion of S&ME that both the project area and mitigation site will have no adverse effect on significant resources, as long as the recommended measures to avoid direct and indirect effects on the Arrowhead Dairy NRHP-eligible structures are included in the project plans, and no further cultural resources investigations should be required for the current project area or mitigation site. However, if the potential effects to the NRHP-eligible Arrowhead Dairy structures cannot be avoided, project activities change within the NRHP-listed Landsford Canal, and/or the LOD shifts within the boundary proposed around NRHP-eligible Old Stone Graveyard, additional consultation with the SHPO and other consulting parties may be necessary to minimize or mitigate potential adverse effects.

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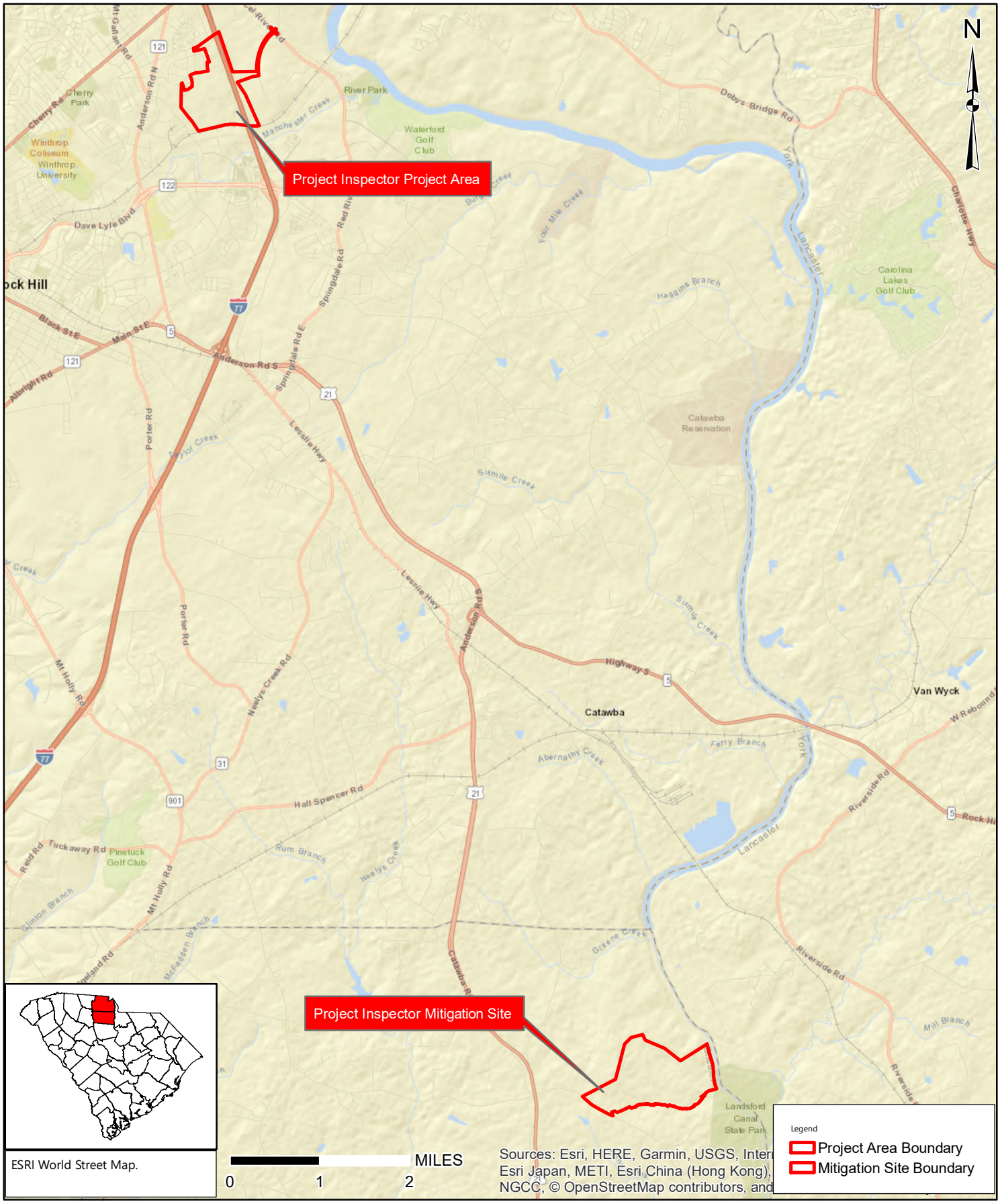
# 1.0 Introduction

On behalf of SCDOC, S&ME has completed cultural resource investigations of the proposed project area associated with Project Inspector in York County, South Carolina and of the proposed Project Inspector mitigation site in Chester County, South Carolina (Figures 1.1 through 1.5). The project area spans the east and west sides of I-77, with the east side consisting of a proposed interchange at I-77 and associated road infrastructure (turn lanes, on/off ramps, existing road widening, land acquisition, etc.) with access to the interchange; the western portion of the project area is comprised of approximately 256 acres of wooded property that extends between Eden Terrace to the north and the Norfolk Southern railroad to the south (Figure 1.2 and 1.3). The mitigation site is approximately 484 acres in size and is located between Landsford Road and the Catawba River (Figures 1.4 and 1.5).

The purpose of the survey was to assess the project area's and mitigation site's potential for containing significant cultural resources and to make recommendations regarding additional work that may be required pursuant to Section 106 of the National Historic Preservation Act, as amended, and other pertinent federal, state, or local laws. This work was done in anticipation of federal permitting by the USACE, as well as funding from the FHWA, and was carried out in general accordance with S&ME Proposal Number 42-1900437, dated May 31, 2019, and Change Order 2, dated December 18, 2019.

S&ME carried out background research and field investigation tasks intermittently from June 2019 through January 2020. The fieldwork was conducted by Senior Archaeologist Kimberly Nagle, Crew Chiefs Paul Connell and Aileen Kelly, and Archaeological Technicians Brianna Baker and Jessica Simpson and consisted of excavating shovel tests and photo documenting the project area. Graphics, GIS maps, and photographs were prepared by Ms. Nagle and Senior Architectural Historian/Historian Heather Carpini, M.A. Architectural evaluations for the project were conducted by Ms. Carpini.

This report has been prepared in compliance with the National Historic Preservation Act of 1966, as amended; the Archaeological and Historic Preservation Act of 1979; procedures for the Protection of Historic Properties (36 CFR Part 800); and 36 CFR Parts 60 through 79, as appropriate. Field investigations and the technical report meet the qualifications specified in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (Federal Register [FR] 48:44716–44742), and the *South Carolina Standards and Guidelines for Archaeological Investigations* (COSCAPA et al. 2013). Supervisory personnel meet the Secretary of the Interior's Professional Qualifications Standards set forth in 36 CFR Part 61.

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| DRAWN BY: | KJN |
| DATE: | 1/20/2020 |

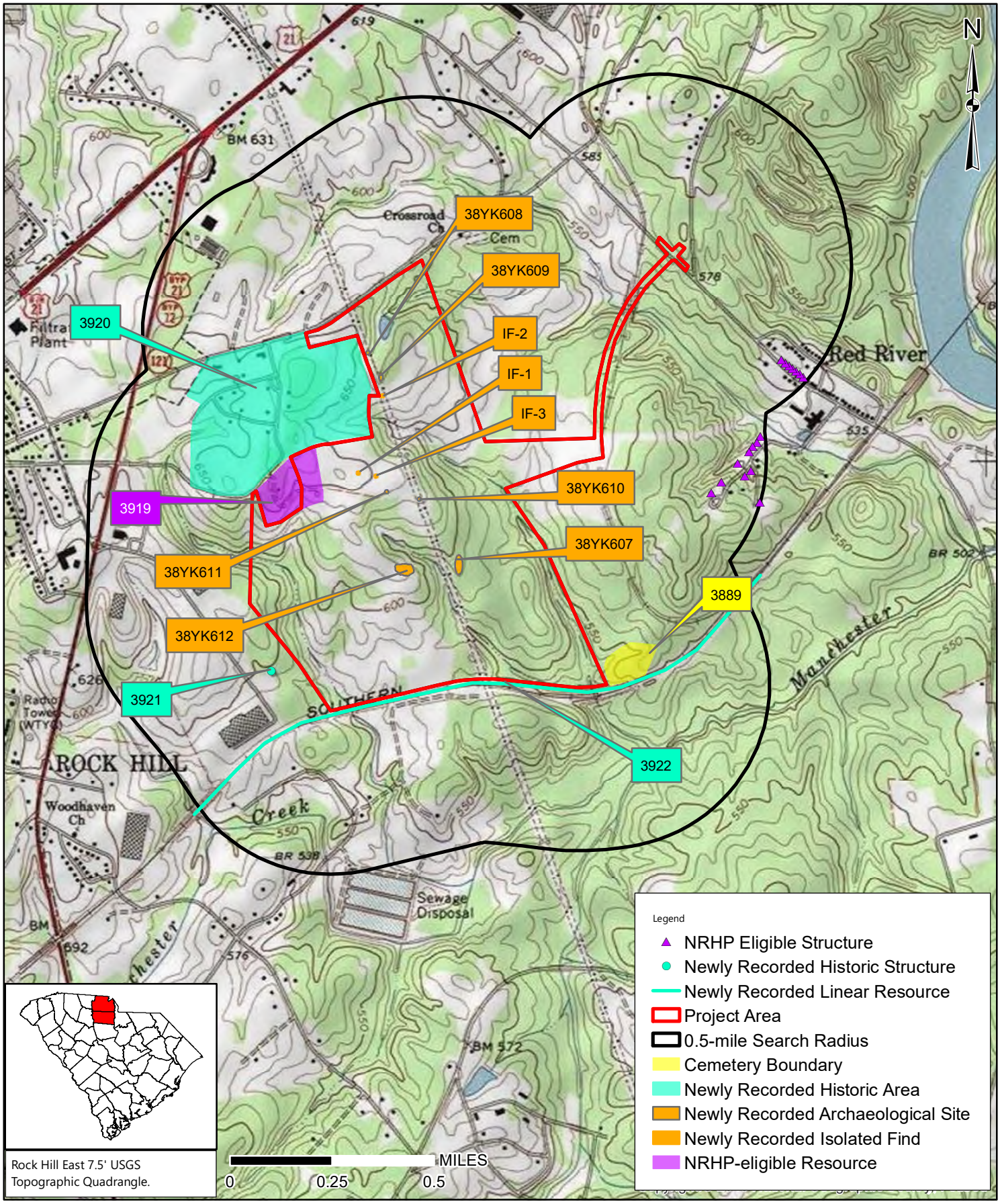
# OverviewMap

Project Inspector Project Area and Mitigation Site

Chester and York Counties, South Carolina

FIGURE NO.

1.1




Rock Hill East 7.5' USGS Topographic Quadrangle.

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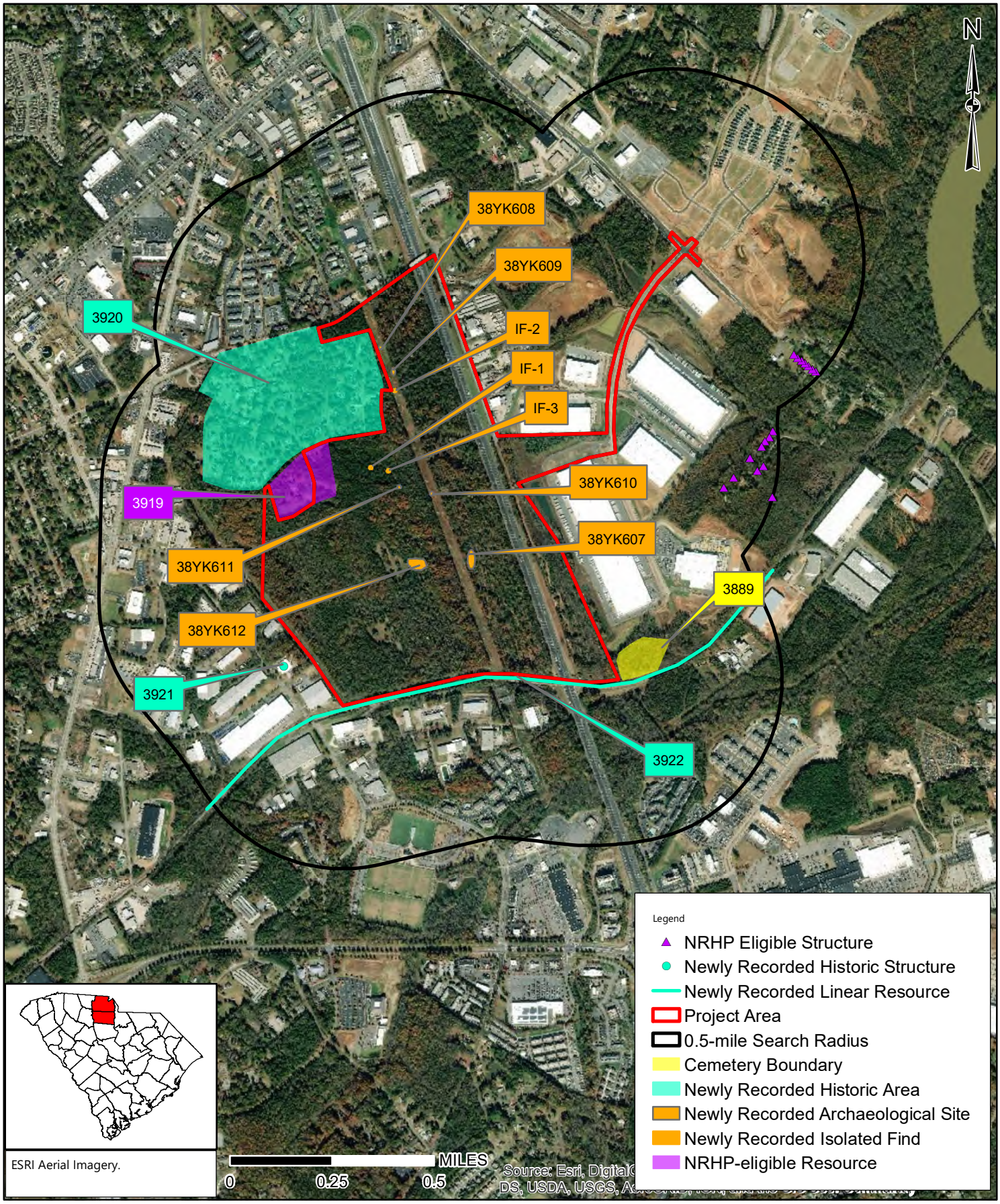
| SCALE: | 1:20,000 |
| PROJECT NO: | 4261-19-077 |
| DRAWN BY: | KJN |
| DATE: | 1/20/2020 |

# Topographic Map

Project Inspector Project Area

Chester and York Counties, South Carolina

FIGURE NO. 1.2

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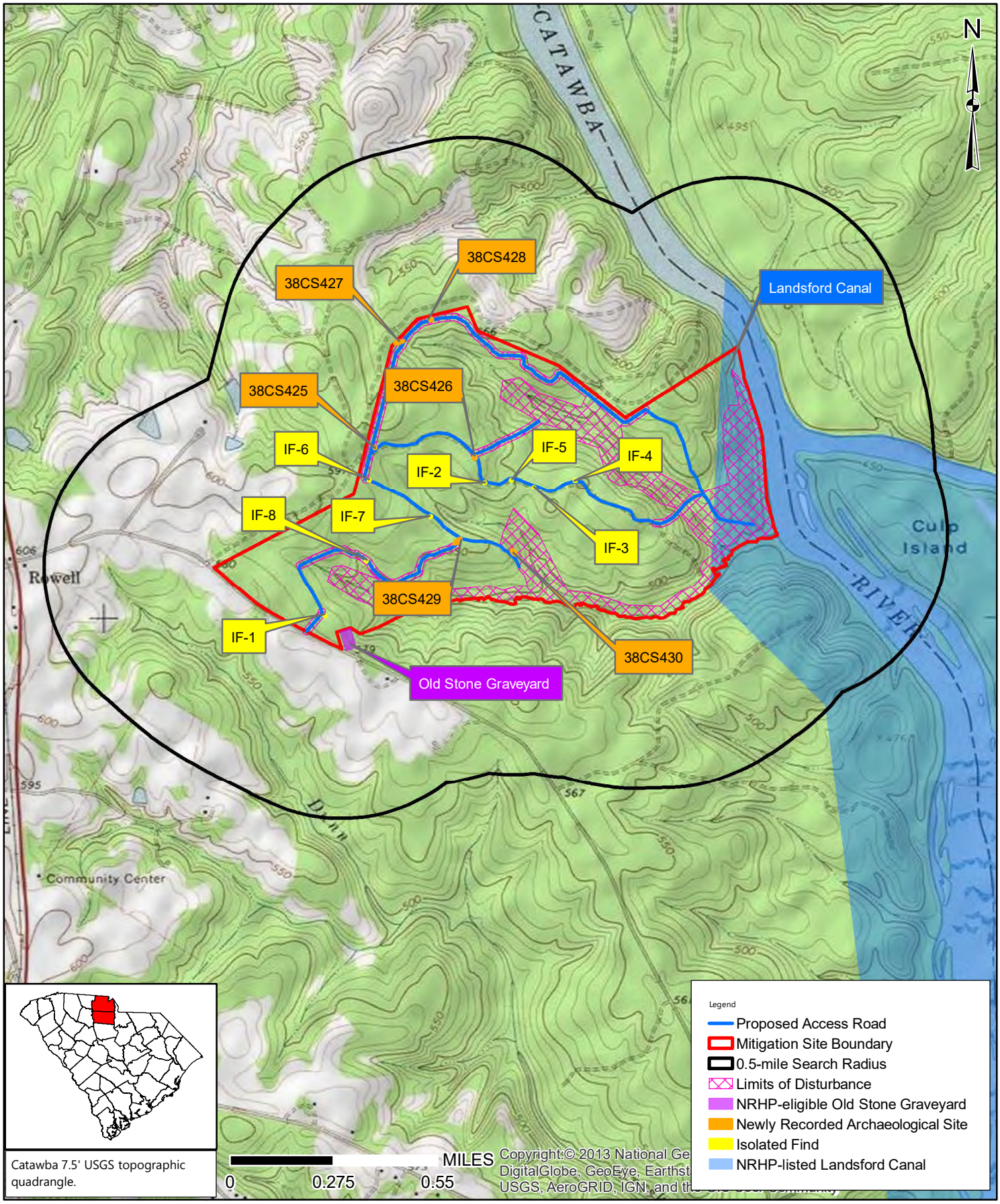
| | | | |
|---|---|---|---|
| SCALE: | 1:20,000 | **Aerial Map** | FIGURE NO. |
| PROJECT NO: | 4261-19-077 | Project Inspector Project Area | 1.3 |
| DRAWN BY: | KJN | | |
| DATE: | 1/20/2020 | Chester and York Counties, South Carolina | |




| | | | |
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| SCALE: | 1:21,654 | **Topographic Map**<br>Project Inspector Mitigation Site | FIGURE NO. 1.4 |
| PROJECT NO: | 4261-19-077 | | |
| DRAWN BY: | KJN | | |
| DATE: | 1/17/2020 | Chester and York Counties, South Carolina | |

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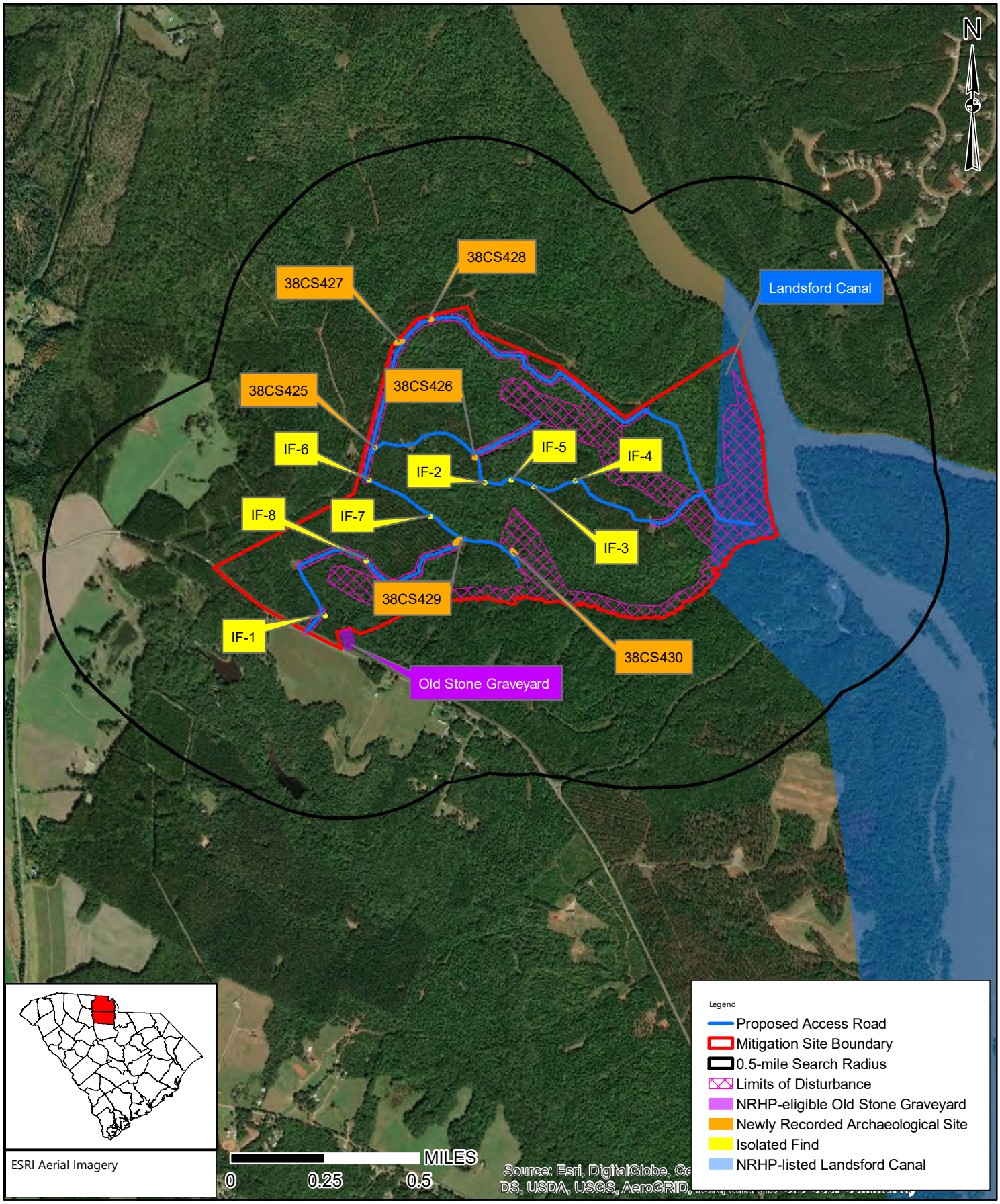


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| PROJECT NO: | 4261-19-077 |
| DRAWN BY: | KJN |
| DATE: | 1/17/2020 |

# Aerial Map

Project Inspector Mitigation Site

Chester and York Counties, South Carolina

FIGURE NO.

1.5

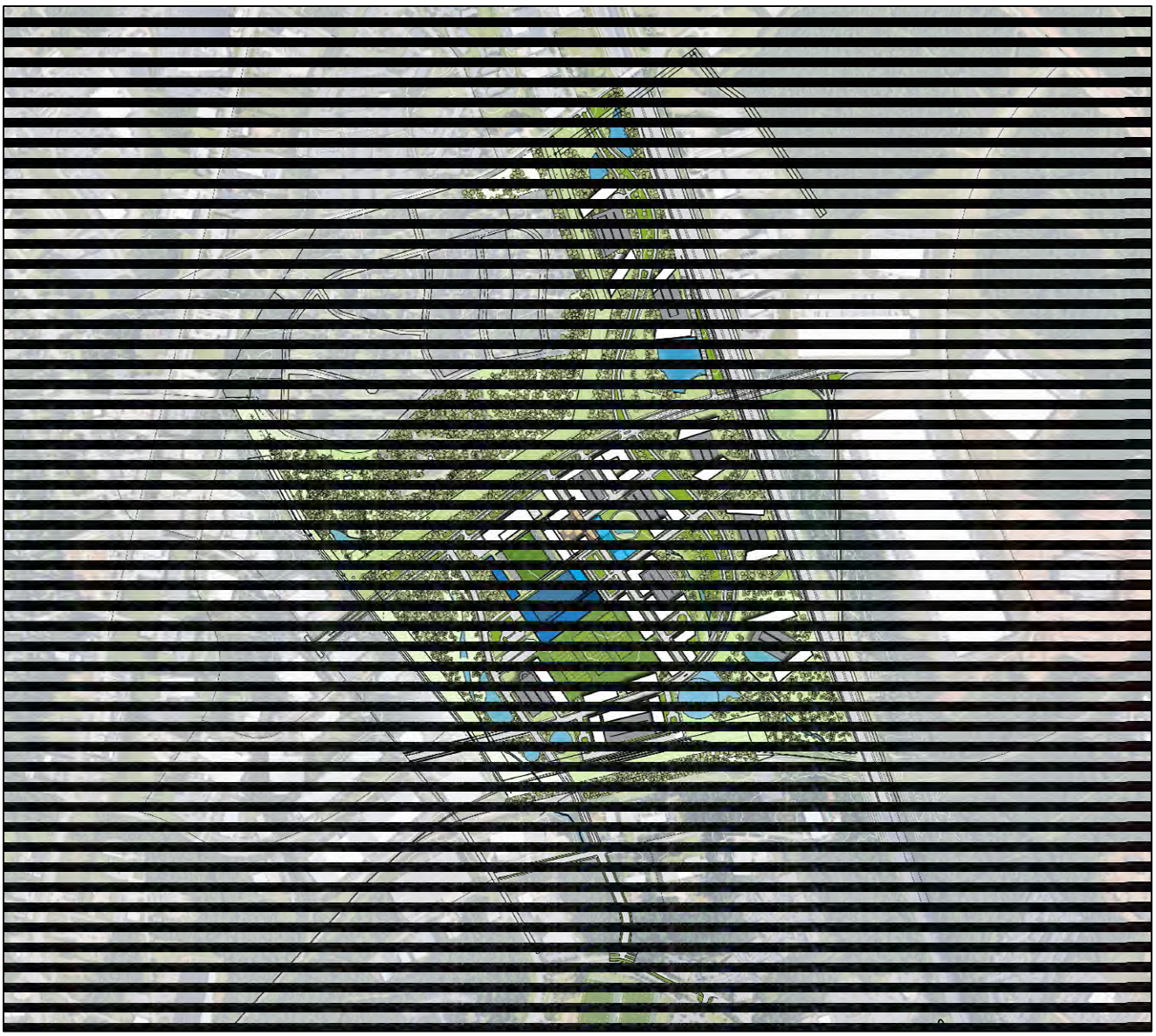
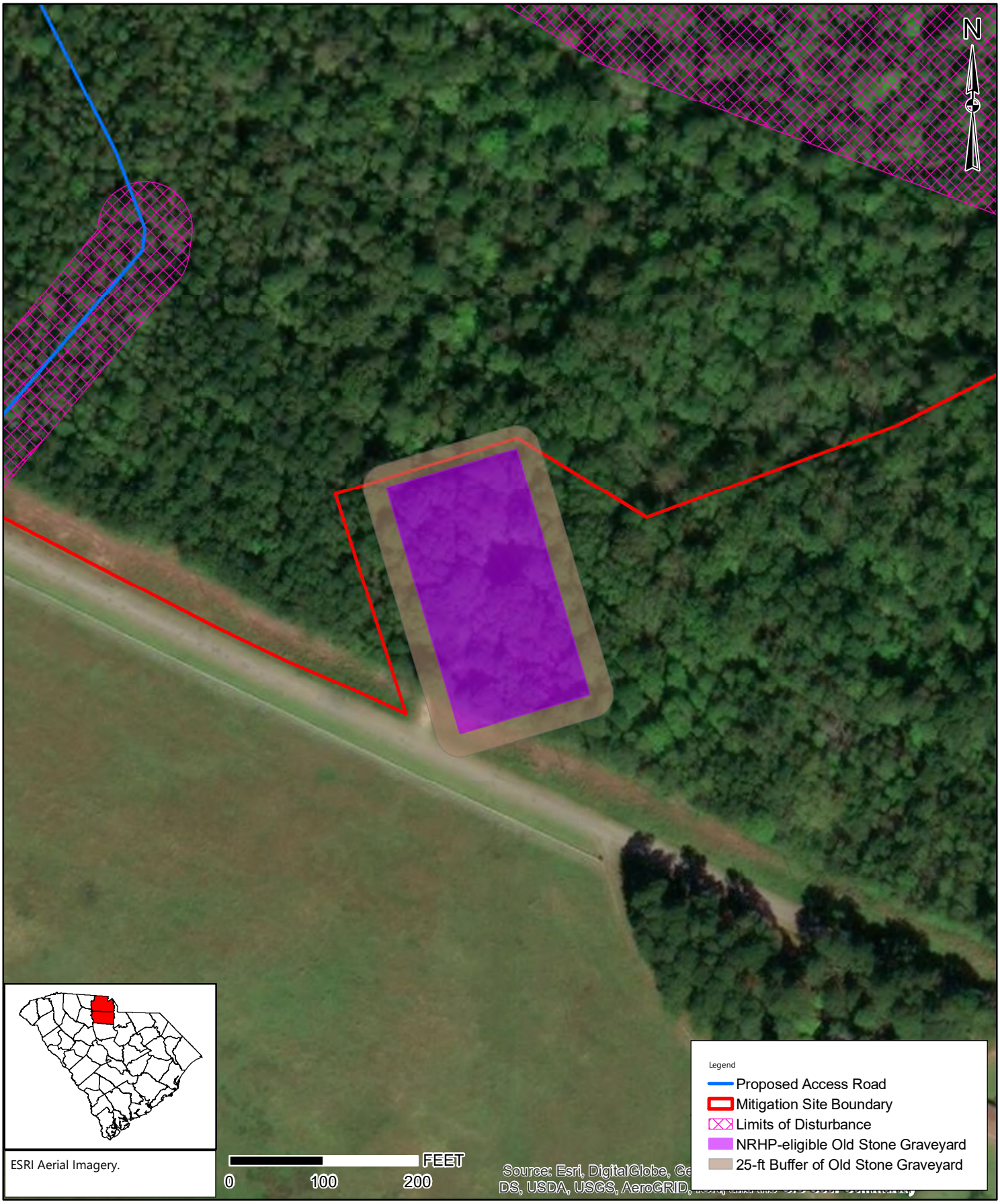


**Figure 1.6. Conceptual plan for project area.**




| | | | |
|---|---|---|---|
| SCALE: | 1:1,644 | **Aerial showing Old Stone Graveyard Buffer** | FIGURE NO. |
| PROJECT NO: | 4261-19-077 | Project Inspector Mitigation Site | 1.7 |
| DRAWN BY: | KJN | | |
| DATE: | 1/17/2020 | Chester and York Counties, South Carolina | |

Drawing Path: T:\Projects\2019\ENV\4261-19-077_SCDOC_Project_Inspector_Rock Hill\Working_Documents\Phase 440 Cultural Resources\GIS\Figures\Figure 1-7 Cemetery.mxd plotted by KNagle 01-17-2020

# 2.0 Environmental Setting

## 2.1 Location

The project area is approximately three miles northeast of the city center of Rock Hill, in the east central portion of York County. York County. which covers approximately 696 square miles, is bounded by Gaston County, North Carolina to the north, Mecklenburg County, North Carolina to the northeast, Lancaster County to the east, Chester County to the south, Union County to the southwest, Cherokee County to the west, and Cleveland County, North Carolina to the northwest.

The mitigation site is located in the northeastern corner of Chester County, where the Chester County border is shared with Lancaster and York Counties. The site is located along Landsford Road, approximately 0.5-mile east of the community of Rowell, spanning the area from Landsford Road to the Catawba River, directly north of the Landsford Canal State Park.

## 2.2 Geology and Topography

The project area and mitigation site are located in the Piedmont physiographic province of South Carolina (Kovacik and Winberry 1989). The Piedmont is a 100 mile wide belt that encompasses most of the northwestern portion of the state (Kovacik and Winberry 1989:16). The Piedmont physiographic province, which is underlain by soils weathered in place from the parent crystalline bedrock material. Rocks found in the Piedmont are generally metamorphic, with igneous granite intrusions (Kovacik and Winberry 1989). Topography in the project area is slightly sloping with elevations ranging from approximately 540 ft above mean sea level (AMSL), by an intermittent stream in the southeastern portion of the project area, to 650 ft AMSL, along the northern boundary of the project area (Figure 1.2). Topography in the mitigation site is also slightly sloping with elevations ranging from approximately 400 ft AMSL along the Catawba River, which makes up the eastern boundary of the mitigation site, to 600 ft AMSL, along a proposed access road in the northern portion of the site (Figure 1.4).

## 2.3 Hydrology

The project area and mitigation site are located in the Catawba River drainage basin, which covers approximately 2,315 square miles and consists of approximately 7.5 percent of the state's area (South Carolina Department of Natural Resources [SCDNR] 2013). Little Flat Rock Creek is present along the eastern boundary and flows through the center of the project area, there are also three intermittent streams within the project area, they flow south into Manchester Creek, which continues east and flows into the Catawba River approximately 1.7 miles from the project area. The Catawba River forms the mitigation sites eastern boundary, an unnamed tributary forms the sites southern boundary, and three intermittent streams fall within the mitigation site.

## 2.4 Soils

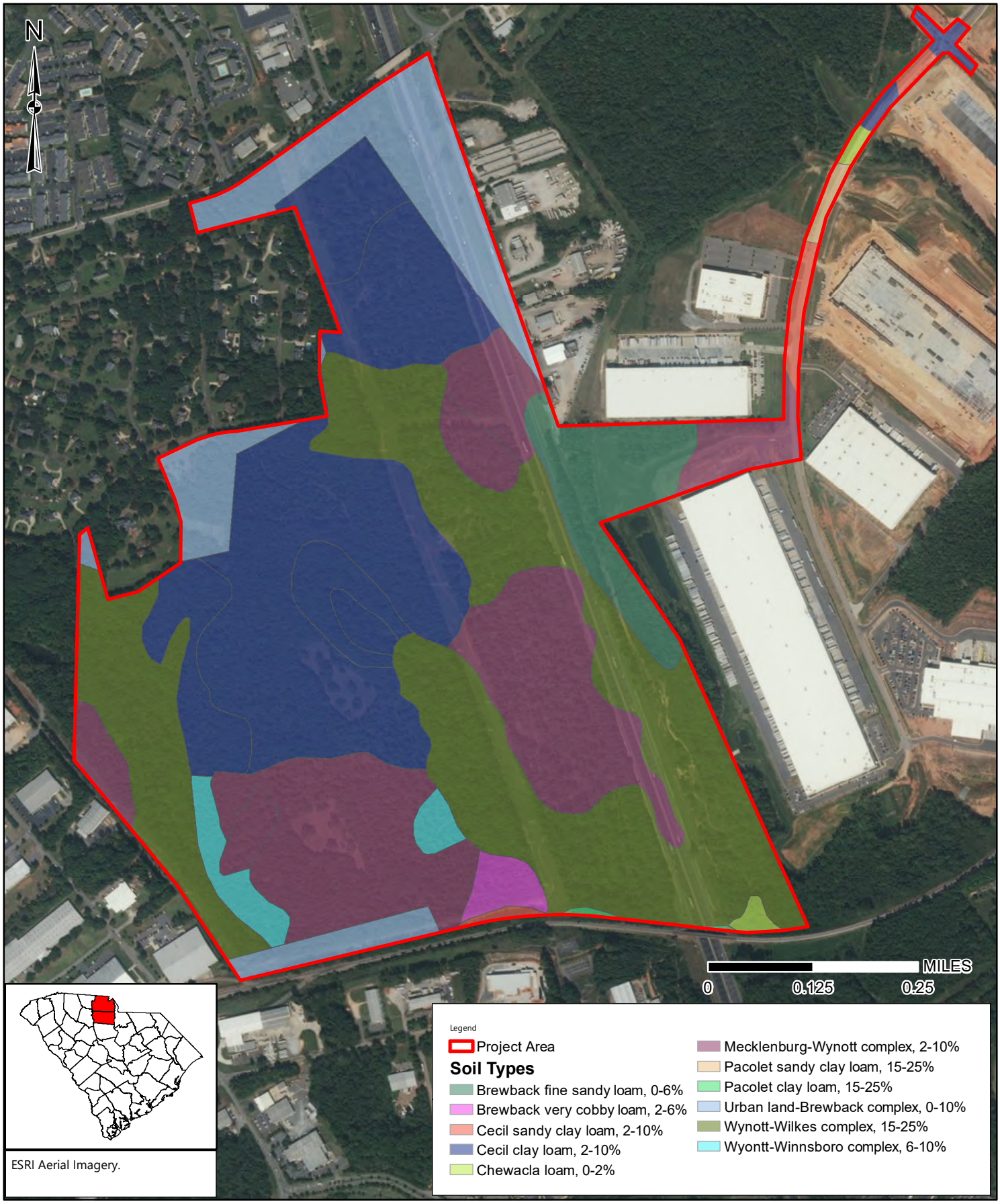
The project area contains 11 specific soil types (Figure 2.1); their descriptions can be found in Table 2.1 (USDA Web Soil Survey, Accessed July 2, 2019). The mitigation site contains five specific soil types (Figure 2.2); their descriptions can be found in Table 2.2 (USDA Web Soil Survey, Accessed December 31, 2019).

**Table 2.1. Specific soil types within the project area.**

| Soil Name | Type | Drainage | Location | Slope | Percentage of APE |
|---|---|---|---|---|---|
| Brewback | Fine sandy loam | Somewhat poorly drained | Interfluves | 0–6% | 5.1% |
| Brewback | Very cobbly loam | Somewhat poorly drained | Interfluves | 2–6% | 1.0% |
| Cecil | Sandy clay loam | Well drained | Interfluves | 2–10% | 1.0% |
| Cecil | Clay loam | Well drained | Interfluves | 2–10% | 28.1% |
| Chewacla | Loam | Somewhat poorly drained | Floodplains | 0–2% | 0.4% |
| Mecklenburg-Wynott complex | | Well drained | Interfluves | 2–10% | 22.5% |
| Pacolet | Sandy clay loam | Well drained | Side slope | 15–25% | 0.3% |
| Pacolet | Clay loam | Well drained | Interfluves | 15–25% | 0.1% |
| Urban land-Brewback complex | | Somewhat poorly drained | Hillslope | 0–10% | 10.1% |
| Wynott-Wilkes complex | | Well drained | Interfluves | 15–25% | 29.5% |
| Wynott-Winnsboro complex | | Well drained | Side slope | 6–10% | 1.9% |

**Table 2.2. Specific soil types within the mitigation site.**

| Soil Name | Type | Drainage | Location | Slope | Percentage of APE |
|---|---|---|---|---|---|
| Appling | Loamy sand | Well drained | Interfluves | 2–6% | 1.0% |
| Cecil | Sandy loam | Well drained | Interfluves | 2–6% | 0.8% |
| Cecil | Sandy clay loam | Well drained | Interfluves | 2–10% | 56.6% |
| Pacolet | Sandy loam | Well drained | Interfluves | 10–25% | 33.0% |
| Toccoa | Loam | Moderately well drained | Floodplains | | 8.6% |




ESRI Aerial Imagery.

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| PROJECT NO: | 4261-19-077 |
| DRAWN BY: | KJN |
| DATE: | 1/20/2020 |

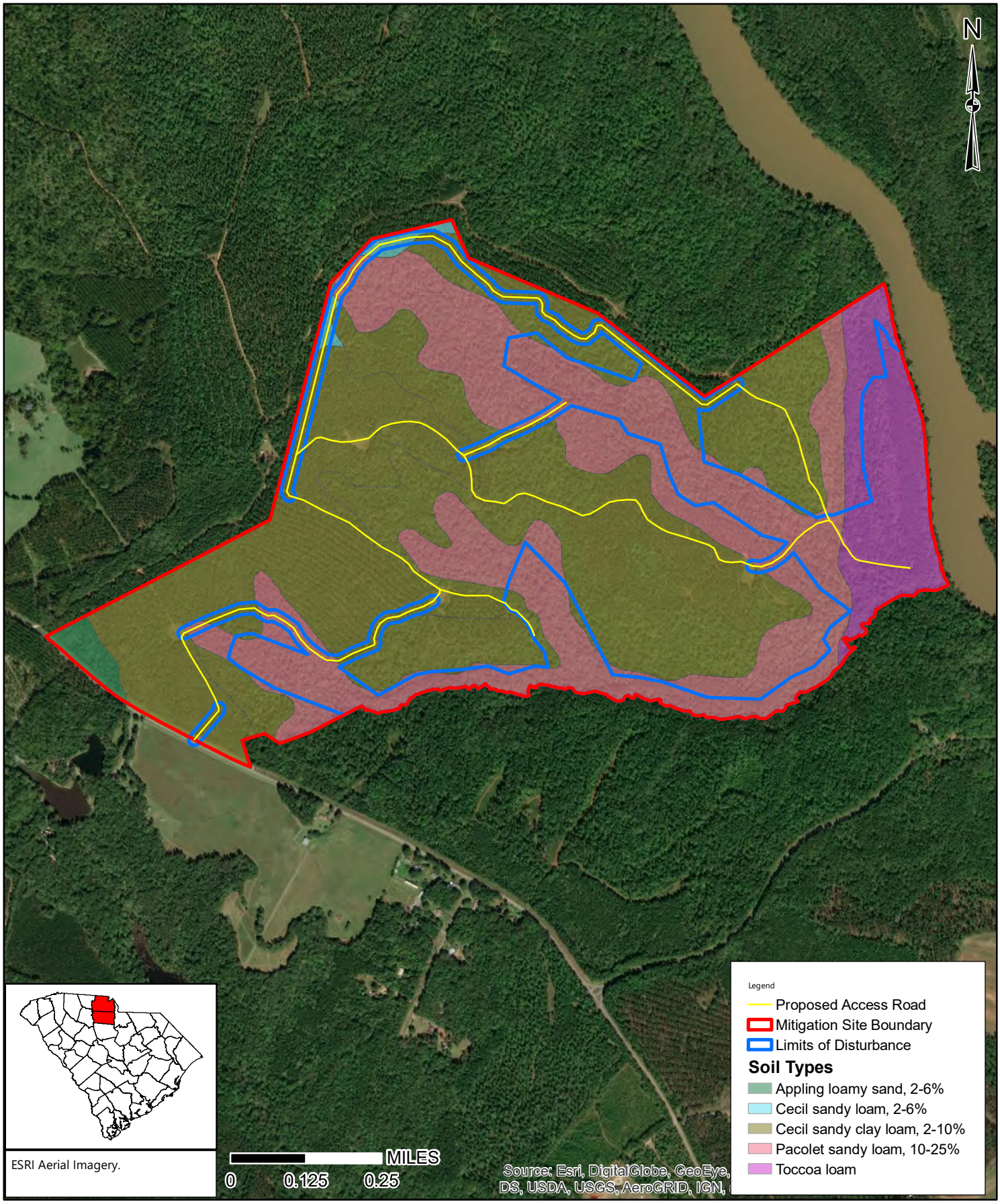
# Soils Map

Project Inspector Project Area

Chester and York Counties, South Carolina

FIGURE NO.

2.1

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| PROJECT NO: | 4261-19-077 |
| DRAWN BY: | KJN |
| DATE: | 1/20/2020 |

# Soils Map

Project Inspector Mitigation Site

Chester and York Counties, South Carolina

FIGURE NO.

2.2

## 2.5 Climate and Vegetation

The climate of Chester and York counties is characterized as humid subtropical, with hot, humid summers and cool, dry winters. Precipitation does not vary greatly by season; July is the hottest month with an average temperature of 91° Fahrenheit (F) and January is the coldest month with an average daily temperature range from 53° F.

Vegetation in the western portion project area consists of secondary growth, planted pine, and mixed pine and hardwood areas; while disturbances include numerous dirt roads, silviculture, and a transmission line corridor (Figures 2.3 through 2.6). The eastern portion of the project area has been largely disturbed by industrial development, paved roadways, and the construction of I-77; there is little to no remaining vegetation that hasn't been planted in association with the development of the area (Figures 2.7 and 2.8). Vegetation in the mitigation site consists of a mix of hardwood stands, planted pine, and areas of mixed pine and hardwood; while disturbances include numerous dirt roads (Figures 2.9 through 2.11).

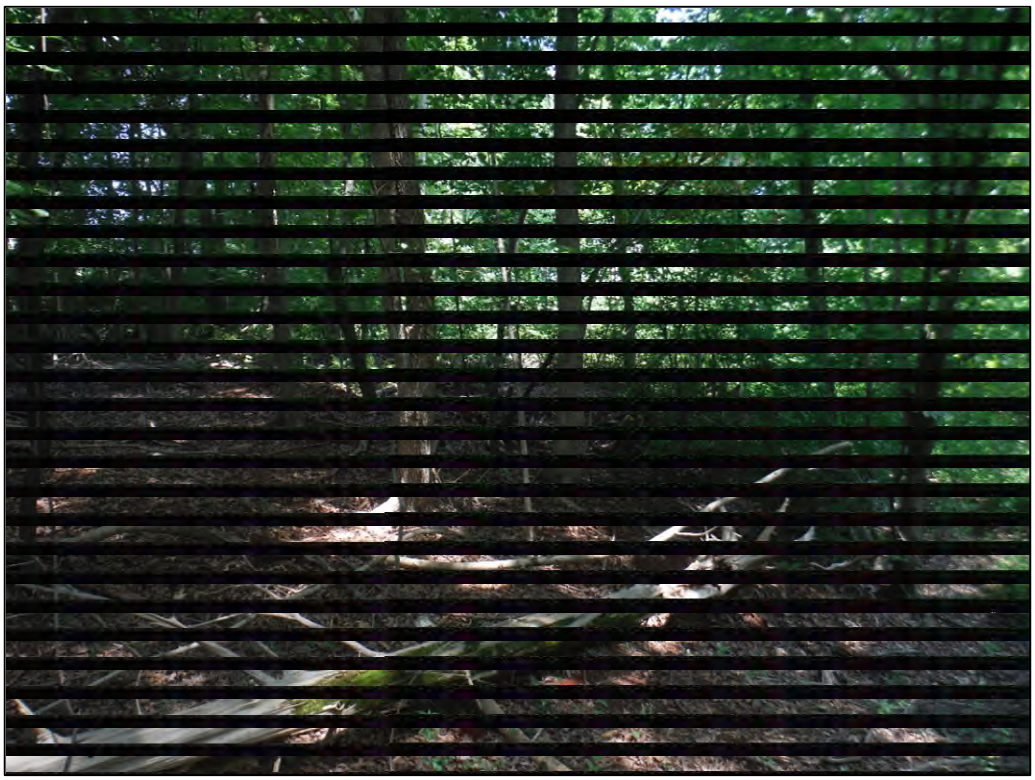


**Figure 2.3. View of typical vegetation in western portion of the project area in wooded areas, facing east.**

**Figure 2.4. View of typical vegetation in western portion of the project area in fallow fields, facing west.**

**Figure 2.5. Typical vegetation and disturbance associated with the transmission line corridor and dirt roads, facing south.**

**Figure 2.6. View of disturbance associated with the railroad and transmission line corridors in southern portion of the project area, facing south.**

**Figure 2.7. Vegetation in eastern portion of the project area, facing west.**

**Figure 2.8. Industrial park and associated development in eastern portion of the project area, facing southwest.**

**Figure 2.9. Mixed pine and hardwood within the mitigation site, facing southwest.**

**Figure 2.10. Planted pine within the mitigation site, facing east.**

**Figure 2.11. Typical dirt road within the mitigation site, facing east.**

# 3.0 Cultural Context

The cultural context of the region is reviewed below for two purposes: first, to outline previous research in the region as well as the nature of historic and prehistoric resources that might be expected in the project area, and second, to provide a comparative framework in which to place resources identified within the project area and area of potential effects (APE) in order to better understand their potential significance and NRHP eligibility. The cultural context of the project area includes the prehistoric record and the historic past, which are discussed in this section of the report.

## 3.1 Prehistoric Context

Over the last three decades there has been much debate over when humans first arrived in the New World. The traditional interpretation is that humans first arrived in North America via the Bering land bridge that connected Alaska to Siberia at the end of the Pleistocene, approximately 13,500 years ago. From Alaska and northern Canada, these migrants may have moved southward through an ice-free corridor separating the Cordilleran and Laurentide ice sheets to eventually settle in North and South America.

Some researchers have suggested that initial colonization of the New World began well before Clovis, with some dates going back more than 35,000 years (Dillehay and Collins 1988; Goodyear 2005). Evidence for pre-Clovis occupations are posited for the Meadowcroft Rockshelter in Pennsylvania, the Cactus Hill and Saltville sites in Virginia, and the Topper site in South Carolina, although this evidence is not widely accepted and has not been validated (Adovasio and Pedler 1996; Dillehay and Collins 1988; Goodyear 2005). A number of sites providing better evidence for a presence in the New World dating between 15,000 and 13,500 years ago have been discovered. Although far from numerous, these sites are scattered across North and South America, including Alaska, Florida, Missouri, Oregon, Tennessee, Texas, Wisconsin, and southern Chile. Despite this, the earliest definitive evidence for occupation in the Southeastern United States is at the end of the Pleistocene, approximately 13,000 years ago (Anderson and O'Steen 1992; Bense 1994).

### *3.1.1 Paleoindian Period (ca. 13,000–10,000 B.P.)*

Unfortunately, most information about Paleoindian lifeways in the Southeast comes from surface finds of projectile points rather than from controlled excavations. However, the Tree House site (38LX531), located along the Saluda River near Columbia, has shed light on Paleoindian lifeways in the area. The Tree House site is a multi-component, stratified site containing occupations ranging from the Early Paleoindian to Mississippian periods (Nagle and Green 2010). Evidence from the site, which yielded an *in-situ* Clovis point, indicated short-term use by relatively mobile populations. The tools found at the Tree House site could have been used for hunting and butchering, and it is likely that the site was used as a hunting camp during the Early and Late Paleoindian subperiods. Lithic raw materials associated with the Paleoindian component tended to be higher quality stone such as Black Mingo chert, Coastal Plain chert, and crystal quartz, although lesser quality local materials such as quartz were used as well (Nagle and Green 2010:264).

The limited information we have for the Paleoindian Period suggests the earliest Native Americans had a mixed subsistence strategy based on the hunting (or scavenging) of the megafauna and smaller game combined with the foraging of wild plant foods. Groups are thought to have consisted of small, highly transient bands made up of several nuclear and/or extended families. Paleoindian artifacts have been found in both riverine and inter-riverine contexts (Charles and Michie 1992:193). Paleoindian projectile points appear to be concentrated along major rivers near the Fall Line and in the Coastal Plain, although it is almost certain that many additional sites

along the coast have been inundated by the rise of sea level that has occurred since that time (Anderson et al. 1992; Anderson and Sassaman 1996).

Paleoindian tools are typically well-made and manufactured from high-quality, cryptocrystalline rock such as Coastal Plain and Ridge and Valley chert, as well as Piedmont metavolcanics such as rhyolite (Goodyear 1979). Paleoindians traveled long distances to acquire these desirable raw materials and it is likely that particularly favored quarries were included in seasonal rounds, allowing them to replenish their stock of raw material on an annual basis.

The most readily recognizable artifact from the early Paleoindian Period is the Clovis point, which is a fluted, lanceolate-shaped spear point. Clovis points, first identified from a site in New Mexico, have been found across the nation, although they tend to be clustered in the eastern United States (Anderson and Sassaman 1996:222). Paleoindian artifact assemblages typically consist of diagnostic lanceolate projectile points, scrapers, gravers, unifacial and bifacial knives, and burins. Projectile point types include fluted and unfluted forms, such as Clovis, Cumberland, Suwanee, Quad, and Dalton (Anderson et al. 1992; Justice 1987:17–43).

In South Carolina, the Clovis subperiod is generally thought to date from 11,500 to 11,000 B.P. (Sassaman et al. 1990:8), however, radiocarbon data indicate that a more accurate time frame for the Clovis subperiod in North America may be 11,050 to 10,800 B.P. (Waters and Stafford 2007); this has yet to gain widespread acceptance. Suwanee points, which are slightly smaller than Clovis points, are dated from 11,000 to 10,500 B.P. This is followed by Dalton points, which are found throughout the Southeast from about 10,500 to 9900 B.P.

### *3.1.2 Archaic Period (ca. 10,000–3000 B.P.)*

Major environmental changes at the terminal end of the Pleistocene led to changes in human settlement patterns, subsistence strategies, and technology. As the climate warmed and the megafauna became extinct, population size increased and there was a simultaneous decrease in territory size and settlement range. Much of the Southeast during the early part of this period consisted of a mixed oak-hickory forest. Later, during the Hypsithermal interval, between 8000 and 4000 B.P., southern pine communities became more prevalent in the interriverine uplands and extensive riverine swamps were formed (Anderson et al. 1996a; Delcourt and Delcourt 1985).

The Archaic Period typically has been divided into three subperiods: Early Archaic (10,000–8000 B.P.), Middle Archaic (8000–5000 B.P.), and Late Archaic (5000–3000 B.P.). Each of these subperiods appears to have been lengthy, and the inhabitants of each were successful in adapting contemporary technology to prevailing climatic and environmental conditions of the time. Settlement patterns are presumed to reflect a fairly high degree of mobility, making use of seasonally available resources in the changing environment across different areas of the Southeast. The people relied on large animals and wild plant resources for food. Group size gradually increased during this period, culminating in a fairly complex and populous society in the Late Archaic.

#### Early Archaic (10,000–8000 B.P.)

During the Early Archaic, there was a continuation of the semi-nomadic hunting and gathering lifestyle seen during the Paleoindian Period; however, there was a focus on modern game species rather than on the megafauna, which had become extinct by that time. During this time there also appears to have been a gradual, but steady increase in population and a shift in settlement patterns. In the Carolinas and Georgia, various models of Early Archaic social organization and settlement have been proposed (Anderson et al. 1992; Anderson and

Hanson 1988). In general, these models hypothesize that Early Archaic societies were organized into small, band-sized communities of 25 to 50 people whose main territory surrounded a portion of a major river (Anderson and Hanson 1988: Figure 2). During the early spring, groups would forage in the lower Coastal Plain and then move inland to temporary camps in the Piedmont and mountains during the summer and early fall. In the late fall and winter, these bands would aggregate into larger, logistically provisioned base camps in the upper Coastal Plain, near the Fall Line. It is believed that group movements would have been circumscribed within major river drainages, and that movement across drainages into other band territories was limited. At a higher level of organization, bands were believed to be organized into larger "macrobands" of 500 to 1,500 people that periodically gathered at strategic locations near the Fall Line for communal food harvesting, rituals, and the exchange of mates and information.

Daniel (1998, 2001) has argued that access to high quality lithic material has been an under-appreciated component of Early Archaic settlement strategies. He presents compelling evidence that groups were moving between major drainages just as easily as they were moving along them. In contrast to earlier models, group movements were tethered to stone quarries rather than to specific drainages. Regardless of which model is correct, settlement patterns generally reflect a relatively high degree of mobility, making use of seasonally available resources such as nuts, migratory water fowl, and white-tailed deer.

Diagnostic markers of the Early Archaic include a variety of side and corner notched projectile point types such as Hardaway, Kirk, Palmer, Taylor, and Big Sandy, and bifurcated point types such as Lecroy, McCorkle, and St. Albans. Other than projectile points, tools of the Early Archaic subperiod include end scrapers, side scrapers, gravers, microliths, and adzes (Sassaman et al. 2002), and likely perishable items such as traps, snares, nets, and basketry. Direct evidence of Early Archaic basketry and woven fiber bags was found at the Icehouse Bottom site in Tennessee (Chapman and Adovasio 1977).

## Middle Archaic (8,000–5000 B.P.)

The Middle Archaic subperiod coincides with the start of the Altithermal (a.k.a. Hypsithermal), a significant warming trend where pine forests replaced the oak-hickory dominated forests of the preceding periods. By approximately 6000 B.P., extensive riverine and coastal swamps were formed by rising water tables as the sea level approached modern elevations (Whitehead 1972). It was during this subperiod that river and estuary systems took their modern configurations. The relationship between climatic, environmental, and cultural changes during this subperiod, however, is still poorly understood (Sassaman and Anderson 1995:5–14). It is assumed that population density increased during the Middle Archaic, but small hunting and gathering bands probably still formed the primary social and economic units. Larger and more intensively occupied sites tend to occur near rivers and numerous small, upland lithic scatters dot the interriverine landscape. Subsistence was presumably based on a variety of resources such as white-tail deer, nuts, fish, and migratory birds; however, shellfish do not seem to have been an important resource at this time.

During the Middle Archaic, groundstone tools such as axes, atlatl weights, and grinding stones became more common, while flaked stone tools became less diverse and tend to be made of locally available raw materials (Blanton and Sassaman 1989). Middle Archaic tools tend to be expediently manufactured and have a more rudimentary appearance than those found during the preceding Paleoindian and Early Archaic periods. The most common point type of this subperiod is the ubiquitous Morrow Mountain, but others such as Stanly, Guilford, and Halifax also occur, as well as transitional Middle Archaic-Late Archaic forms such as Brier Creek and Allendale/MALA (an acronym for Middle Archaic Late Archaic) (Blanton and Sassaman 1989; Coe 1964). The major

difference in the artifact assemblage of the Stanly Phase seems to be the addition of stone atlatl weights. The Morrow Mountain and Guilford phases also appear during the Middle Archaic, but Coe (1964) considers these phases to be without local precedent and views them as western intrusions.

#### Late Archaic (5000–3000 B.P.)

The Late Archaic is marked by a number of key developments. There was an increased focus on riverine locations and resources (e.g., shellfish), small-scale horticulture was adopted, and ceramic and soapstone vessel technology was introduced. These changes allowed humans to occupy strategic locations for longer periods of time. In the spring and summer, Late Archaic people gathered large amounts of shellfish. It is not known why this productive resource was not exploited earlier, but one explanation is that the environmental conditions conducive to the formation of shellfish beds were not in place until the Late Archaic. Other resources that would have been exploited in the spring and summer months include fish, white-tailed deer, small mammals, birds, and turtles (House and Ballenger 1976; Stoltman 1974). During the late fall and winter, populations likely subsisted on white-tailed deer, turkey, and nuts such as hickory and acorn. It is also possible that plants such as cucurbita (squash and gourds), sunflower, sumpweed, and chenopod, were being cultivated on a small-scale basis.

The most common diagnostic biface of this subperiod is the Savannah River Stemmed projectile point (Coe 1964), a broad-bladed stemmed point found under a variety of names from Florida to Canada. There are also smaller variants of Savannah River points, including Otarre Stemmed and Small Savannah River points that date to the transitional Late Archaic/Early Woodland. Other artifacts include soapstone cooking discs and netsinkers, shell tools, grooved axes, and worked bone.

The earliest pottery in the New World comes from the Savannah River Valley and coastal regions of South Carolina and Georgia. Both Stallings Island and Thom's Creek pottery date from about 4500–3000 B.P. and have a wide variety of surface treatments including plain, punctated, and incised designs (Sassaman et al. 1990). For a long time it was believed that fiber-tempered Stallings Island pottery was the oldest pottery in the region (perhaps in the New World), and that sand-tempered Thom's Creek wares appeared a few centuries later (Sassaman 1993). Work at several shell ring sites on the coast, however, has demonstrated that the two types are contemporaneous, with Thom's Creek possibly even predating Stallings Island along the coast (Heide and Russo 2003; Russo and Heide 2003; Saunders and Russo 2002).

### *3.1.3 Woodland Period (ca. 3000–1000 B.P.)*

Like the preceding Archaic Period, the Woodland is traditionally divided into three subperiods—Early Woodland (3000–2300 B.P.), Middle Woodland (2300–1500 B.P.), and Late Woodland (1500–1000 B.P.)— based on technological and social advances and population increase. Among the changes that occurred during this period were a widespread adoption of ceramic technology, an increased reliance on native plant horticulture, and a more sedentary lifestyle. There is also an increase in sociopolitical and religious interactions as evidenced by an increased use of burial mounds, increased ceremonialism, and expanded trade networks (Anderson and Mainfort 2002). In addition, ceramics became more refined and regionally differentiated, especially with regard to temper.

#### Early Woodland (3000–2300 B.P.)

The Early Woodland subperiod is generally marked by the intensification of horticulture, an increased use of ceramics in association with a semisedentary lifeway, and the introduction of the bow and arrow. The earliest expression of the Early Woodland subperiod in the Piedmont is the Badin phase (Ward and Davis 1999).

Representative cultural material includes sand-tempered cordmarked or fabric-impressed ceramics and large, crude triangular projectile points (Ward and Davis 1999). Differences between the southern and northern Piedmont traditions became more pronounced through time and by the Late Woodland subperiod ceramics were quite diversified (Ward 1983).

### Middle Woodland (2300–1500 B.P.)

In some areas of the Piedmont, the Middle Woodland subperiod is characterized by the Yadkin phase, whose ceramics are similar to the previous Badin type, except they are tempered with crushed quartz rather than sand (Ward and Davis 1999). However, as Webb and Leigh (1995:29) point out, there is no clear, linear relationship between the development of the two phases. In some areas, Yadkin may represent the earliest ceramics, whereas in other areas Badin may be the earliest type. The Yadkin Large Triangular Point is the diagnostic point of the Early and Middle Woodland subperiods throughout much of North and South Carolina. Although substantial regional differences appear during this time, the Piedmont region was relatively unaffected by the elaborate Hopewell and Swift Creek cultures.

### Late Woodland (1500–1000 B.P.)

The Late Woodland subperiod is one of the least understood prehistoric subperiods, both in the South Carolina Piedmont and in the Southeast as a whole. Few diagnostic artifacts are known that can definitively date occupations to this subperiod. The few diagnostic artifacts associated with the Late Woodland subperiod in the South Carolina Piedmont include small triangular and pentagonal projectile points, as well as Swift Creek, Napier, and Woodstock ceramics (Benson 2006:53–54).

## *3.1.4 Mississippian Period (ca. 1000–350 B.P.)*

The Mississippian Period saw dramatic changes across most of the Southeast. Mississippian societies were complex sociopolitical entities that were based at mound centers, usually located in the floodplains along major river systems. The flat-topped platform mounds served as both the literal and symbolic manifestation of a complex sociopolitical and religious system that linked chiefdoms across a broad network stretching from the Southeastern Atlantic Coast, to Oklahoma (Spiro Mounds) in the west, to as far north as Wisconsin (Aztalan). Mound centers were surrounded by outlying villages that usually were built along major rivers to take advantage of the rich floodplain soils. Smaller hamlets and farmsteads dotted the landscape around villages and provided food, tribute, and services to the chief in return for protection and inclusion in the sociopolitical system. While Mississippian subsistence was focused to a large extent on intensive maize agriculture, the hunting and gathering of aquatic and terrestrial resources supplemented Mississippian diets (Anderson 1994).

Mound centers have been found along most major river systems in the Southeast, and South Carolina is no exception. Major Mississippian mounds in the area include the Belmont and Mulberry sites along the Wateree River in central South Carolina; Santee/Fort Watson/Scotts Lake on the Santee River; the Irene site near Savannah; Hollywood, Lawton, Red Lake, and Mason's Plantation in the central Savannah River Valley; and Town Creek along the Pee Dee River in North Carolina (Anderson 1994).

Diagnostic artifacts of the Mississippian Period include small triangular projectile points and sand-tempered Lamar, Savannah, and Etowah pottery types (Anderson and Joseph 1988; Elliot 1995). These types are primarily identified by their complicated stamped designs, although simple stamped, check stamped, cordmarked, and

other surface treatments also occur. Various ceremonial items made from stone, bone, shell, copper, and mica were used as symbolic markers of chiefly power and status.

There is increasing evidence that territorial boundaries between chiefdoms were closely maintained during the Mississippian Period. Within the South Carolina Piedmont, Judge (2003, see also DePratter and Judge 1990) has identified six phases of Mississippian occupation within the Wateree Valley: Belmont Neck (A.D. 1200–1250), Adamson (A.D. 1250–1300), Town Creek (A.D. 1300–1350), McDowell (A.D. 1350–1450), Mulberry (A.D. 1450–1550), and Daniels (A.D. 1550–1675). Cable (2000) adds a Savannah phase (A.D. 1200–1300) to this list, between the Belmont Neck phase (which he puts at A.D. 1100–1200) and Adamson phase (which he places between A.D. 1300–1350). Meanwhile, groups living in the southern part of the North Carolina Piedmont were part of the Pee Dee culture, which includes the Teal (A.D. 950–1200), Town Creek (A.D. 1200–1400), and Leak (A.D. 1400–1600) phases (Ward and Davis 1999:123–134).

## 3.2 Historical Context

With its fertile soil and natural transportation advantages, land along the Catawba River has long been attractive for human settlement. During the seventeenth and eighteenth century, encroachment of European settlers and their African slaves into the coastal areas forced many Lowcountry native groups to migrate north and west towards the area around the Catawba River. Here these groups eventually merged and became known as the Catawba Nation (Hudson 1970; Merrell 1989). From the 1700s through the present day, the Catawba Nation and the expanding population of South Carolina have carried out their lives in the Piedmont region. Like other Native American tribes, the Catawba were often at odds with state and federal governments during the nineteenth and twentieth centuries, fighting to maintain their ancestral homelands and hunting grounds. Today, the Catawba Nation continues to survive in the area around the river, retaining some aspects of their traditional culture (Green et al. 2002).

### *3.2.1 Chester County*

The land that became Chester County was still considered backcountry during the early 1700s; although officially part of St. Mark's Parish, which was used as its judicial division, the land in the northern portion of the parish was very remote from the organized parish center. However, despite its out-of-the-way location, settlement had begun on Rocky Creek and Fishing Creek, within the boundary of present day Chester County, by 1755, approximately 500 white families resided within a 30 mile radius of the Catawba Nation. The majority of early settlers in the area migrated from northern colonies, such as Virginia and Pennsylvania, although some did move inland from Lowcountry areas (Merrell 1989:177–180; Shankman et. al. 1983:13–15; Kovacik and Winberry 1989:80). In 1764, a boundary was surveyed between North and South Carolina, which established this area as the northern portion of South Carolina. In 1769, when the colony was divided into districts, the area became part of Camden District (Stauffer 1998:8).

From the late seventeenth century into the early eighteenth century, rice and indigo were the primary cash crops for South Carolina farmers, with the largest settlements concentrated around the coast and tidal rivers. After the American Revolution, indigo underwent a sharp decline and, although rice was still grown in tidal areas, it was surpassed in importance by cotton, especially in areas further from the coast. Eli Whitney's 1793 invention of the cotton gin significantly bolstered this migration to cotton as the principal agricultural yield in South Carolina. This invention made farming of short-staple cotton in upcountry areas profitable by greatly decreasing the amount of labor needed to separate the cotton seeds from the fibers (Green et al. 2002; Kovacik and Winberry 1989:83–95).

In 1785, Chester County was established, with boundaries the same as its present-day area, from Camden District; five years later, the new United States government conducted the first census. At this time Chester County had a population of 6,866, with 5,881 of the residents classified as free whites, 47 considered "other free persons," and only 938, or less than 14 percent of the population, listed as slaves. Following the turn of the nineteenth century, until the Civil War, the population of Chester County not only expanded, but it also changed significantly in its composition. By 1800, area farmers had begun to convert to mass cotton production and slave populations increased during the first decades of the nineteenth century. In 1800, Chester County's slave population comprised only 14.2 percent of the county's overall residents. By 1820, the number of slaves in Chester County had more than tripled from its 1800 figure and had increased nearly five times from its 1790 figure, and by 1840 there were 7,692 slaves in the county—more than 6.5 times the number recorded only forty years earlier. Although slavery had become more widespread in the county by 1840, slaves only accounted for slightly more than 43 percent of the Chester County's total population, which remained significantly below the state average of 54.2 percent. However, by 1860, widespread slavery in Chester County had increased the slave population to nearly 60 percent of the county's population (Social Explorer 2019).

Chesterville (shortened to Chester in 1886) was created shortly after the creation of the county; by 1795, the town, then known as Chester Court House, was awarded a United States Post Office. The community was settled by Scots-Irish families and served as a central trading post for the farms within the county. The original courthouse was built in the 1790s, with the current courthouse being the third within the town and was built in 1852. Despite being the county seat, the town was not officially chartered as a municipality until 1840.

By 1861, the region was facing the reality of the Civil War. Agriculture was disrupted by men leaving for war and cotton, no longer being sold and shipped to Northern manufacturers, sat in warehouses waiting for a buyer. Although Chester County did not experience significant battles during the conflict, the Piedmont region of South Carolina, especially land near the rivers and along the railroad, was important to the Confederacy. The roads, canals, and railroads provided vital routes for the movement of supplies and troops from the lower south into North Carolina and Virginia. As the war progressed, troop movements and skirmishes came closer to home. During 1864 and 1865, Union troops moved northward through South Carolina, burning and looting, with residents from captured cities fleeing before them. Some of these refugees fled to Chester County, seeking protection ahead of the approaching army, and Chesterville became the most southern railroad point in the Confederacy following the destruction of Columbia. Chesterville had a Confederate arsenal and four hospitals to care for wounded soldiers; it was also the final railroad stop for both the Confederate Treasury and for Varina Davis, the wife of Jefferson Davis, and her family as they traveled south from Richmond to join Jefferson Davis in Georgia.

Like many other South Carolina residents, those in the Chester County region mostly returned to cotton farming after the Civil War, often limiting their production to only cotton, or supplementing it with a small amount of corn. As cotton prices dropped, farmers had to grow more of the crop just to pay their bills. Farms in Chester County increased in number but decreased in size after the war. From 1860 to 1880, the number of farms in the county nearly tripled; by 1920, the number of farms in the county grew to 4,144, more than four times the 1860 number, as large plantations were divided and worked by tenant farmers or sharecroppers. These systems, where small farmers worked for larger landowners, often for only a small share of profits, created a perpetual system of borrowing and debt. In turn, this necessitated the cultivation of more marginal land (Social Explore 2019; Kovacik and Winberry 1987:108–111; Green et al. 2002).

In addition to the breaking up of large farms, exhausted soils caused many farmers to migrate towards the Broad and Catawba rivers area, looking for lands that were more fertile to increase their yields. Tenants were constantly seeking better soils and larger plots to help stay afloat in the poor cotton market. This ongoing cycle of tenancy and mobility lasted throughout the early twentieth century. The situation was further exacerbated by boll weevil infestations that caused a virtual collapse of the state's cotton industry. By the end of World War I, over 76 percent of farms in Chester County were operated by tenants, approximately 11 percent higher than the state average. Although both black and white farmers were part of this system, blacks were more marginalized than their white counterparts and were more affected by these developments. This left them unable to free themselves from tenancy and sharecropping, and resulted in 82.7 percent of tenants in Chester County being classified as "non-white" (Social Explorer 2019; Kovacik and Winberry 1987:108–111; Green et al. 2002).

Although cotton production still dominated the South Carolina Piedmont region, industrial development began to develop in the late nineteenth century. Following a pattern that was occurring throughout the South, investors began financing and building mills to bring textile production closer to the source of raw cotton. They also reinvested in railroads, in an attempt to link more rural farming areas directly to mill towns and ultimately to northern markets (Kovacik and Winberry 1987:114–115). In 1888, the Chester Manufacturing Company began operation and the Catawba Spinning Company mill opened in 1892; the Chester Manufacturing Company would later become Springsteen Mills and the spinning operation would be renamed Eureka Cotton Mill. In 1896, Benjamin Dawson Heath created Manetta Mills and its mill town of Lando, which housed a fulling mill and eventually had a company owned railroad leading from the town to Edgemoor (Berni et al. 2001; Moore 1989:220, 226–227).

Chester County was no different from many Southern communities during the first half of the twentieth century. While the total population of the county increased between 1910 to 1940, from 29,429 to 32,579 residents, the non-white population fell by over 4,000, as many African-Americans left the rural south for larger cities in the Northeast and Midwest, searching for steady work and better pay (Kovacik and Winberry 1987; Social Explorer 2019).

In addition to the expansion of industrial and residential development, the Catawba River area also underwent some major changes that would greatly affect the topography of the Piedmont region. The new textile mills needed electricity to run their machines and, in 1900, brothers Walker G. Wylie and Robert H. Wylie realized this opportunity and incorporated the Catawba Power Company. In 1904, they began to operate a hydroelectric station at India Hook on the Catawba River. This was the first station in what would become a network of generators. A flood destroyed the dam and generating station in 1916, but both the station and the dam were rebuilt in 1925 and named Wylie for the original founders. Also in 1916, the Fishing Creek Dam and Hydroelectric Station were built in eastern Chester County, creating Fishing Creek Reservoir and drying up a large portion of the Great Falls that once flowed south of the dam. The Catawba Power Company changed its name to the Southern Power Company, which then merged with the Duke Power Company in 1927. In 1985, Duke Power began the operation of the Catawba Nuclear Station on Lake Wylie (Green et al. 2002; Shankman et al. 1983).

World War II provided a jumpstart to the textile industry, which continued after the fighting was over; however Chester County industries did not compete with those in nearby York County or the social and economic advantages of nearby Charlotte. By 1946, 16 textile companies employed over 6,000 residents in the nearby Rock Hill area but the textile industry in Chester County was much smaller. The different types of textiles made in the surrounding area was supplemented by other industry, including the production of truck bodies, soft drinks, and dairy products. By 1950, Chester County's population had only increased by 18 residents over the previous decade

and by 1960, the population had declined by nearly 2,000 residents (Shankman et al. 1983:156–157; Social Explorer 2019).

### *3.2.2 York County*

From its earliest settlement, South Carolina was viewed as a source of wealth for its colonial power, primarily through agricultural production. When English settlers established Charles Towne in 1670, they were following in the footsteps of both the Spanish and the French by attempting to found a permanent settlement along the Carolina coast. Unlike previous attempts, however, the Charles Towne settlement was ultimately successful. Although the earliest colonists concentrated themselves along the coast, throughout the area known as the Lowcountry, some settlers began to move further inland during the early and mid-eighteenth century. The establishment of inland townships in the 1730s attracted more residents to the area, although the closest townships to present-day York County were Saxe Gothe, which developed into Lexington near the confluence of the Congaree and Saluda rivers, and Fredericksburg, which later became Pine Tree Hill (and then Camden) located northeast of the Wateree River (Edgar 1998:53–60).

Although a portion of the land that comprises York County was still part of the Catawba territory during this time, the area attracted settlers and, by 1755, approximately 500 white families resided within a 30 mile radius of the Catawba Nation. The majority of early settlers in the area migrated from northern colonies, such as Virginia and Pennsylvania, although some did move inland from Lowcountry areas (Merrell 1989:177–180; Shankman et. al. 1983:13–15; Kovacik and Winberry 1989:80). In 1764, a boundary was surveyed between North and South Carolina, which established the area as the northern portion of South Carolina. In 1769, when the colony was divided into districts, the area became part of Camden District (Stauffer 1998:8).

By 1765, there were at least 10,000 settlers residing in the Piedmont region. At the outbreak of the American Revolution, a decade later, population increases had made the European settlements in this area important strategic points (Moore 1993:19). Fighting in the inland areas of South Carolina increased in 1780, after the capture of Charleston and Camden by the British. The American victory at King's Mountain in northern York County, in October 1780, significantly hindered British attempts to recruit more loyalist soldiers in the South Carolina interior, caused General Cornwallis to delay his march into North Carolina, and ultimately proved to be a considerable blow to British confidence (Gordon 2003:116; Edgar 1998:235). Eventually, the British were forced to abandon their inland outposts, and subsequently Charleston, in December 1782 (Edgar 1998:240).

Yorkville (which shortened its name to York in 1915), originally referred to as Fergus Crossroads, was made the county seat when York County was created in 1785. The community had been settled in the 1750s by Scots-Irish families, who had migrated to the area from Pennsylvania via the Great Wagon Road. The original settlement was named after the tavern, which was owned by William and John Fergus, and the crossroads became the intersection of Congress and Liberty streets. A frame courthouse and a jail were constructed in 1786, on land donated by William Edward Hayne; a new brick courthouse replaced the frame structure shortly afterward. By 1823, the town had a population of 415 residents, comprised of 292 white residents (approximately 70 percent) and 123 black residents. Yorkville was officially incorporated in 1841, the town charter was drafted in 1849, and the first city council met in 1850 (*Yorkville Enquirer* 1889 February 27; *The State* 1958 October 5; Burr 1979).

In 1790, the new United States government conducted the first census. At this time York County had a population of 6,604, with 5,600 of the residents classified as free whites, 29 considered "other free persons," and only 923, or less than 15 percent of the population, listed as slaves. Following the turn of the nineteenth century, until the Civil

War, the population of York County not only expanded, but it also changed significantly in its composition. By 1800, area farmers had begun to convert to mass cotton production and slave populations increased dramatically during the first decades of the nineteenth century. By 1810, the number of slaves in York County had tripled from the 1790 figure, and by 1830 there were 6,633 slaves in the county—more than six times the number recorded only forty years earlier. Although slavery had become more widespread in the county by 1830, slaves only accounted for slightly more than 35 percent of the York County's total population, which remained significantly below the state average of 54.2 percent (Social Explorer 2019).

In addition to the cotton gin and the growth in slave labor, cotton farmers also benefited from canal construction, which peaked in South Carolina during the early 1800s. These canals, including the Langsford and Lockhart canals, made shipment of raw cotton to coastal markets easier and significantly less expensive than travel over roads. Access to coastal markets made selling cotton as a cash crop a profitable enterprise, allowing plantation owners to increase land holdings and wealth (Shankman et al. 1983:19–24; Kovacik and Winberry 1989). Also benefiting upstate cotton farmers was the presence of railroads, which proved to be a better means of transporting agricultural products than canals by traveling more quickly, carrying more cotton, and reaching more areas. The Charlotte and South Carolina Railroad, spanning from Charleston to Chester, began running through York County in 1852; three years later, a spur line, King's Mountain Railroad, was completed and a railroad trestle was constructed at the natural river crossing of Nation Ford (Kovacik and Winberry 1989: 95–98).

The advent of the railroad fostered the development of towns near the places where trains stopped. Expansion of the railroad system in the Piedmont region of South Carolina encouraged the growth of York and the surrounding counties. Small towns appeared along the railroad routes, and some villages that had already existed grew larger and more prominent. Fort Mill could boast a railroad depot by 1851, although the line coming through the area would not be completed until the following year. In 1852, in an area planned and laid out by local residents Alexander Templeton Black, George Pendleton White, and James Moore, consisting of twenty-three lots on either side of the track and a Main Street, a post office was established and named Rock Hill (Brown 1953:74–77, 87; Green et al. 2002). Yorkville experienced significant growth after the construction of King's Mountain Railroad, as it served as a primary backcountry depot for the Piedmont area. The population of the county seat doubled between 1850 and 1860, to reach nearly 1,500 residents; the per capita wealth of the town was second among the urban areas in the state; and it obtained the nickname "the Charleston of the Upcountry" (*The State* 1958 October 5; Burr 1979; *Yorkville Enquirer* 1889 February 27).

By 1861, the region was facing the reality of the Civil War. During 1864 and 1865, Union troops moved northward through South Carolina, burning and looting, with residents from captured cities fleeing before them. Some of these refugees fled to York County, seeking protection ahead of the approaching army. Recognizing the importance of the railroad trestle at Nation Ford, as it provided an essential link between the northern and southern Confederacy, the Confederate army had constructed a three-sided earthwork to defend this strategic point. Yet this proved of little consequence, since the trestle was destroyed by fire during an April 1865 skirmish between Union and Confederate troops. Shortly afterward, Confederate President Jefferson Davis retreated southward with his cabinet and crossed the Catawba River at Nation Ford, near the charred ashes of the trestle, signaling the approaching end of the Confederacy (Shankman et al. 1983:38; Green et al. 2002).

In addition to the breaking up of large farms, exhausted soils caused many farmers to migrate towards the Catawba River area, looking for lands that were more fertile to increase their yields. Tenants were constantly seeking better soils and larger plots to help stay afloat in the poor cotton market. This ongoing cycle of tenancy

and mobility lasted throughout the early twentieth century. The situation was further exacerbated by boll weevil infestations that caused a virtual collapse of the state's cotton industry. By the end of World War I, nearly 75 percent of farms in York County were operated by tenants, approximately 10 percent higher than the state average. Although both black and white farmers were part of this system, blacks often were more marginalized than their white counterparts and were more affected by these developments. This left them unable to free themselves from tenancy and sharecropping, and resulted in 75 percent of tenants in York County being classified as "non-white" (Social Explorer; Kovacik and Winberry 1987:108–111; Green et al. 2002).

As in the early nineteenth century, towns near railroad depots were established and grew prodigiously. The antebellum settlement of Rock Hill was incorporated as a town in 1870 and, within twenty years, it had become the largest town in York County with 2,744 residents. Two railroads had trains that went through the city during the 1880s, when mill industries began appearing. In 1890, there were 689 residents in Fort Mill, but by 1900 that number had more than doubled to 1,394. Yorkville, which was situated at the junction of the north-south and east-west railroad lines, had a population of 1,600 residents in 1880 and was considered to have tremendous advantages that would only foster additional growth. In addition to the five churches, there were two hotels, two telegraph offices, saw and grist mills, cotton gins, a weekly newspaper, and two major schools. The continued growth of the textile industry during the late 1800s and early 1900s, with the establishment of Cannon Mills and Springs Mills, increased the economic development of the town. However, during the second half of the nineteenth century, Yorkville was also a major hub of Ku Klux Klan activity in South Carolina (US Department of the Interior 1897; Green et al. 2002; *Yorkville Enquirer* 1889 February 27).

Although cotton production still dominated the South Carolina Piedmont region, industrial development began to develop in the late nineteenth century. In 1881, prominent local citizens organized the first textile mill in Rock Hill, the Rock Hill Cotton Factory. The Fort Mill Manufacturing Company opened in 1887 and was the original production facility of Springs Industries, one of the United States' largest textile companies (Moore 1989:220, 226–227). York Cotton Mill, which became Cannon Cotton Mills, opened in 1897; shortly afterward, other mills were built around York, including Victory Cotton Oil Company and Lockmore Cotton Mills (Salo et al. 2008).

By 1910, the network of textile mills in the Piedmont Region was offering a large number of jobs, which influenced many people to move into the nearby towns, including York, Rock Hill, and Fort Mill. Many of these mills were associated with large towns and cities and the mill communities began to interlace with the larger community, as was the case in Rock Hill. In other instances, mill owners situated their mills, as well as the associated housing and commercial ventures, away from the established cities. This created isolated mill towns, such as Red River. Although textile mills were popular investments in the early twentieth century, economic and agricultural depressions hit hard in the 1920s and many mills closed during this time. Some reopened with the increased need for production brought on by World War II (Pettibon 2001:1A; Green et al. 2002).

York County was no different from many Southern communities during the first half of the twentieth century. While the total population of the county increased from 1910 to 1940, the non-white population fell by over 4,000, as many African-Americans left the rural south for larger cities in the Northeast and Midwest, searching for steady work and better pay (Kovacik and Winberry 1987; Social Explorer 2019).

World War II provided a jumpstart to the textile industry, which continued after the fighting, was over; York County populations increased accordingly. By 1946, 16 textile companies employed over 6,000 residents in the Rock Hill area. Production included different types of textiles, such as rayon, poplin, printed and finished cottons,

and hosiery. Truck bodies, soft drinks, and dairy products were also made in the county. By 1950, York County's population had grown to 71,596, up from the 58,663 in 1940. Rock Hill, the largest city in York County and the fifth largest in the state, had a population of 24,502 (Shankman et al. 1983:156–157; Social Explorer 2019).

In the late twentieth and early twenty-first centuries, the Catawba River area has retained its importance and has continued to expand. The December 1983 opening of Interstate 77 was a significant factor in this growth, establishing the Catawba River area as a vital connection between Columbia, South Carolina and Charlotte, North Carolina and ultimately the northeast (Moore 1987: 238–239, 251). Beginning in 1970, residential growth boomed around Lake Wylie and Tega Cay. Regardless of this growth, York County has been unable to sustain its flourishing textile industry, as many companies have moved their businesses out of state and often out of the country. Springs Industries' plant at Fort Mill closed in 1983 and Randolph Yarns closed its Red River mill in December 2000, demolishing the structure in April 2001 (Green et al. 2002; Pettibon 2001:A1).

### *3.2.3 History of the Catawba Nation*

The earliest comprehensive Euro-American account of Native Americans in the Piedmont region of South Carolina came from of John Lawson's 1701 visit to the area. While Lawson actually documents little regarding the Catawba, his description of the Waxhaw is likely representative of the Catawba as well (Hudson 1970:2). Having left Charleston, Lawson visited Sewee, Santee, Congaree, and Wateree villages along the Santee and Wateree rivers before encountering the Waxhaw, Esaw, and Sugaree along the Catawba River in the Piedmont (Merrell 1986:1–7; Hudson 1970:1–2).

Early ethnohistorical accounts of the Catawba identify them as descendants of Siouan-speaking groups who migrated to the Piedmont after A.D. 1000 (Mooney 1894; Speck 1935; Swanton 1946; Brown 1996). Historian James Merrell (1989) has argued that these groups settled at various places along the rivers and streams of South Carolina, creating distinctive identities but sharing a common cultural heritage. By 1700, European influences such as disease, warfare, and trade, as well as battles with the Iroquois, forced these distinctive groups further north and west, toward the Catawba River and into the Piedmont (Hudson 1970; Merrell 1989).

The Catawba River and Nation Ford, a natural ford near the intersection of the Catawba River and Sugar Creek, was an attractive area for the migrating native groups to relocate to, due to its accessibility and rich soils. This was also the area in which the Occaneechi Path, a Native American trading route, connected the Catawba with the Cherokee to the northwest, the English settlements around Jamestown to the north, and European settlements along the South Carolina coast (Hudson 1970). The Occaneechi Path, also known as the Catawba Road or Nation Ford Road, had existed since at least 1645, when forts were constructed along the frontier. This intersection of trade routes placed the Catawba in the powerful position of middlemen between the Virginia colonists, the South Carolina colonists, and the Cherokee (Hudson 1970).

By the seventeenth century, traders from Charleston began to expand into areas beyond the coastal settlement, engaging Native American groups in a lucrative trade of deerskins and slaves for weapons, alcohol, textiles, and other goods. In the Piedmont, South Carolina traders competed with traders from Virginia who had been trading with native groups along the Occaneechi Path since about 1680 (Hudson 1970: 31–39; Merrell 1989).

By 1715, many Indian groups fleeing colonial expansion found refuge among the Catawba. By 1750, the Catawba Nation had become an important player in Colonial politics and militarism (Davis and Riggs 2004; Hudson 1970). These complex political and military alliances can be divided into five periods; English Contact (ca. 1675–1715),

Coalescent (1716–1759), Late Colonial (1760–1775), Revolutionary (1776–1781), and Federal (1781–1820). Each is marked by specific cultural changes (Davis and Riggs 2004).

During the English Contact period, trade between Native Americans and the English began sporadically, but soon developed into strong economic relations, as the Native Americans became dependent on first English and then American goods (Davis and Riggs 2004; Hudson 1970; Merrell 1989). Also during this period, European colonists and Indian raiders captured Native Americans for use as slaves on large plantations. Although provincial laws forbade the practice, traders forced many Native Americans into slavery. By 1708, approximately one third of the slave population in South Carolina was Native Americans (Weir 1997:26–27, 62).

The Coalescent Period began with the Yamasee War in April 1715, when groups such as the Yamasee and Creek attempted to eliminate white settlement in South Carolina because of enslavement, trader abuse, and encroachment on their lands (Green 2001). Although the Catawba had not yet been subjected to enslavement by the settlers, colonial trade practices were a source of contention and, by May 1715, the Catawba had decided to join the war. In 1716, the colonists, with the help of the Cherokee, had defeated the allied native groups, who fled south to find refuge with the Spanish in Florida and north to the Catawba in the Piedmont (Hudson 1970:42–43; Merrell 1986: 66–80). Hudson (1970) has argued that since their participation in the Yamasee War, none of the Catawba's political or military decisions were made without consideration of colonial political power and interests.

In the years following the Yamasee War, the Catawba maintained their homeland in the Piedmont, serving as a buffer for the English settlements along the South Carolina coast from the French intrusion in the north (Davis and Riggs 2004; Merrell 1989). The unintentional protection they provided and the economic base they created forced South Carolina politicians to tolerate and accept, if not respect, the Catawba. At the same time they lost their favored middleman trader status, as Charleston merchants established direct trade routes with the Virginia colonists and the Cherokee (Hudson 1970). Furthermore, the Catawba Nation faced continuing threats from their longtime enemy, the Iroquois. They withstood the Iroquois threats for at least two decades, eventually making peace in 1751 (Merrell 1989). However, disease and continued participation in wars further decreased the number of Catawba, so that, by 1760, a population of only 500 remained (Merrell 1989:195). With a decrease in hunting lands and an increase in disease and warfare, the once powerful Catawba Nation became almost totally reliant on colonial powers and traders for its continued existence.

In 1756, John Evans, a frequent trader to the Catawba, was sent by Governor Glen to document the results of the Treaty of Catawba Town (Brown 1966:206). Evan's observations included a map of the military capabilities of the Catawba Nation (Figure 3.1). Recent research by the University of North Carolina Research Laboratories of Archaeology [UNCRLA] (Davis and Riggs 2004) has attempted to locate and study the Catawba towns represented on the Glen Map of 1756. Four of these towns, Sucah Town, Weyane, Charraw Town, and Noostee are believed to be located along the Great Trading Path near the Catawba River.

The Catawba continued their military alliance with the colonial powers throughout the Late Colonial and Revolutionary periods, fighting against the French in the French and Indian War of 1760–1761 and then against England in the Revolutionary War of 1776–1781 (Brown 1966; Davis and Riggs 2004; Hudson 1970:49–51; Merrell 1989). In 1760, in return for their alliance during the French and Indian War, the Catawba were granted 225 square miles, or 144,000 acres, of land through the Treaty of Pine Tree Hill. Three years later, this grant was confirmed by the Treaty of Augusta (Pettus 2005:6). By 1764, colonial settlement into the Piedmont areas of both North and South Carolina had increased so much that an official boundary was needed between the two states; the Catawba

had their traditional lands along the Catawba River surveyed as well and in 1775 the tract appears on Henry Mouzon's Map (Figure 3.2). Colonial expansion and increased settlement in the backcountry required the creation of judicial districts beyond Charleston and coastal settlements. In 1769, the region, including the project area, became part of the Camden District; York County was created in 1785 (Kovacik and Winberry 1989:7–9; Merrell 1989:198–201).

Throughout the post-Revolutionary Federal Period, the population of the Catawba declined and they consolidated in their 15 square mile area along the Catawba River; at the same time, the white settlement in the area continued to increase. The Catawba's military and economic importance diminished as American settlers, fresh from their victory against the British crown, continued their westward expansion. The Catawba began allowing individual tribe members to rent their acreage to white settlers through leases with up to 99 year terms (Pettus 2005:8). The lease system required the signatures of the tribe headmen on the lease and the state appointed a set of commissioners to oversee and approve the documents. Although there were a number of complaints about this system, from both the Catawba and the white lessees, the leasing system continued into the nineteenth century. Many of the white settlers divided and subleased their land, charging up to 10 dollars per acre for land they had leased for only a few cents per acre. The Catawba complained about this practice, seeking restitution and payments from the "squatters" (Pettus 2005:30–32). However, while they were still recognized by the South Carolina government as a "nation," in reality they numbered little more than 100 persons (Hudson 1970; Merrell 1989). By the turn of the nineteenth century, the Catawba were reduced to a subsistence based on farming and hunting, supplemented with sales of their traditional pottery and leases of their land to American settlers (Davis and Riggs 2004; Hudson 1970; Merrell 1989).

As South Carolina continued to develop and grow throughout the mid-nineteenth century, the state attempted to acquire the meager lands that the Catawba still owned. In 1840, the Catawba signed the Treaty of Nation Ford with the state of South Carolina, which gave them land near the Cherokee in western North Carolina and a yearly stipend in return for their land along the Catawba River. However, South Carolina failed to live up to its agreement and there was continued tension between the Catawba and Cherokee. As a result, in 1848 the Catawba requested to move west of the Mississippi (Hudson 1970: 64–66). In the following decades the Catawba were essentially a people without a home, migrating between North and South Carolina without an official place to reside. In addition, they received little to no money from the government of South Carolina for the sale of their land. By 1850, approximately 100 Catawba were again living on what remained of their traditional land along the Catawba River (Hudson 1970; Merrell 1989: 247–257).

During the twentieth century, the Catawba Indian Nation expanded and changed, as it faced the same economic and military disruptions as the rest of America. With the urging of the Bureau of Indian Affairs, along with state and local governments, the Catawba were encouraged to assimilate into the surrounding community. At the dawn of the new century, the census listed only 66 residents living on the Catawba Indian Reservation (US Department of Interior 1901). During the mid-twentieth century, many Catawba were assimilated into the larger community. They found work in the rapidly increasing textile industry, conducted work for the Works Progress Administration, or joined the military during World War II (Brown 1966; Hudson 1970:81-87). Concurrently, the Catawba revived and maintained some of their traditions, such as pottery production, while losing others, as when the last native speaker of the Catawba language died in the 1950s (Brown 1966). By 1980, the Catawba numbered approximately 1,300, the majority of whom lived away from the 630-acre reservation. In 1980, the Catawba Nation filed suit against the state of South Carolina, claiming that their 1840 treaty had never been ratified by the United States Senate, and was therefore invalid. The Catawba claimed that they had legal right to the 144,000 acres that

comprised their original reservation established in 1760 (Kovacik and Winberry 1987:62–63). After years of legal battles, in 1993 the two sides reached an agreement that restored Catawba federal recognition and provided a $50 million cash settlement (Pettus 2005:56).

## 3.3 Background Research

On June 3 and December 18, 2019, a background literature review and records search was conducted at the South Carolina Institute of Archaeology and Anthropology (SCIAA) in Columbia. The area examined was a 0.5-mile radius around the project area and mitigation site (Figures 3.1 and 3.2). The records examined at SCIAA include a review of ArchSite, a GIS-based program containing information about archaeological and historic resources in South Carolina. If cultural resources were noted within the 0.5-mile search radius, then additional reports and site forms contained at SCIAA and the South Carolina Department of Archives and History (SCDAH) were consulted.

A review of ArchSite for the project area indicated there are two previously recorded archaeological sites, 10 previously recorded structures, 17 NRHP-eligible structures, one NRHP-eligible historic area, and seven previously completed cultural resource surveys within a 0.5-mile radius of the project area (Figure 3.1, Table 3.1). None of the archaeological sites, aboveground resources, or historic areas are within the current project area; the NRHP-eligible historic area is directly adjacent to the boundary of the proposed project area (Figures 1.2 and 1.3). The 17 NRHP-eligible structures are associated with the community of Red River, located roughly 0.3-mile southeast of the eastern edge of the project area; none of the structures are visible from the proposed project area due to the topography and existing industrial/urban development between the project area and the resources.

Of the seven previously conducted cultural resource surveys within a 0.5-mile radius of the project area (Bland 1999; Fletcher and Wagoner 2009; Martin 2016; Norris 2007, 2012, 2017; Wagoner and Fletcher 2010), two have covered portions of the proposed project area (Bland et al. 1999; Fletcher and Wagoner 2009). The 1999 survey was completed for the South Carolina Department of Transportation (SCDOT) for a proposed interchange modification at the I-77/US 21 exit; three archaeological sites and no aboveground resources were identified during the 1999 survey and none of the resources are within the current project area (Bland et al. 1999). The 2009 survey was completed for the SCDOT in association with the Celriver Road widening project (Fletcher and Wagoner 2009); no archaeological sites and six aboveground resources were identified during the survey and none of these resources are within or adjacent to the current project area (Fletcher and Wagoner 2009). The five other surveys did not cover a portion of the current project area.

A review of ArchSite for the mitigation site indicated there are six previously recorded archaeological sites, no previously recorded structures, one NRHP-listed resource, one NRHP-eligible resource, and two previously completed cultural resource surveys within a 0.5-mile radius of the mitigation site (Figure 3.2, Table 3.2). None of the archaeological sites are within the mitigation site, the NRHP-eligible resource is adjacent to the southwestern corner of the mitigation site, and a portion of the NRHP-listed resource is within the mitigation site (Figures 1.4 and 1.5). The two previously completed cultural resource surveys (Nelson 2017 and Norris 2004) do not cover a portion of the mitigation site.

**Table 3.1. Previously recorded cultural resources within a 0.5-mile search radius of the project area.**

| Site Number | Description | Eligibility | Source |
|---|---|---|---|
| 38YK0568 | Prehistoric lithic and ceramic scatter | Not Eligible | Wagoner and Fletcher 2010 |
| 38YK0570 | Prehistoric artifact scatter; Historic artifact scatter | Not Eligible | Wagoner and Fletcher 2010 |
| | Arrowhead Dairy, barns, 1927 and 1931 | Eligible | ArchSite |
| 1541 | Red River Gabled Cottage, 1910 | Eligible | ArchSite |
| 1542 | Red River Hipped Cottage, 1910 | Eligible | ArchSite |
| 1543 | Red River Gabled Cottage, 1910 | Eligible | ArchSite |
| 1544 | Red River Hipped Cottage, 1910 | Eligible | ArchSite |
| 1545 | Red River Gabled Cottage, 1910 | Eligible | ArchSite |
| 1546 | Red River Hipped Cottage, 1910 | Eligible | ArchSite |
| 1547 | Red River Gabled Cottage, 1910 | Eligible | ArchSite |
| 1549 | House, 1915 | Eligible | ArchSite |
| 1550 | House, 1910 | Eligible | ArchSite |
| 1551 | House, 1920 | Eligible | ArchSite |
| 1552 | House, 1920 | Eligible | ArchSite |
| 1553 | House, 1920 | Eligible | ArchSite |
| 1554 | House, 1910 | Eligible | ArchSite |
| 1555 | House, 1920 | Eligible | ArchSite |
| 1556 | House, 1910 | Eligible | ArchSite |
| 1557 | House, 1920 | Eligible | ArchSite |
| 1558 | House, 1910 | Eligible | ArchSite |
| 1559 | Temple Baptist Church, 1920 | Not Eligible | ArchSite |
| 3027 | House, circa 1950 | Not Eligible | ArchSite |
| 3766 | Celriver Church of God, circa 1960 | Not Eligible | ArchSite |
| 3766.01 | Celriver Church of God outbuilding, 1960 | Not Eligible | ArchSite |
| 3767 | Celriver Church of God Parsonage, 1960 | Not Eligible | ArchSite |
| 3768 | House, 1910 | Not Eligible | ArchSite |
| 3769 | House, 1910 | Not Eligible | ArchSite |
| 3769.01 | Outbuilding, 1910 | Not Eligible | ArchSite |
| 3770 | House, 1910 | Not Eligible | ArchSite |
| 3888 | AquaSol Building, circa 1963 | Not Eligible | ArchSite |

**Table 3.2. Previously recorded cultural resources within a 0.5-mile search radius of the mitigation site.**

| Site Number | Description | Eligibility | Source |
|---|---|---|---|
| 38CS0005 | 19th century canal | Not Eligible | ArchSite |
| 38LA0416 | Late Archaic lithic scatter | Not Eligible | ArchSite |
| 38LA0469 | Prehistoric artifact scatter | Not Eligible | ArchSite |
| 38LA0470 | Middle Woodland-Mississippian habitation site | Not Eligible | ArchSite |
| 38LA0471 | Archaic/Woodland/Mississippian habitation site | Not Eligible | ArchSite |
| 38LA0474 | Middle/Late Woodland artifact scatter | Not Eligible | ArchSite |
| 0008 | Landsford Canal | Listed | ArchSite |
| 0044 | Old Stone Graveyard | Eligible | ArchSite |

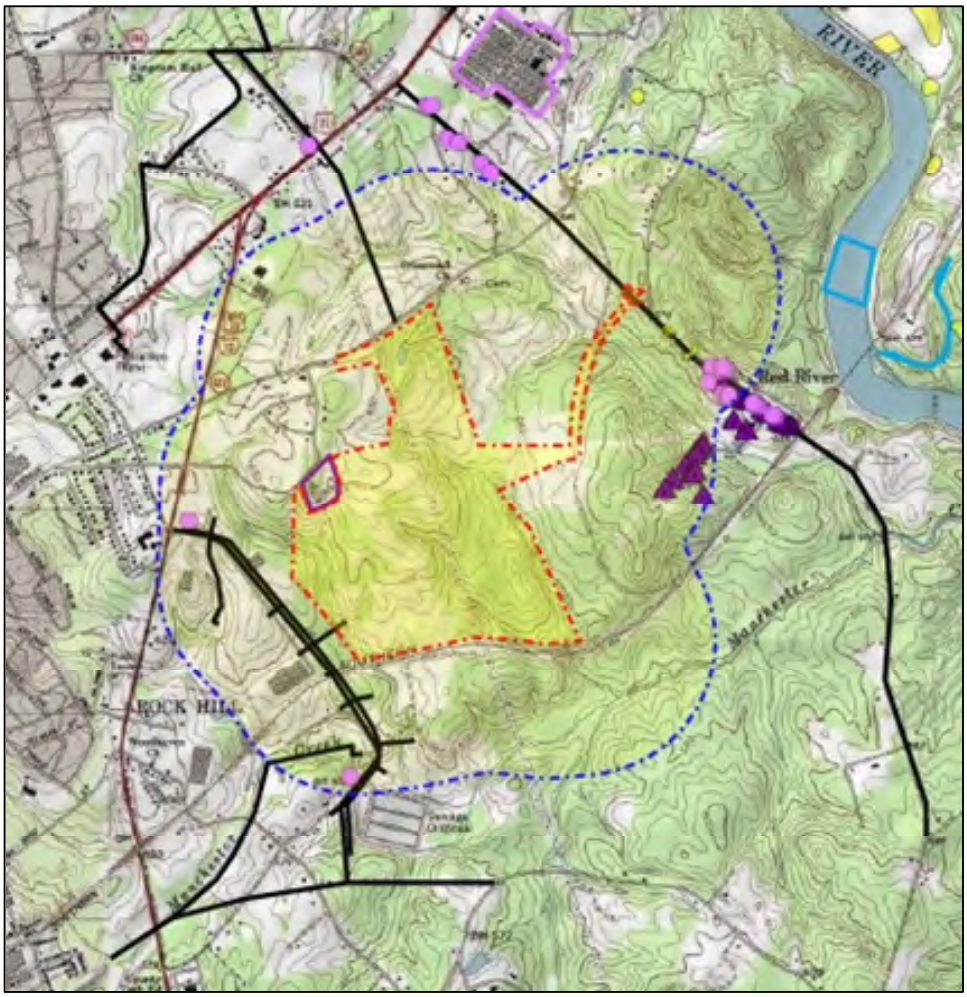



**Figure 3.1. ArchSite map showing 0.5-mile search radius of the project area.**

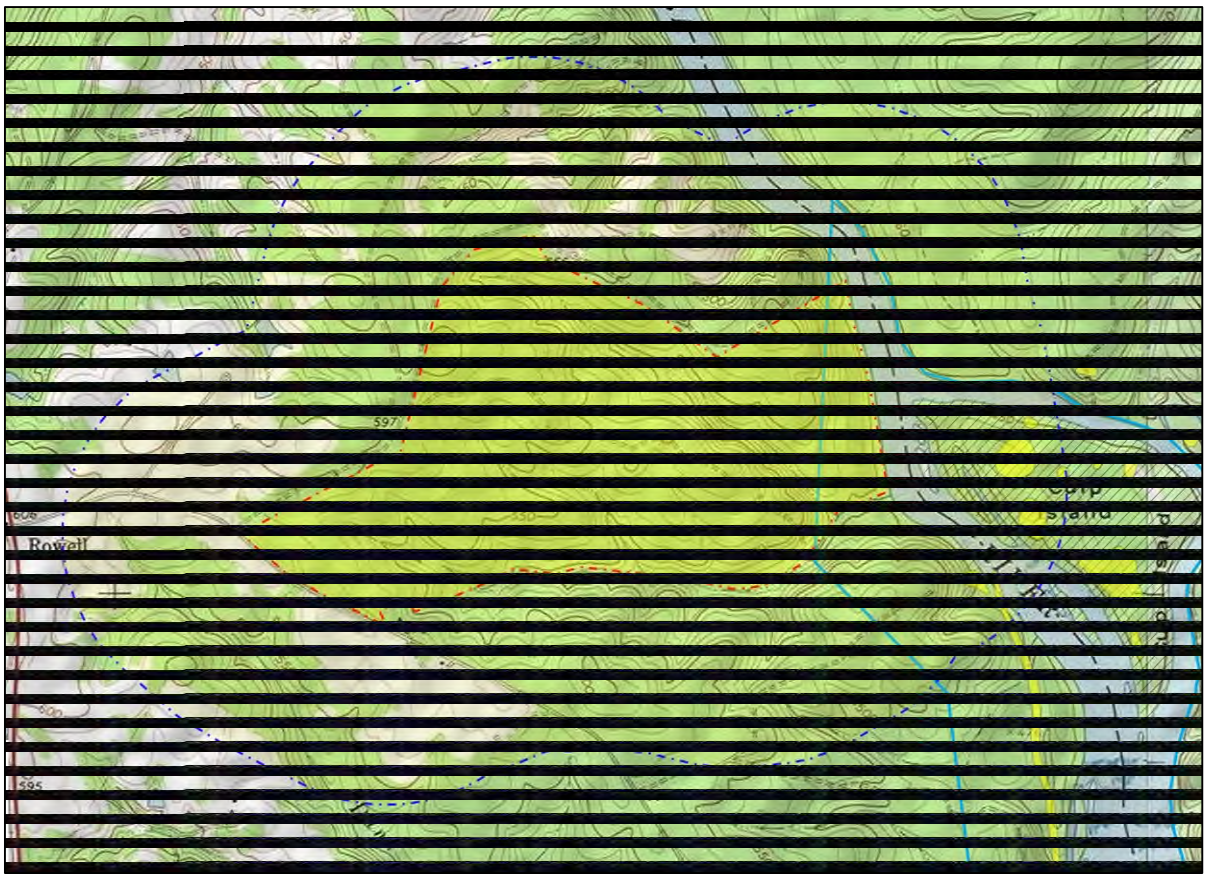



**Figure 3.2. ArchSite map showing 0.5-mile search radius of the mitigation site.**

As part of the background research, Henry Mouzon's (1775) map of North and South Carolina, Mills Atlas maps (1825), a 1905 USDA soil survey map of York County, a 1912 USDA soil survey map of Chester County, South Carolina Department of Transportation (SCDOT) maps from 1939, 1942, 1951, 1958, 1961, and 1968, a United States Geological Survey (USGS) topographic maps from 1968, and aerial maps from 1941, 1950, and 1976 were examined for the project area and mitigation site. Mouzon's map indicates that the project area was located within the Catawbaw Nation territory, which was 144,000 acres in size (Figure 3.3). For the mitigation site, Mouzon's map shows the area south of the Catawbaw Nation territory, with multiple landowners in the vicinity of the site (Figure 3.3). Mill's Atlas of York District shows that the project area was still a part of the Catawba Indian Land. The project area is located at the intersection of three labeled roadways: a road marked "Old Nation Road" to the north, a road labeled as "From York to the River" is present to the west, and a road labeled from "From Chester C.H. to Herron Ferry" to the south. A small settlement labeled Catawba Nation is present to the southeast (Figure 3.4). Mill's Atlas of Chester District shows the mitigation site and general vicinity was largely uninhabited, the canal has been established to the south of the site along with Land's Ford, a toll house, Tiovoli, and General Davy's House and Mill (Figure 3.5).

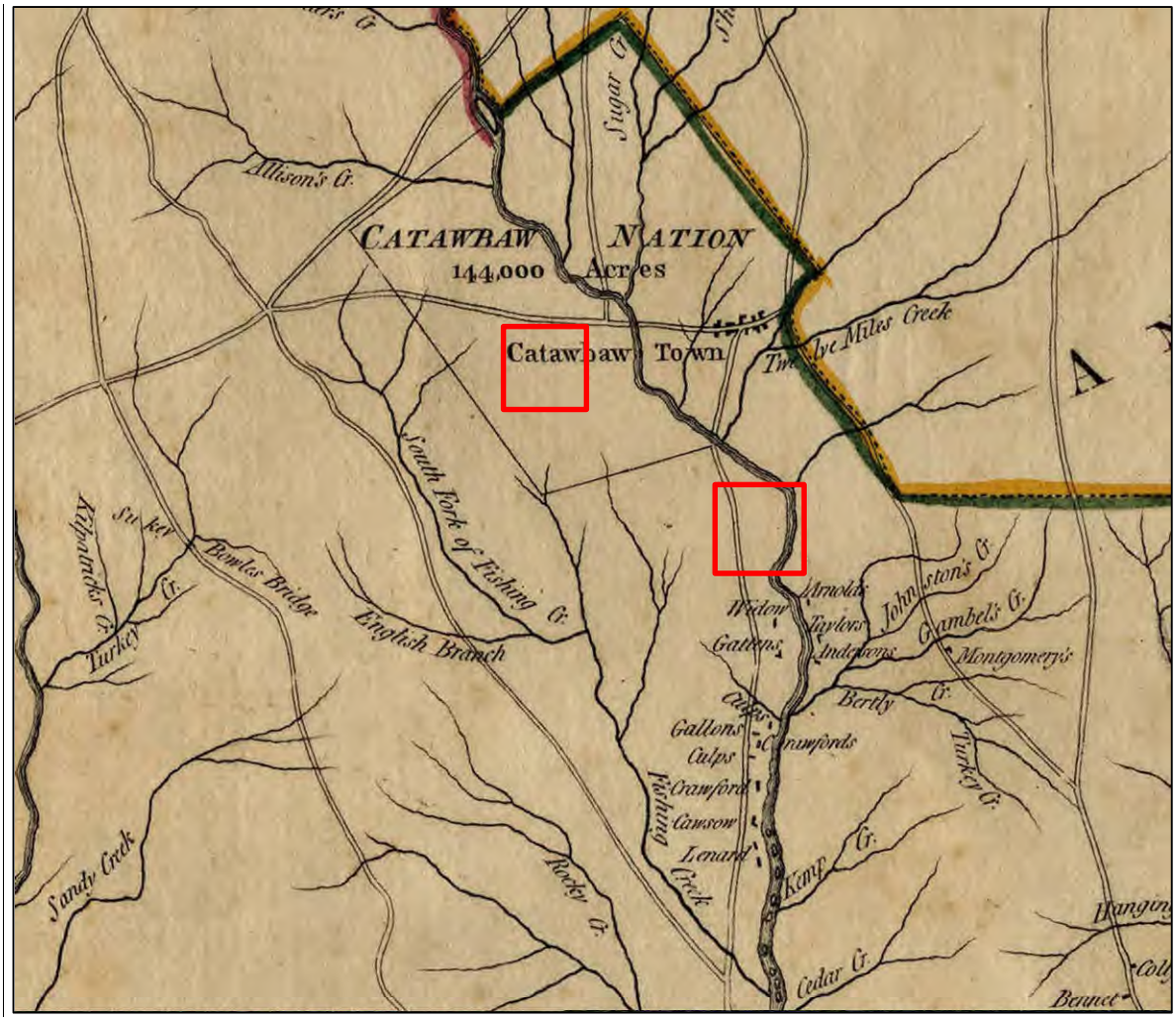



**Figure 3.3. Portion of Mouzon's map (1775), showing vicinity of project area and mitigation site.**

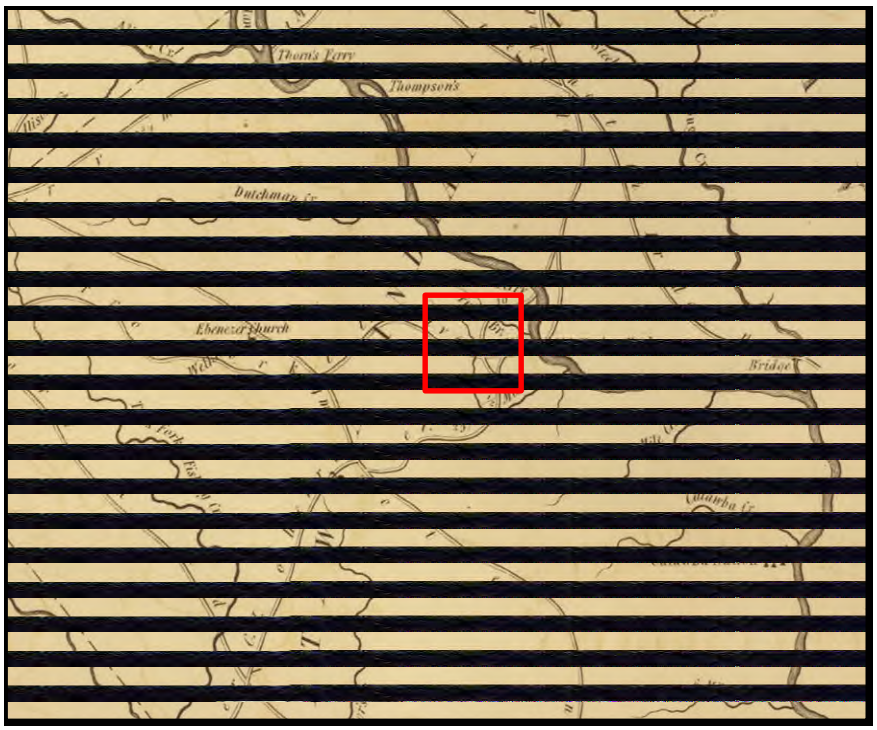



**Figure 3.4. Portion of Mills' Atlas map of York District (1825), showing vicinity of project area.**

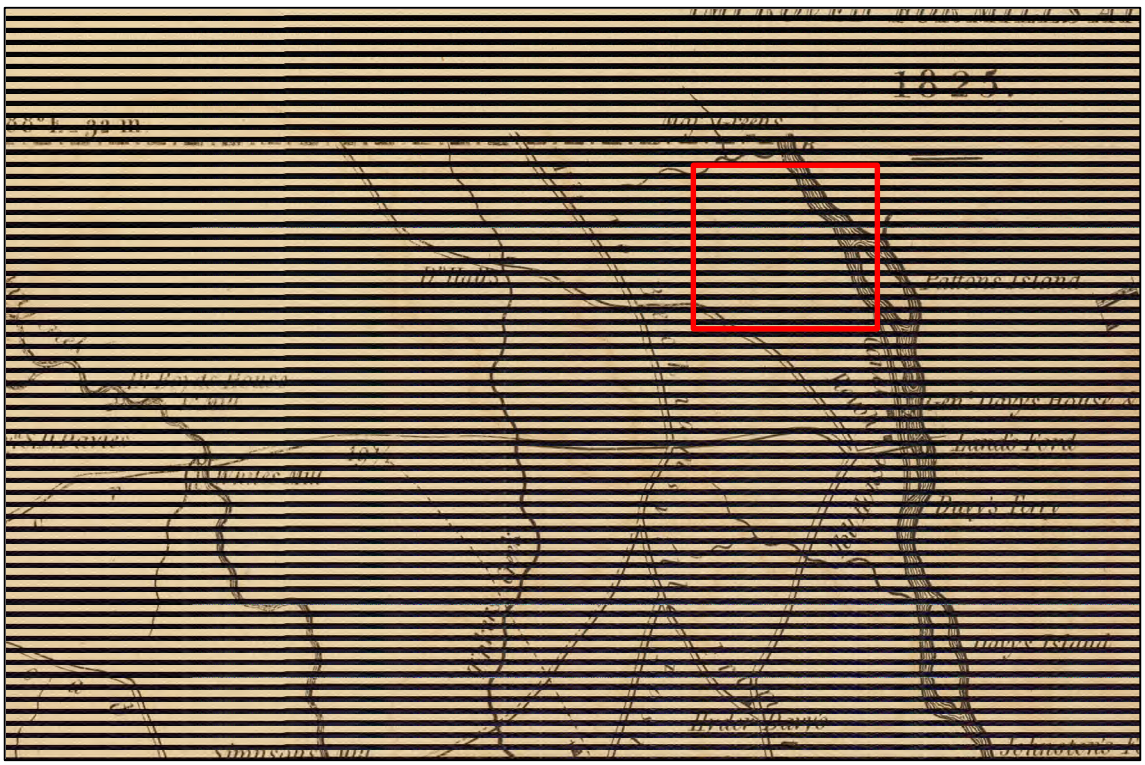



**Figure 3.5. Portion of Mills' Atlas map of Chester District (1825), showing vicinity of mitigation site.**

The 1905 USDA soil survey map of York County shows the project area is no longer in an area identified as the Catawba Indian Lands; the city of Rock Hill had been established to the southeast and a railroad had been constructed to the south (Figure 3.6). The 1912 USDA soil survey map of Chester County shows settlement in the area around the mitigation site, the community of Rowell had been established to the west, roadways and residence were constructed, and Lands Ford remains to the south (Figure 3.7). The 1939 SCDOT map of York County shows the increased growth and development of the area surrounding the project area; Eden Terrance had been established to the north and the community of Red River had been established to the east, with a population of 685 (Figure 3.8). The 1941 aerial map shows that there were three buildings/building complexes within the project area, Arrowhead Dairy (3919) was adjacent to the project area, and the surrounding area remained rural (Figures 3.9). The 1942 SCDOT map of Chester County shows an increase in rural development around the mitigation site, however the mitigation site itself is undeveloped; the Old Stone Graveyard is depicted on the map and the roadways have similar configurations to their current routes (Figure 3.10).

The 1950 aerial map of the project area shows a similar setting to the 1941 aerial; however, one of the structures appears to have been removed or demolished (Figure 3.11). The 1951 SCDOT map of York County shows the further growth of the surrounding lands around the project area, with the corporate boundaries of Rock Hill expanding to the west and multiple buildings within Red River present to the east; no structures are present within the project area (Figure 3.12). The 1958 SCDOT map of Chester County shows the mitigation site in an undeveloped area east of the community of Rowell, with the Old Stone Graveyard adjacent to the site (Figure 3.13). The 1961 SCDOT map of York County shows basically the same setting surrounding the project area as ten years earlier, along with one structure along the western boundary (Figure 3.14). The 1968 USGS Rock Hill East topographic map depicts industrial buildings to the southwest and residential development to the northwest of the project area; an outbuilding off a dirt road is present the along the western boundary and a transmission line is present in the eastern portion of the project area (Figure 3.15). The 1968 SCDOT map of Chester County shows the same setting surrounding the mitigation site as in 1958, with the exception of the Landsford Canal Recreation Center having been created to the south (Figure 3.16). The 1968 USGS Catawba topographic map depicts Rowell to the west of the mitigation site with no structures or development within the site itself (Figure 3.17). The 1976 aerial map of the project area shows that the neighborhood adjacent to the project area was being developed, a second structure in the project area is no longer shown on the map, and I-77 has been constructed (Figure 3.18).

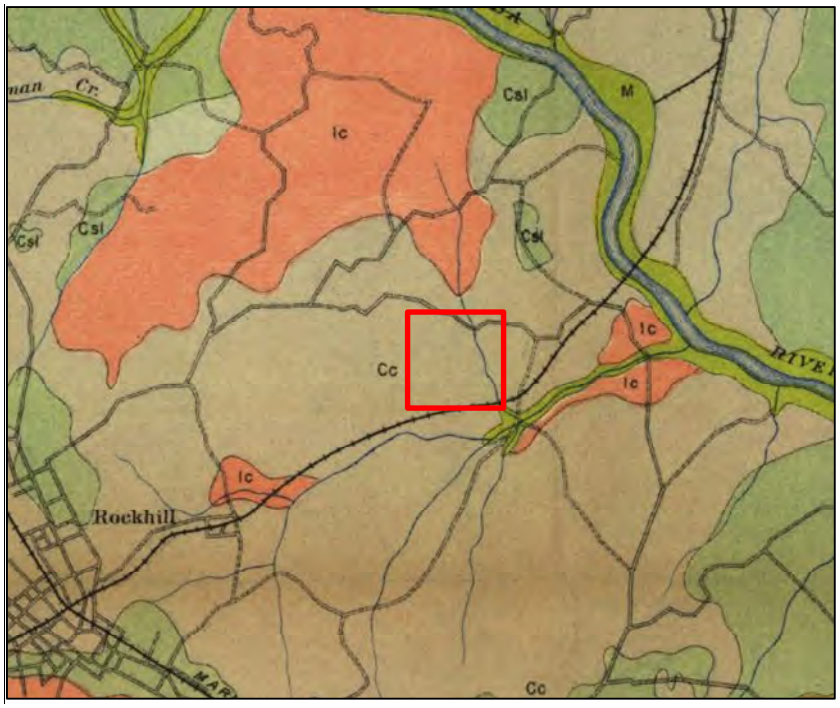



**Figure 3.6. Portion of 1905 USDA soil survey map of York County, indicating vicinity of the project area.**

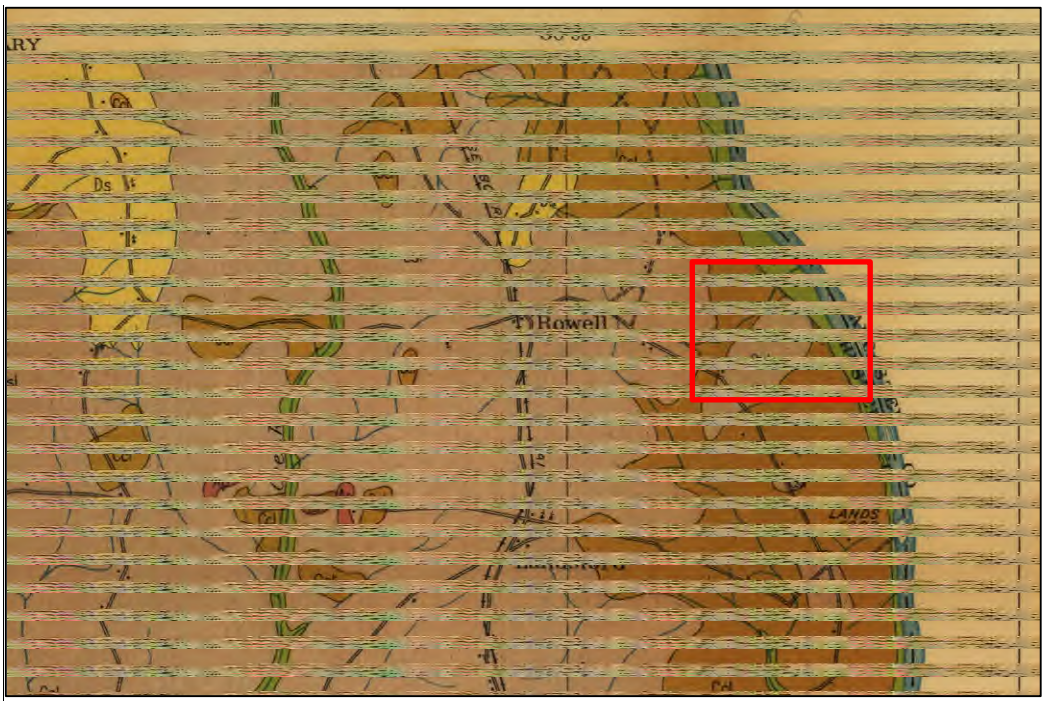



**Figure 3.7. Portion of 1912 USDA soil survey map of Chester County, indicating vicinity of the mitigation site.**

**Figure 3.8. Portion of 1939 SCDOT map of York County, indicating vicinity of the project area.**

**Figure 3.9. Portion of 1941 aerial map showing the project area.**

**Figure 3.10. Portion of 1942 SCDOT map of Chester County, indicating vicinity of the mitigation site.**

**Figure 3.11. Portion of 1950 aerial map showing the project area.**

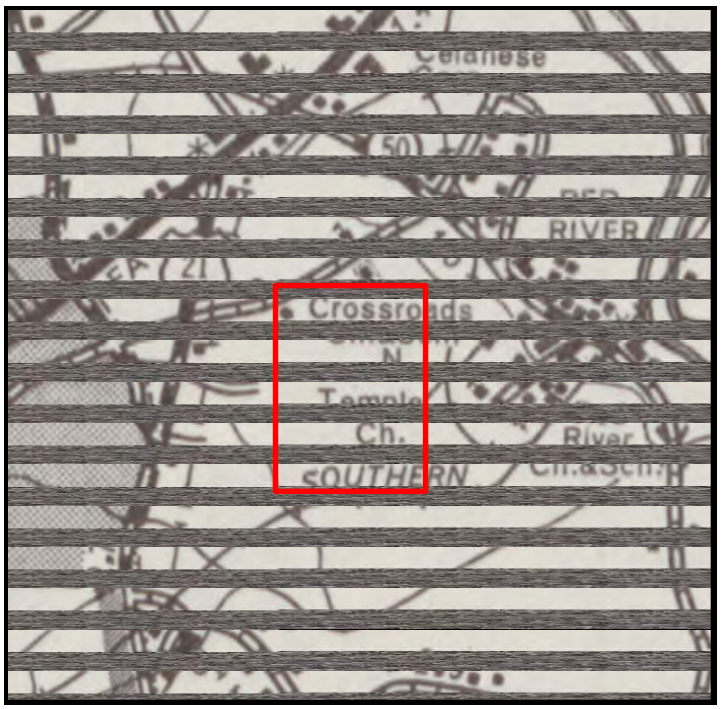



**Figure 3.12. Portion of 1951 SCDOT map of York County, indicating vicinity of the project area.**

**Figure 3.13. Portion of 1958 SCDOT map of Chester County, indicating vicinity of the mitigation site.**

**Figure 3.14. Portion of 1961 SCDOT map of York County, indicating vicinity of the project area.**

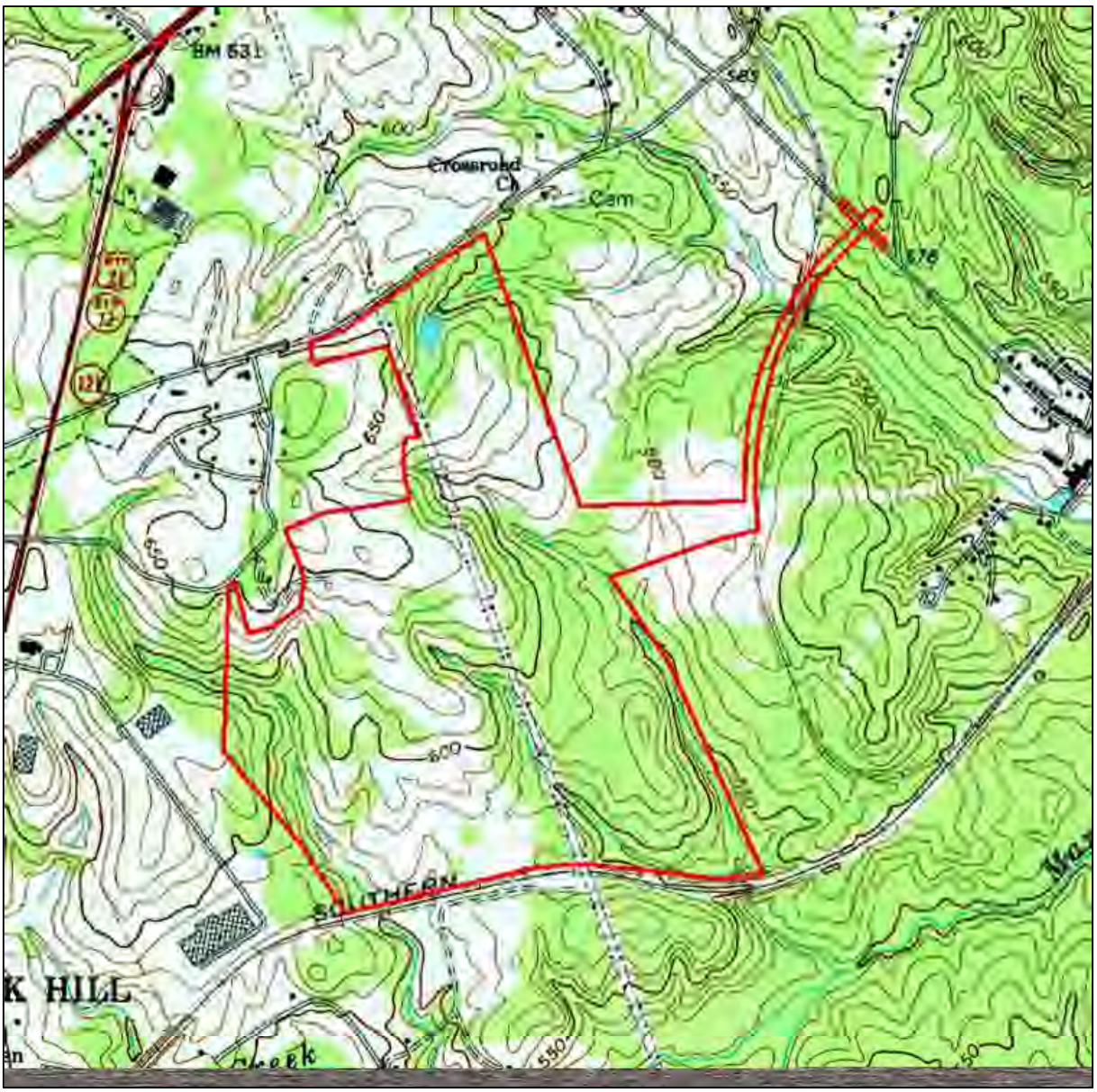



**Figure 3.15. Portion of *Rock Hill East* 1968 7.5-minute USGS topographic map, showing the project area.**

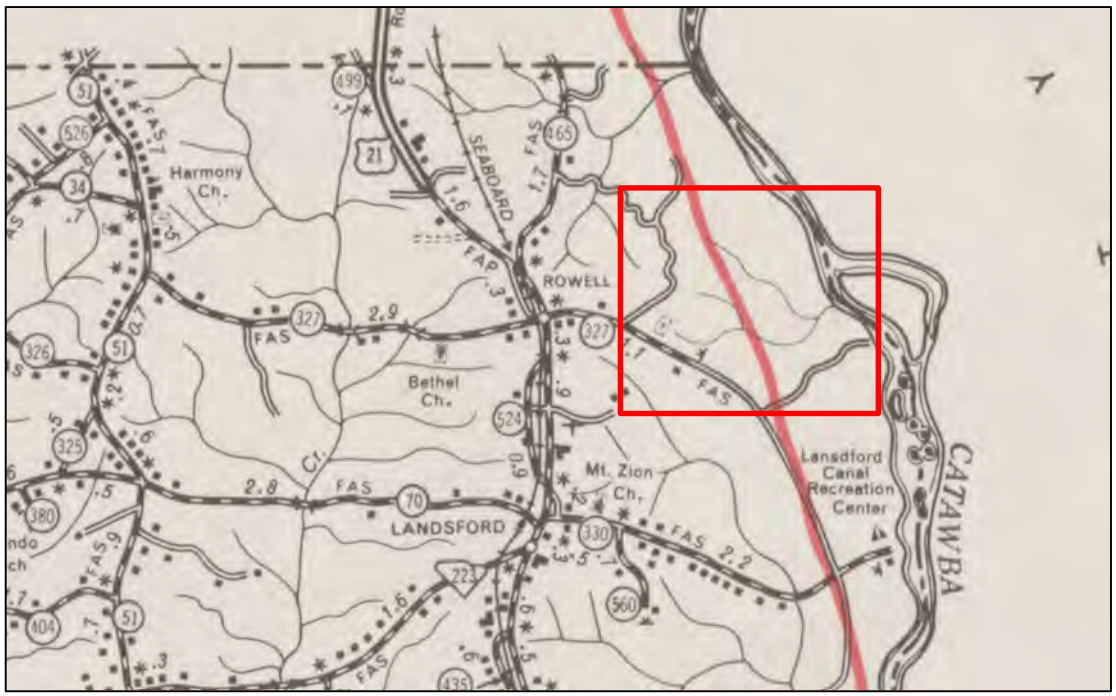



**Figure 3.16. Portion of 1968 SCDOT map of Chester County, indicating vicinity of the mitigation site.**

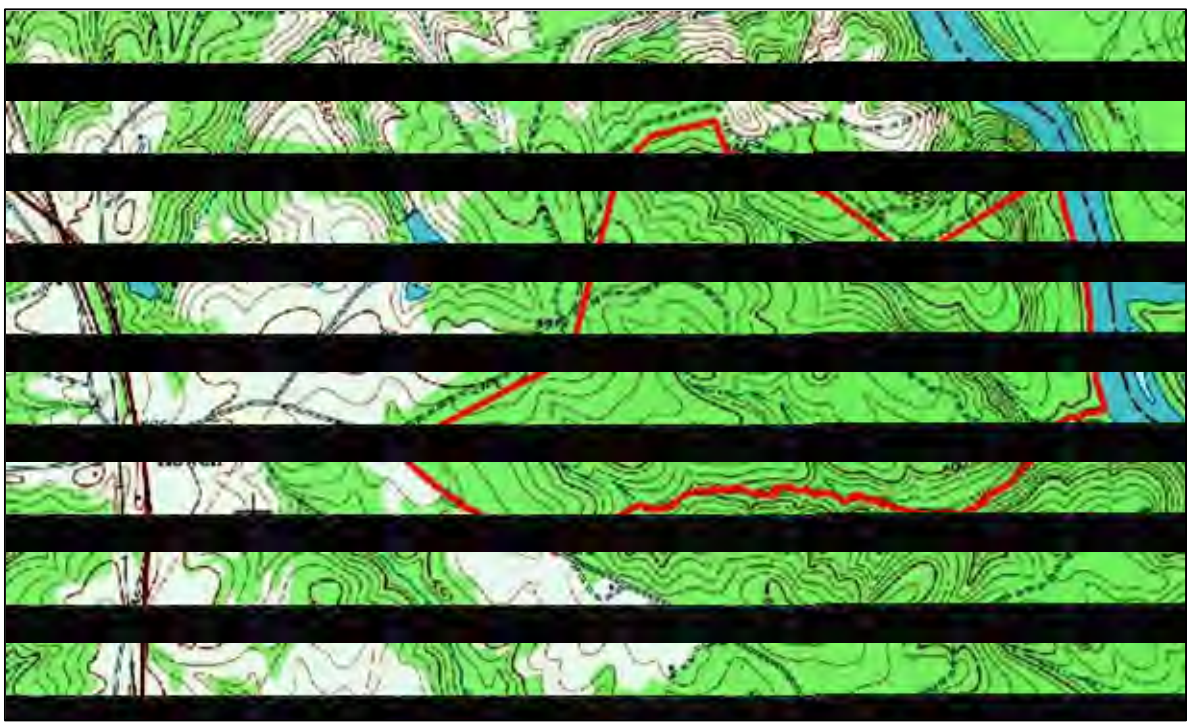


**Figure 3.17. Portion of *Catawba* 1968 7.5-minute USGS topographic map, showing the location of the mitigation site.**

**Figure 3.18. Portion of an aerial from 1976 showing the location of the project area.**

# 4.0 Methods

## 4.1 Archaeological Field Methods

Fieldwork for the project was conducted from July 8 through 12, 2019, October 15, 2019, and January 6 through 10, 2020. The field methods include both pedestrian survey and shovel testing. Shovel tests were at least 30 cm by 30 cm and excavated to sterile subsoil or 80 cm below surface (cmbs), whichever was encountered first. Soil from the shovel tests was screened though ¼-inch wire mesh and soil colors were determined through comparison with Munsell Soil Color Charts. If sites were identified, they would be located using a GPS unit and plotted on USGS 7.5 minute topographic maps. Artifacts recovered during the survey were organized and bagged by site and relative provenience within each site.

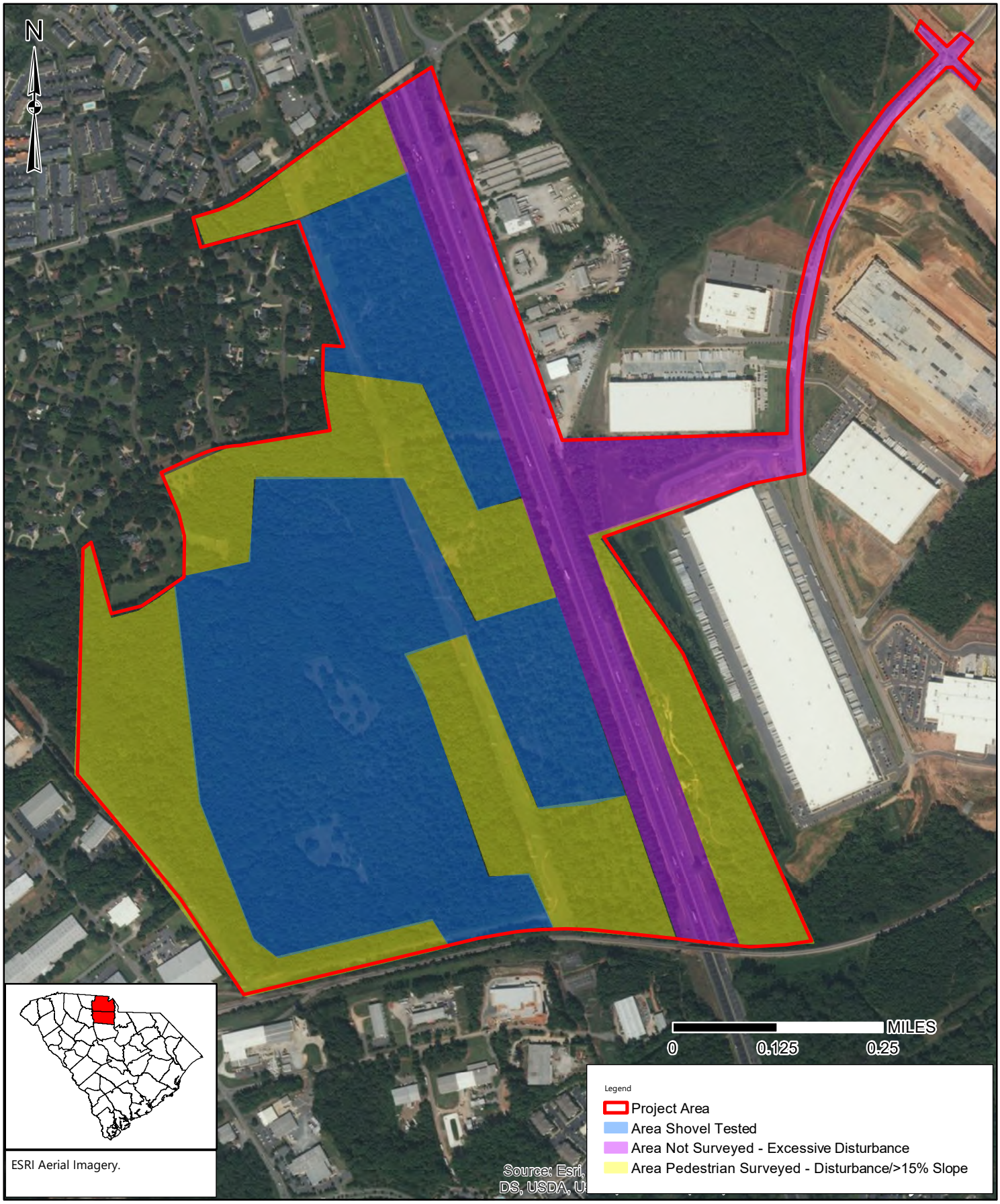
Site boundaries were determined by excavating shovel tests at 15-m intervals radiating out in a cruciform pattern from positive shovel tests or surface finds at the perimeter of each site. Sites were recorded in the field using field journals and standard S&ME site forms and documented using digital imagery and detailed site maps. State site forms were filled out and submitted to SCIAA once fieldwork was complete. For purposes of the project, an archaeological site is defined as an area yielding three or more historic or prehistoric artifacts and/or an area with visible or historically recorded cultural features (e.g., shell middens, rockshelters, chimney falls, brick walls, piers, earthworks, etc.). An isolated find is defined as yielding less than three historic or prehistoric artifacts.

Specifically for the project area, pedestrian survey was conducted in the approximately 122.2 acres that contained slope greater than 15 percent or was disturbed by urban development/utilities; no survey was completed in approximately 66.2 acres where I-77, construction associated with I-77, and excessive disturbance associated with residential and industrial development was present; and the remaining approximately 146.6 acres were systematically shovel tested. Figure 4.1 shows where the different survey methods were used within the project area.

For the mitigation site, the LOD was both pedestrian surveyed and systematically shovel tested. Pedestrian survey was conducted in approximately 75 acres around the streams where slope greater than 15 percent and the remaining approximately 54.1 acres and 1.4 miles of proposed roadways were systematically shovel tested. Figure 4.2 shows where the different survey methods were used within the mitigation site.

## 4.2 Architectural Survey

In addition to the archaeological survey, an architectural survey was conducted to determine whether the proposed project would affect aboveground National Register listed or eligible properties within and surrounding both the project area and the mitigation site. Previously recorded NRHP-listed and eligible resources within the two areas and within a 0.5-mile search radius were examined and effects of the project on the resources were assessed. Existing aboveground resources within the project area and within a 0.5-mile search radius of the project area were examined for National Register eligibility using the criteria established by the U.S. Department of the Interior and the National Park Service and previously recorded aboveground resources were revisited. Previously unrecorded resources 50 years or older in the area surrounding the project area were digitally photographed and marked on the applicable USGS topographic quadrangle maps. State resource forms were filled out and submitted to SCDAH once fieldwork was complete.




Drawing Path: T:\Projects\2019\ENV\4261-19-077_SCDOC_Project_Inspector_Rock Hill\Working_Documents\Phase 440 Cultural Resources\GIS\Figures\Figure 4-1 field methods.mxd plotted by KNagle 01-20-2020

| | |
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| PROJECT NO: | 4261-19-077 |
| DRAWN BY: | KJN |
| DATE: | 1/20/2020 |

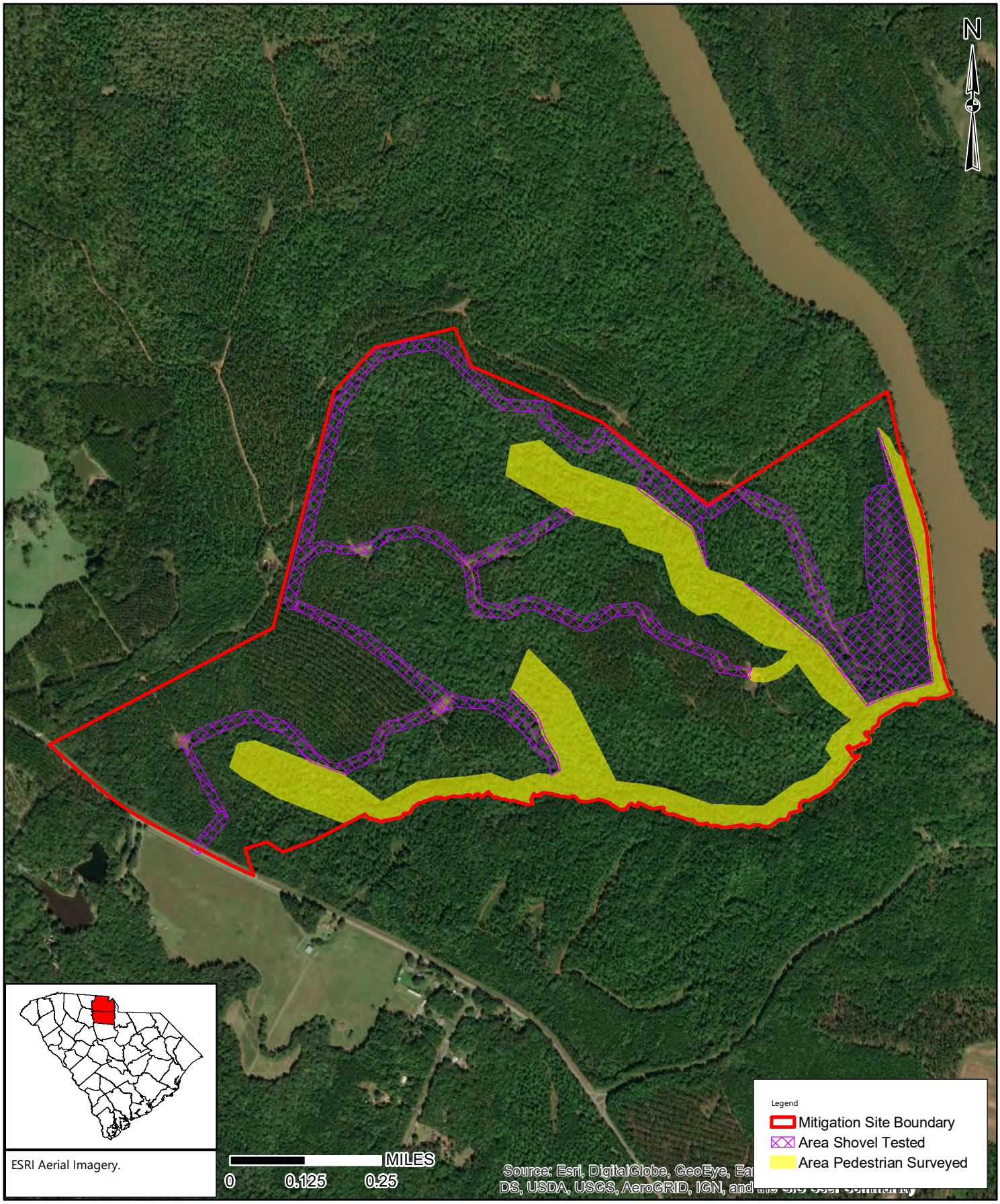
# Field Methods Map

Project Inspector Project Area

Chester and York Counties, South Carolina

FIGURE NO.

4.1




Drawing Path: T:\Projects\2019\ENV\4261-19-077_SCDOC_Project_Inspector_Rock Hill\Working_Documents\Phase 440 Cultural Resources\GIS\Figures\Figure 4-2 field methods.mxd plotted by KNagle 01-17-2020

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# Field Methods Map

Project Inspector Mitigation Site

Chester and York Counties, South Carolina

FIGURE NO.

4.2

A drone/balloon survey was also completed in order determine if the proposed 120-ft tall structure would be visible from Arrowhead Dairy. A drone was flown with three red balloons to a height of 120-ft at two possible building locations and S&ME staff took photographs from Arrowhead Dairy toward the two locations.

## 4.3 Laboratory Methods

Artifacts recovered during the survey were cleaned, identified, and analyzed using the techniques summarized below. Following analysis, artifacts were bagged according to site, provenience, and specimen number. Acid-free plastic bags and artifact tags were used for curation purposes.

Lithic artifacts were initially identified as either debitage or tools. Debitage was sorted by raw material type and size graded using the mass analysis method advocated by Ahler (1989). When present, formal tools were classified by type, and metric attributes (e.g., length, width, and thickness) were recorded for each unbroken tool. Projectile point typology generally followed those contained in Coe (1964) and Justice (1987).

Historic artifacts were separated by material type and then further sorted into functional groups. For example, glass was sorted into window, container, or other glass. Maker's marks and/or decorations were noted to ascertain chronological attributes using established references for historic materials, including Noel Hume (1970), South (1977), and Miller (1991).

The artifacts, field notes, maps, photographs, and other technical materials generated as a result of this project will be temporarily curated at the S&ME office in Columbia, South Carolina. After conclusion of the project, S&ME will transfer the artifacts and relevant notes to a curation facility meeting the standards established in 36 CFR Part 79, *Curation of Federally-Owned and Administered Archaeological Collections*.

## 4.4 National Register Eligibility Assessment

For a property to be considered eligible for the NRHP it must retain integrity of location, design, setting, materials, workmanship, feeling, and association (National Register Bulletin 15:2). In addition, properties must meet one or more of the criteria below:

- **A.** are associated with events that have made a significant contribution to the broad patterns of our history; or
- **B.** are associated with the lives of persons significant in our past; or
- **C.** embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- **D.** have yielded or may be likely to yield information important in history or prehistory.

The most frequently used criterion for assessing the significance of an archaeological site is Criterion D, although other criteria were considered where appropriate. For an archaeological site to be considered significant, it must have potential to add to the understanding of the area's history or prehistory. A commonly used standard to determine a site's research potential is based on a number of physical characteristics including variety, quantity, integrity, clarity, and environmental context (Glassow 1977). All of these factors were considered in assessing a site's potential for inclusion in the NRHP.

# 5.0 Results

The cultural resource investigation of the project area and the mitigation site was conducted July 8 through 12, 2019, October 15, 2019, and January 6 through 10, 2020. As a result of the investigations, 12 archaeological sites (38YK607 through 38YK612 and 38CS425 through 38CS430), 11 isolated finds (IF-1 through IF-3 in the project area and IF-1 through IF-8 in the mitigation site), three previously evaluated aboveground resources (SHPO site number 3919 – Arrowhead Dairy; SHPO site number 0044 – Old Stone Graveyard; SHPO site number 0008 – Landsford Canal) were revisited, and three newly recorded aboveground resources (SHPO site numbers 3920 through 3922) were identified (Figures 1.2 through 1.5). Additionally, photographs were taken from the NRHP-eligible resources associated with the Red River community (SHPO site numbers 1541 through 1558) to verify existing viewshed intrusions and a balloon/drone survey was completed to determine the viewshed impacts of the project on the NRHP-eligible Arrowhead Dairy. The project area and mitigation site are discussed separately below and each of the resources listed above is discussed within the corresponding area in which the resource was identified or revisited.

## 5.1 Project Area Archaeological Survey Results

The project area consists of two survey areas, the eastern side of I-77 and the western side of I-77. The eastern side of I-77 is disturbed by an industrial development complex and the associated paved roadways and buried utility lines, as well as the construction of I-77 and the ongoing development of a residential area, east of the industrial park (Figures 5.1 through 5.3). No shovel testing was completed in this portion of the proposed project area due to the existing disturbances.

The western portion of the project area is a mix of secondary growth, fallow field, pine trees, and mixed pine and hardwood forest (Figures 5.4 through 5.5). Disturbances in this portion of the project area include slope greater than 15 percent, poorly drained soils, and construction associated with the transmission line and railroad corridors (Figures 5.6 through 5.7). The six archaeological sites (38YK607 through 38YK612) and three isolated finds (IF-1 through IF-3) are discussed below.

### *5.1.1 Site 38YK607*

| | |
|---|---|
| **Site Number**: 38YK607 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic isolate; Historic artifact scatter | **Elevation:** 590 ft AMSL |
| **Components:** Unidentified; 19th to 20th century | **Landform:** Hillslope |
| **UTM Coordinates**: E501744, N3868034 (NAD 83) | **Soil Type**: Mecklenburg-Wynott complex |
| **Site Dimensions**: 75 N/S x 30 E/W m | **Vegetation:** Hardwoods |
| **Artifact Depth**: Surface; 0–20 cmbs | **No. of STPs/Positive STPs:** 20/4 |

Site 38YK607 is a prehistoric lithic isolate and nineteenth and twentieth century artifact scatter, located on a hillslope adjacent to a transmission line corridor (Figures 1.2 and 1.3). The site is located in an area of hardwoods and measures approximately 75 m north/south by 30 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.8 and 5.9).

Site 38YK607 was initially recorded during a Cultural Resource Identification Survey (CRIS) for the project; which was thought to be the level of work necessary at the beginning stages of the project. Once the CRIS was completed and USACE and FHWA involvement was noted, a more intensive survey was necessary, and the site was

**Figure 5.1. Existing stoplight intersection and disturbance in eastern portion of project area, facing east.**

**Figure 5.2. Existing roadway through industrial development in eastern portion of the project area, facing northeast.**

**Figure 5.3. Frontage road and disturbance associated with I-77 construction in eastern portion of the project area, facing south.**

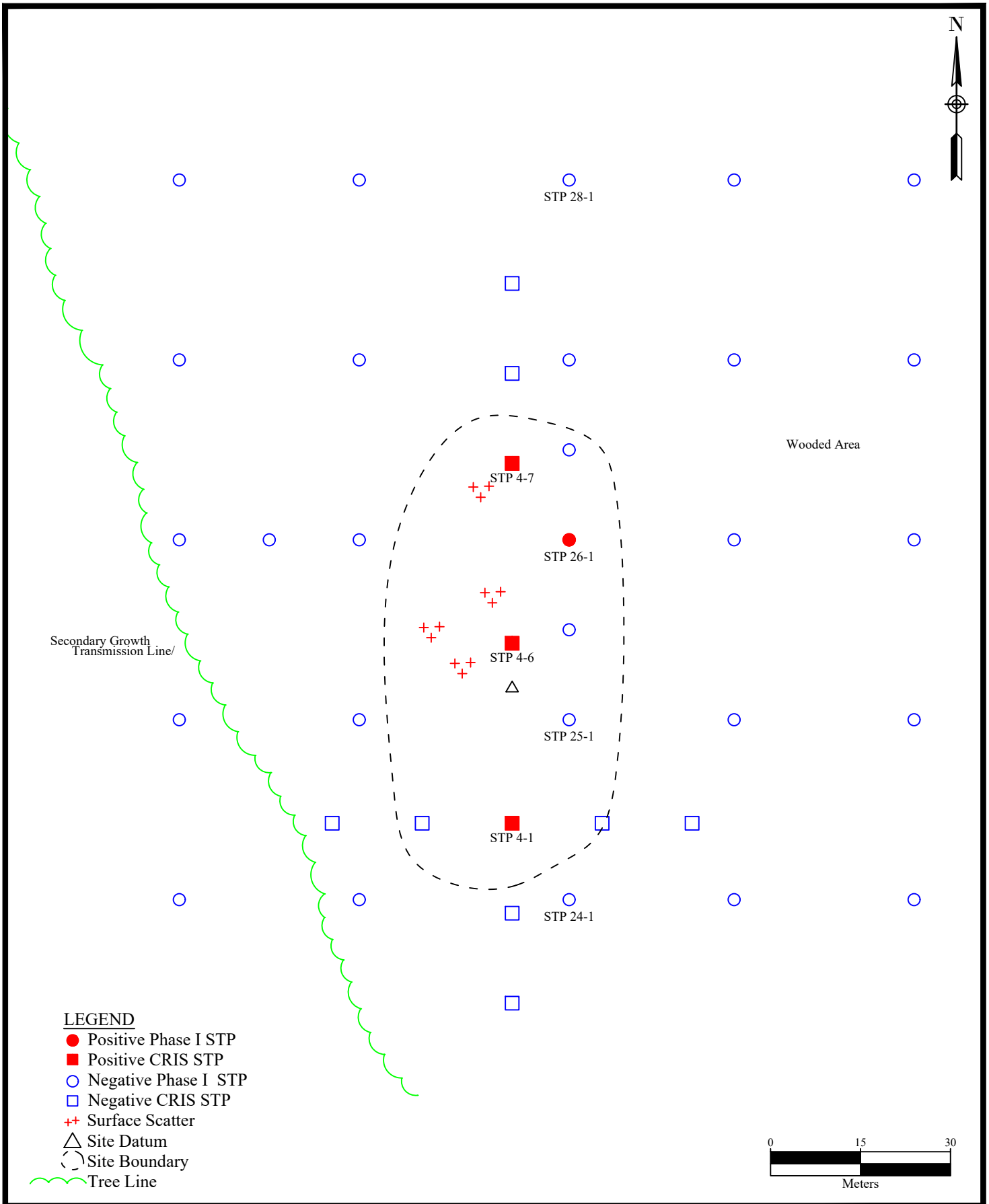
**Figure 5.4. Typical wooded area in western portion of the project area, facing north.**

**Figure 5.5. View of fallow field in western portion of the project area, facing west.**

**Figure 5.6. Typical area of steep slope in the project area, facing northwest.**

**Figure 5.7. Typical disturbance and vegetation in the transmission line corridor, facing south.**

**Figure 5.8. Overview of site 38YK607, facing south.**




# Site Map - 38YK607

Phase I Cultural Resources Survey
Project Inspector
York County, South Carolina

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re-located during the intensive survey. Figure 5.9 shows the CRIS level shovel tests and the intensive survey shovel tests as well.

A total of 20 shovel tests were excavated in and around the site; a typical soil profile contained 20 cm of very dark grayish brown (10YR 3/2) silty loam, terminating with 10+ cm (20–30+ cmbs) of red (2.5YR 5/6) sandy clay subsoil. A total of 11 artifacts were recovered from the site, one prehistoric and 10 historic; three artifacts were collected from the surface of the site and the remaining eight came from between 0–20 cmbs in four shovel tests (Appendix A). The prehistoric artifact consists of a quartz late stage biface fragment. The historic artifacts include two pieces of polychome underglaze decal decorated whiteware, one piece of plain porcelain, four pieces of milk glass, two pieces of clear glass, and one galvanized nail. Historic aerial maps show a structure in this location beginning in 1941, but by 1950 the structure was gone (Figures 3.6 and 3.7); the underglazed decal decorated whiteware dates from 1897–present, while the remaining artifacts are not temporally diagnostic.

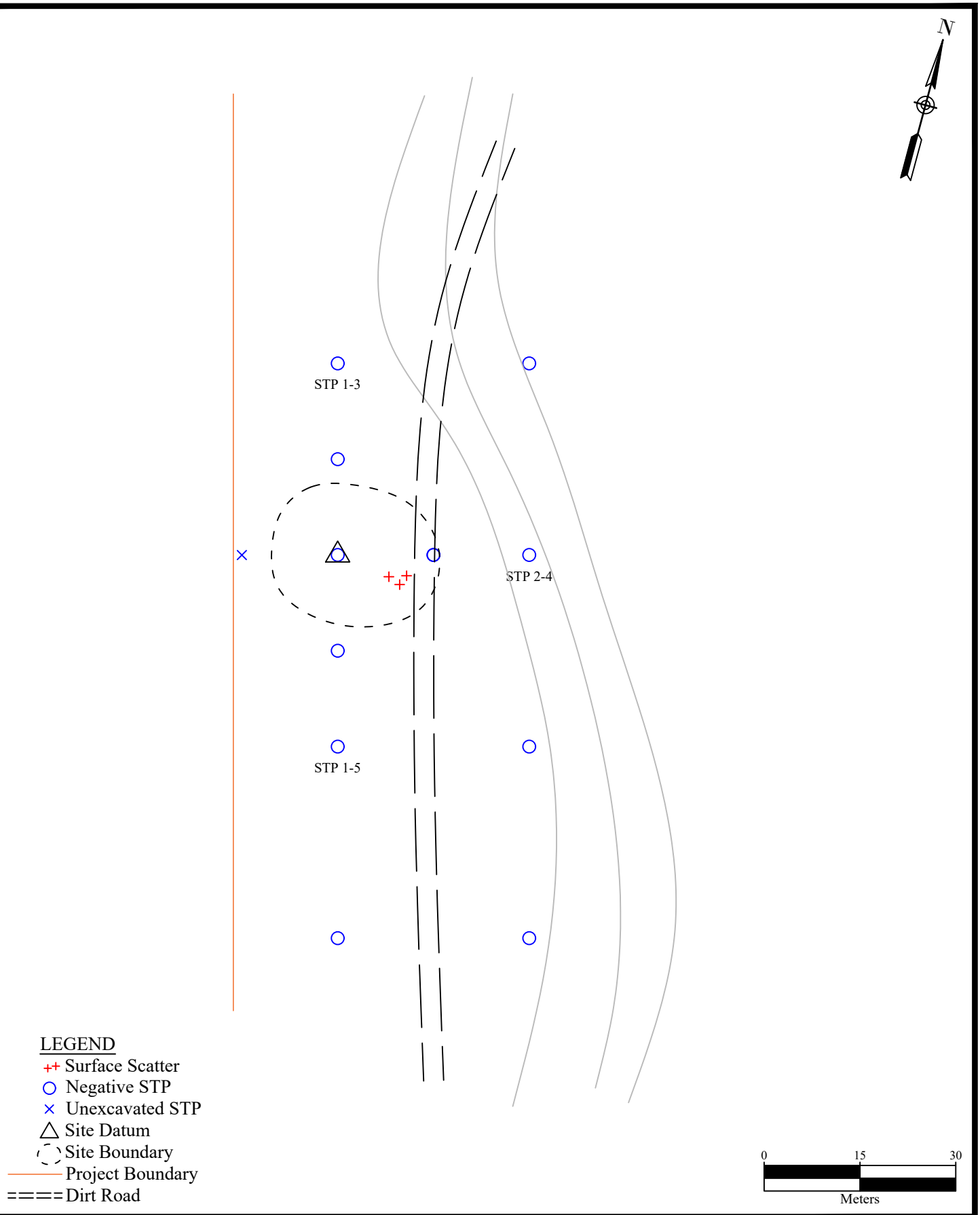
Site 38YK607 is a prehistoric lithic isolate and nineteenth and twentieth century artifact scatter, located on a hillslope adjacent to a transmission line corridor. Given the artifacts were recovered from the surface and plow zone of the site, no intact stratigraphy was noted within the shovel tests, the apparent lack of subsurface features and no evidence of a structure at the site, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory or history of the area (Criterion D). As such, site 38YK607 is recommended ineligible for inclusion in the NRHP.

### *5.1.2 Site 38YK608*

| | |
|---|---|
| **Site Number:** 38YK608 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Historic artifact scatter | **Elevation:** 630 ft AMSL |
| **Components:** 20th Century | **Landform:** Hillslope |
| **UTM Coordinates**: E501386, N3868866 (17N, NAD 83) | **Soil Type**: Cecil clay loam |
| **Site Dimensions**: 15 m N/S x 15 m E/W | **Vegetation:** Secondary growth |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 7/0 |

Site 38YK608 is a twentieth century artifact scatter, located on a hillslope in a transmission line corridor (Figures 1.2 and 1.3). The site is located in secondary growth, measures approximately 15 m north/south by 15 m east/west, and is bounded by two negative shovel tests to the north, south, and east, and the project boundary to the west (Figures 5.10 and 5.11).

Seven shovel tests were excavated in and around site 38YK608; a typical shovel test consisted of 10+ cm of dark red (2.5YR 3/6) sandy clay subsoil (Figure 5.12). A total of seven pieces of glass (two light green, one clear, one milk, one cobalt blue, one solarized/amethyst, and one window) were recovered from the surface of the site (Appendix A). No signs of a structure or foundation was present at the site. Historic maps show no structures in this location and none of the artifacts are diagnostic.




# Site Map - 38YK608

Phase I Cultural Resources Survey
Project Inspector
York County, South Carolina

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**Figure 5.11. Overview of site 38YK608, facing south.**

**Figure 5.12. Typical shovel test profile at site 38YK608.**

Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38YK608 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38YK608 will yield significant information on the history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38YK608 is recommended ineligible for inclusion in the NRHP.

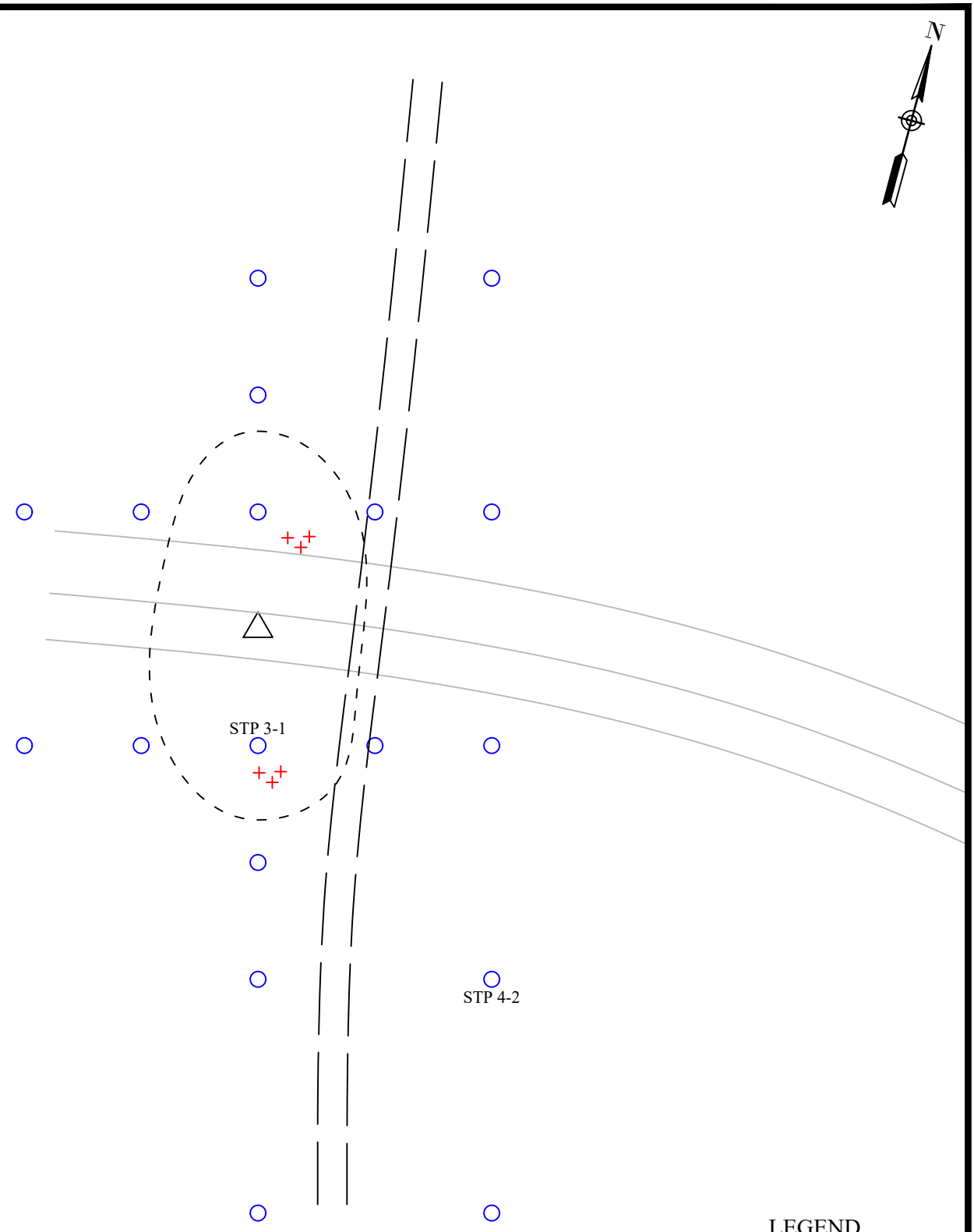
### *5.1.3 Site 38YK609*

| | |
|---|---|
| **Site Number**: 38YK609 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic isolate; Historic artifact scatter | **Elevation:** 630 ft AMSL |
| **Components:** Unidentified; 19th to 20th century | **Landform:** Hillslope |
| **UTM Coordinates**: E501438, N3868773 (NAD 83) | **Soil Type**: Cecil clay loam |
| **Site Dimensions**: 30 N/S x 15 E/W m | **Vegetation:** Secondary growth |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 14/0 |

Site 38YK609 is a prehistoric lithic isolate and nineteenth and twentieth century artifact scatter, located on a hillslope within a transmission line corridor (Figures 1.2 and 1.3). The site is located in an area of secondary growth and measures approximately 30 m north/south by 15 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.13 and 5.14).

A total of 14 shovel tests were excavated in and around the site; a typical soil profile contained 10 cm of red (2.5YR 4/8) silty sand, terminating with 10+ cm (10–20+ cmbs) of dark red (2.5YR 3/6) sandy clay subsoil (Figure 5.15). A total of seven artifacts were recovered from the surface of the site, one prehistoric and six historic (Appendix A). The prehistoric artifact consists of an unidentified quartz contracting stem project point fragment (Figure 5.16). The historic artifacts include one piece of plain whiteware, one piece of salt glazed stoneware, three pieces of cobalt blue glass, and one piece of brown glass. Historic maps show no structures in this location; the plain whiteware dates from 1815–present, while the remaining artifacts are not temporally diagnostic.

Site 38YK609 is a prehistoric lithic isolate and nineteenth and twentieth century artifact scatter, located on a hillslope within an existing transmission line corridor. Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38YK609 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38YK609 will yield significant information on the prehistory or history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38YK609 is recommended ineligible for inclusion in the NRHP.




# Site Map - 38YK609

Phase I Cultural Resources Survey
Project Inspector
York County, South Carolina

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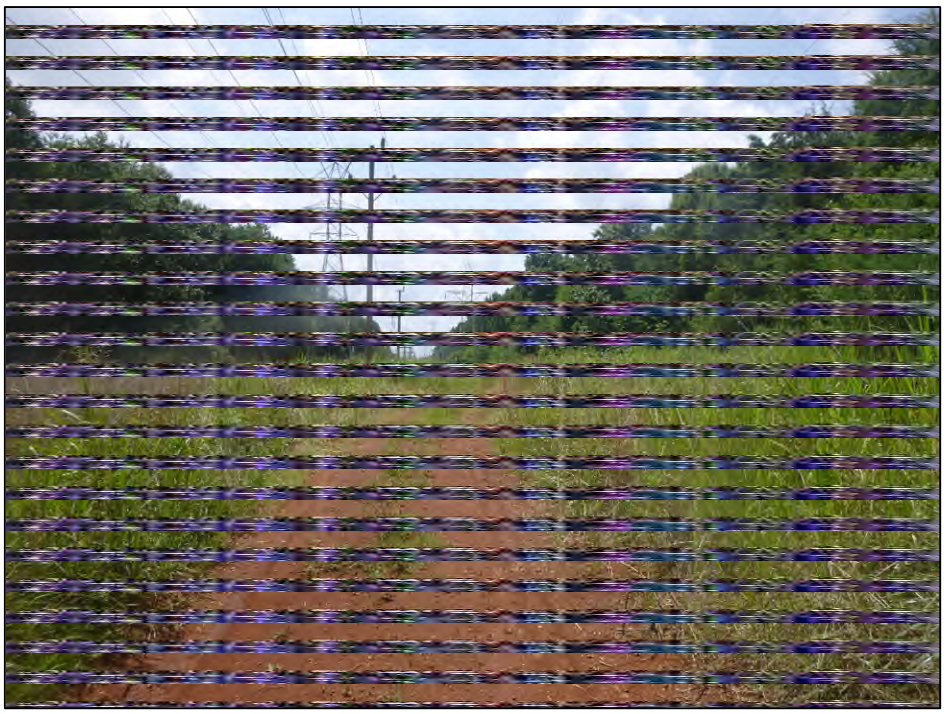


**Figure 5.14. Overview of site 38YK609, facing south.**

**Figure 5.15. Typical shovel test profile at site 38YK609.**

**Figure 5.16. Quartz contracting stem projectile point identified at site 38YK609.**

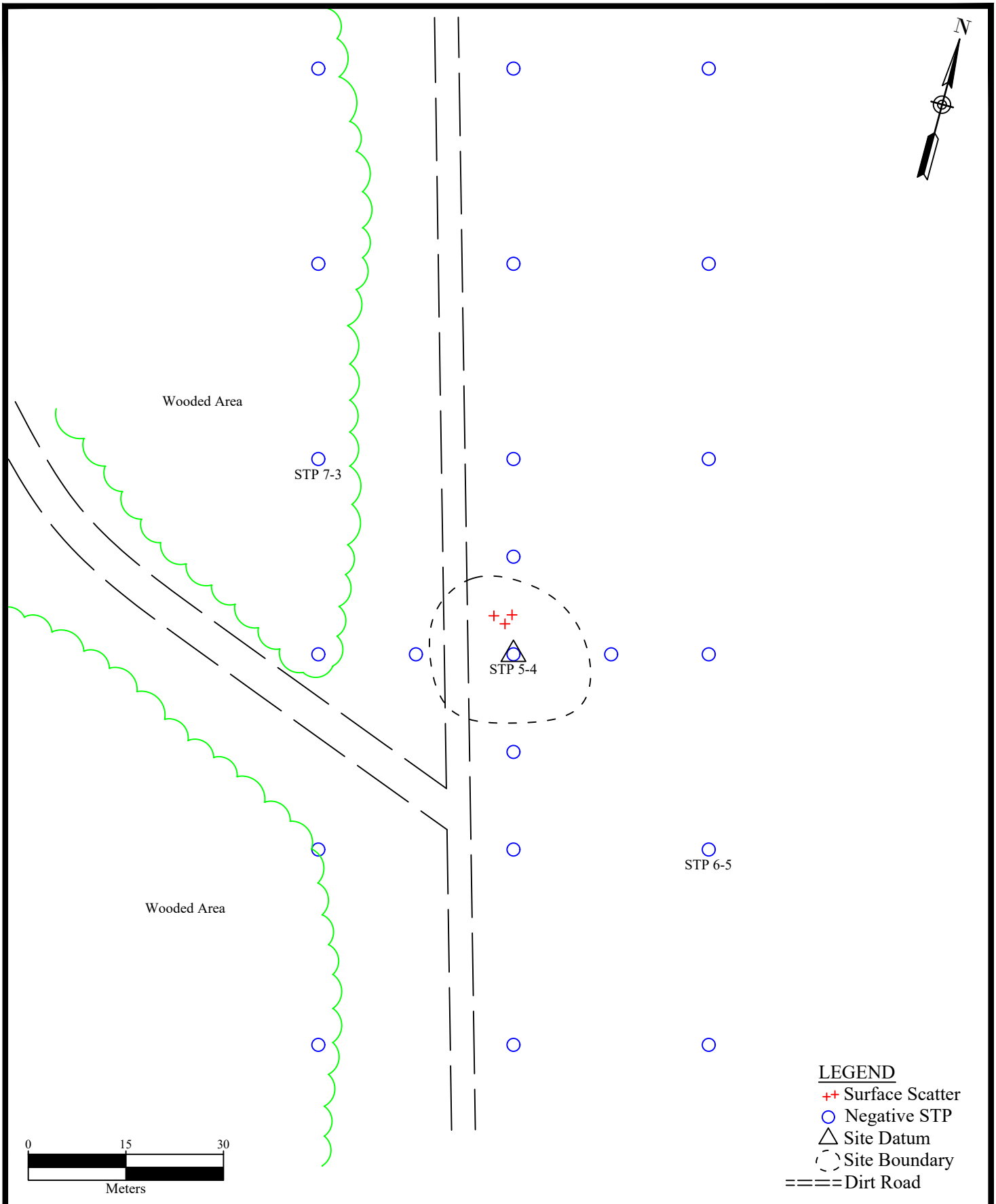
### *5.1.4 Site 38YK610*

| | |
|---|---|
| **Site Number**: 38YK610 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic scatter; Historic glass isolate | **Elevation:** 630 ft AMSL |
| **Components:** Unidentified; Unidentified | **Landform:** Hilltop |
| **UTM Coordinates**: E501588, N3868289 (NAD 83) | **Soil Type**: Cecil clay loam |
| **Site Dimensions**: 15 N/S x 15 E/W m | **Vegetation:** Secondary growth |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 9/0 |

Site 38YK610 is a prehistoric lithic scatter and twentieth century glass isolate, located on a hilltop within a transmission line corridor (Figures 1.2 and 1.3). The site is located in an area of secondary growth and measures approximately 15 m north/south by 15 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.17 and 5.18).

A total of nine shovel tests were excavated in and around the site; a typical soil profile contained 10 cm of dark red (2.5YR 3/6) sandy clay subsoil. A total of nine artifacts were recovered from the surface of the site, eight prehistoric and one historic (Appendix A). The prehistoric artifacts consist seven pieces of lithic debitage (five quartz and two quartzite); the historic artifact consists of one piece of light green glass. Historic maps show no structures in this location and none of the artifacts are temporally diagnostic.

Site 38YK610 is a prehistoric lithic scatter and twentieth century glass isolate, located on a hilltop within a transmission line corridor. Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons




# Site Map - 38YK610

Phase I Cultural Resources Survey
Project Inspector
York County, South Carolina

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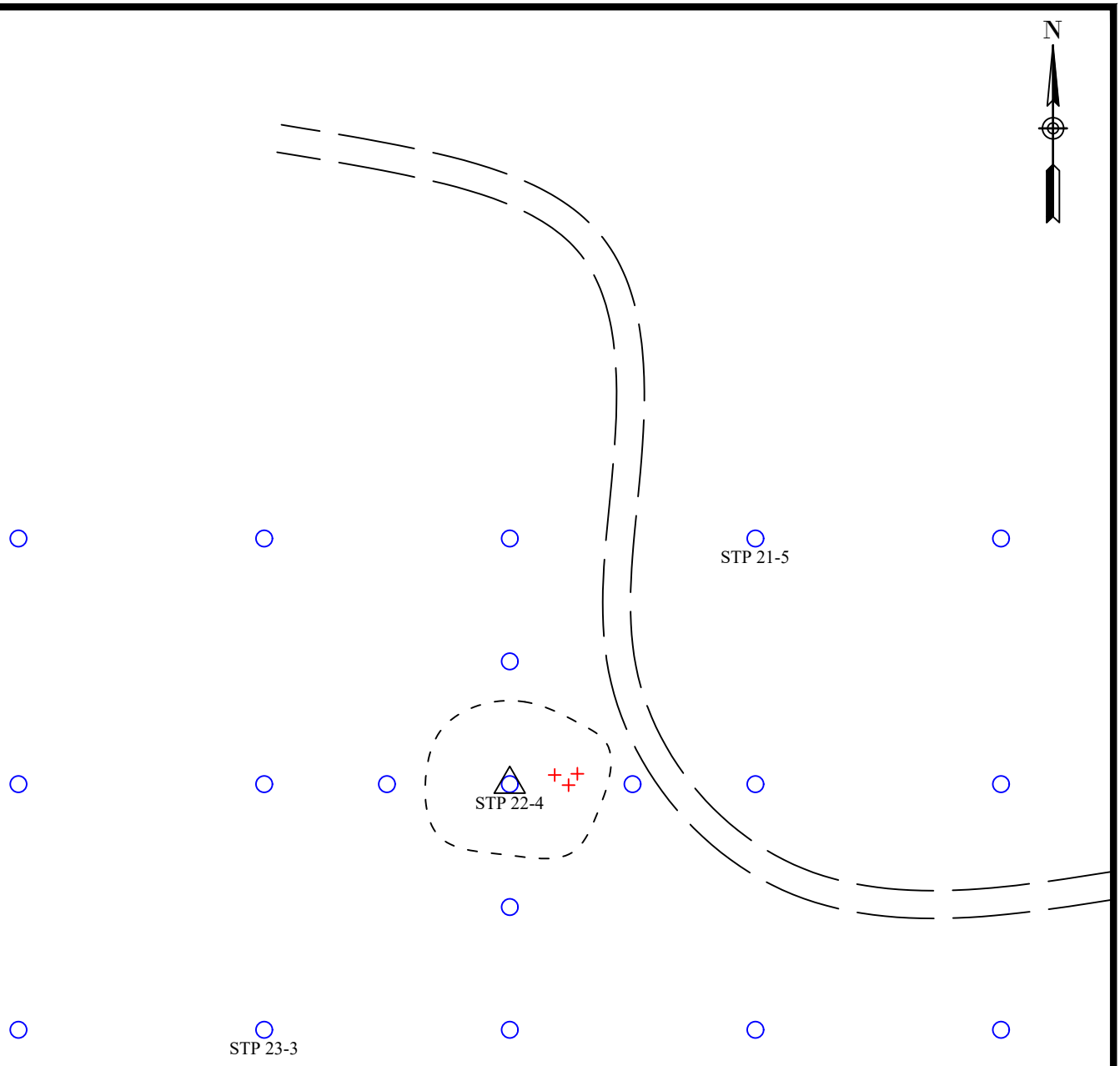
**Figure 5.18. Overview of site 38YK610, facing south.**

in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38YK610 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38YK610 will yield significant information on the prehistory or history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38YK610 is recommended ineligible for inclusion in the NRHP.

### *5.1.5 Site 38YK611*

| | |
|---|---|
| **Site Number**: 38YK611 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic scatter; Historic glass isolate | **Elevation:** 640 ft AMSL |
| **Components:** Unidentified; Unidentified | **Landform:** Hilltop |
| **UTM Coordinates**: E501459, N3868322 (NAD 83) | **Soil Type**: Cecil clay loam |
| **Site Dimensions**: 15 N/S x 15 E/W m | **Vegetation:** Hardwoods |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 9/0 |

Site 38YK611 is a prehistoric lithic scatter and twentieth century glass isolate, located on a hilltop (Figures 1.2 and 1.3). The site is located in an area of hardwoods and measures approximately 15 m north/south by 15 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.19 and 5.20).




LEGEND
++ Surface Scatter
○ Negative STP
△ Site Datum
Site Boundary
==== Dirt Road

0 15 30
Meters

# Site Map - 38YK611

Phase I Cultural Resources Survey
Project Inspector
York County, South Carolina

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**Figure 5.20. Overview of site 38YK611, facing north.**

A total of nine shovel tests were excavated in and around the site; a typical soil profile contained 5 cm of reddish brown (5YR 4/4) silty sand, terminating with 10+ cm (5–15+ cmbs) of dark red (2.5YR 4/8) sandy clay subsoil. A total of four artifacts were recovered from the surface of the site, three prehistoric and one historic (Appendix A). The prehistoric artifacts consist one quartz scraper and two pieces of lithic debitage (one quatz and one rhyolite); the historic artifact consists of one piece of clear glass. Historic maps show no structures in this location and none of the artifacts are temporally diagnostic.

Site 38YK611 is a prehistoric lithic scatter and twentieth century glass isolate, located on a hilltop in a wooded area. Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38YK611 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38YK611 will yield significant information on the prehistory or history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38YK611 is recommended ineligible for inclusion in the NRHP.

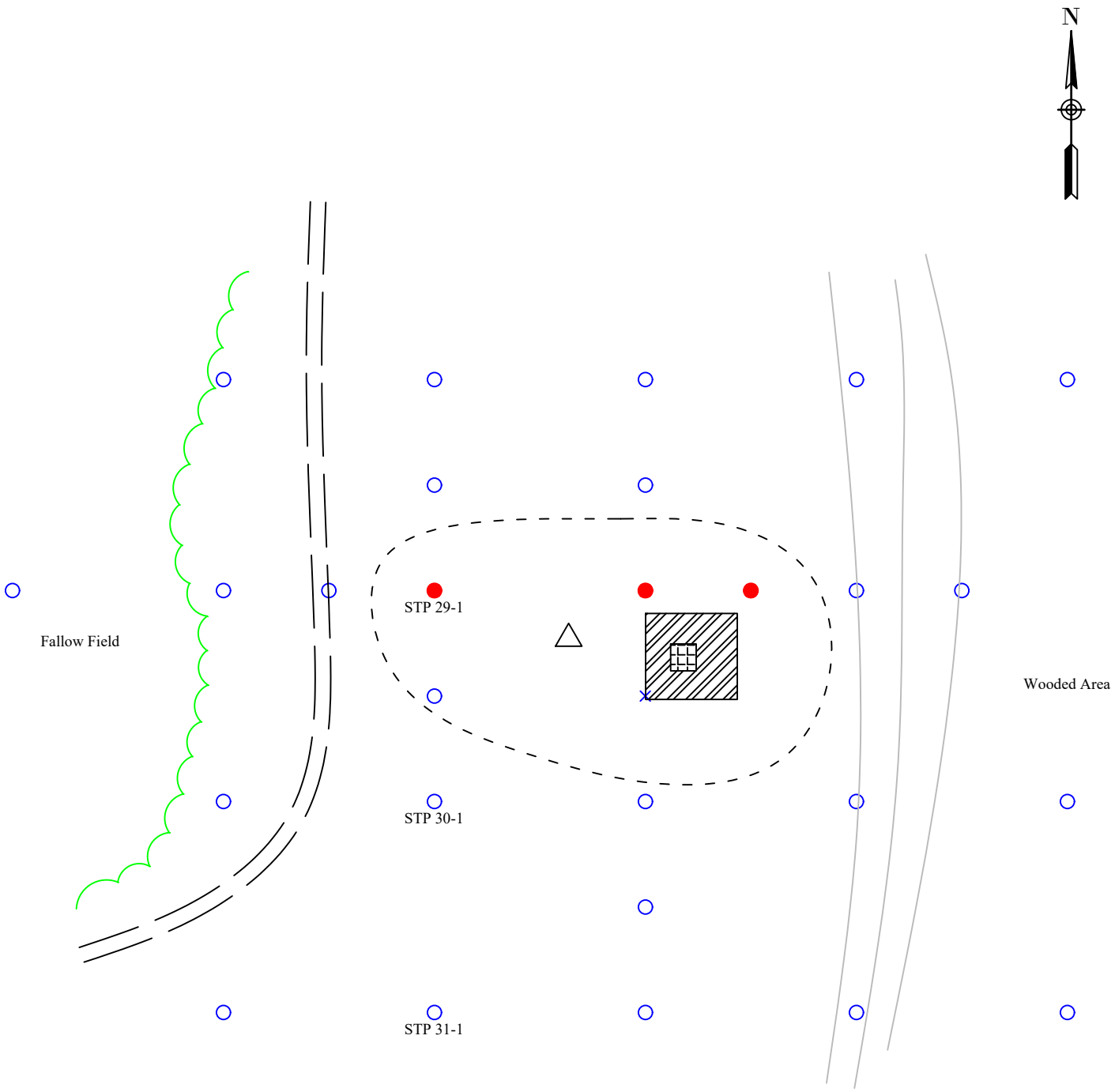
### *5.1.6 Site 38YK612*

| | |
|---|---|
| **Site Number**: 38YK612 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** House site | **Elevation:** 620 ft AMSL |
| **Components:** Early to mid-20th century | **Landform:** Hilltop |
| **UTM Coordinates**: E501534, N3868016 (NAD 83) | **Soil Type**: Cecil clay loam |
| **Site Dimensions**: 75 E/W x 45 N/S m | **Vegetation:** Hardwood/secondary growth |
| **Artifact Depth**: 0–25 cmbs | **No. of STPs/Positive STPs:** 16/3 |

Site 38YK612 is an early to mid-twentieth century house site, located on a hilltop in the central portion of the project area (Figures 1.2 and 1.3). The site is located in an area of hardwoods and secondary growth and measures approximately 75 m east/west by 45 m north/south; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.21 and 5.22).

A total of 16 shovel tests were excavated in and around the site; a typical soil profile contained 5 cm of reddish brown (5YR 4/4) silty sand, terminating with 10+ cm (5–15+ cmbs) of dark red (2.5YR 4/8) sandy clay subsoil (Figure 5.23). A total of 37 historic artifacts were recovered from between 0–25 cmbs in three shovel tests. The artifacts include three pieces of plain whiteware, three pieces of porcelain (two gold banded and one polychrome decal decorated), one piece of lead glazed coarse earthenware, seven pieces of clear glass, 11 pieces of window glass, one piece of burnt glass, one glass button, six nails (five cut and one wire), one screw, one staple, one piece of unidentified metal, and one piece of brick (Appendix B). In addition to the artifacts, a standing brick chimney remains in place along with some pieces of corrugated metal (Figure 5.23). Historic aerials show a structure in this location beginning in 1941 and continuing to 1976 (Figures 3.6, 3.7, and 3.11); by the time the 1993 topographic map was updated, the structure was gone (Figure 3.14). The plain whiteware dates from 1815 to the present; the underglazed decal decorated porcelain dates from 1897–present; the cut nails date from 1790 to present; and the wire nails date from 1850 to present. Although the artifacts date from the late eighteenth century to current, the historic aerials date the site to the early to mid-twentieth century.

Site 38YK612 is an early to mid-twentieth century house site, located on a hilltop in an area of hardwoods and secondary growth. Given that the building has been razed, the apparent lack of subsurface features, and the minimal variety and quantity of artifacts recovered from the site, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the history of the area (Criterion D). As such, site 38YK612 is recommended ineligible for inclusion in the NRHP.




LEGEND
- Positive STP
- Negative STP
- Unexcavated STP
- Brick Chimney
- Architectural Scatter
- Site Datum
- Site Boundary
- Dirt Road
- Tree Line

0 15 30
Meters

# Site Map - 38YK612

Phase I Cultural Resources Survey
Project Inspector
York County, South Carolina

| SCALE: | FIGURE NO. |
|---|---|
| As Shown | 5.21 |
| DATE: | |
| 7/23/2019 | |
| PROJECT NUMBER | |
| 4261-19-077 | |

**Figure 5.22. Overview of site 38YK612, facing northeast.**

**Figure 5.23. Typical soil profile at site 38YK612.**

**Figure 5.24. Standing brick chimney at site 38YK612, facing west.**

### *5.1.7 Isolated Finds*

**Isolated Find 1 (IF-1)** consists of a single quartz unidentified stemmed projectile point fragment (Figure 5.25) collected from the surface, in an area of mixed pine and hardwoods, at UTM coordinates E501350 N3868397 (NAD 83) (Figures 1.2 and 1.3). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the additional shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A), is not associated with the lives of significant persons in the past (Criterion B), does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C), and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-1 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 2 (IF-2)** consists of one piece of quartz debitage and one piece of milk glass, found on the surface of a dirt road in a transmission line corridor, at UTM coordinates E501446 N3868696 (NAD 83) (Figures 1.2 and 1.3). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the additional shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A), is not associated with the lives of significant persons in the past (Criterion B), does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C), and is unlikely to yield significant information on the prehistory or history of the area (Criterion D). As such, IF-2 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 3 (IF-3)** consists of a single piece of rhyolite debitage found on the surface, in an area of hardwoods, at UTM coordinates E501421 N3868383 (NAD 83) (Figures 1.2 and 1.3). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the additional shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A), is not associated with the lives of significant persons in the past (Criterion B), does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C), and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-3 is recommended ineligible for inclusion in the NRHP.

**Figure 5.25. Stemmed projectile point fragment found at IF-1.**

## 5.2 Project Area Architectural Survey Results

As part of the cultural resources intensive survey, a historic architecture survey was undertaken to identify resources greater than 50 years of age within a 0.5-mile radius of the proposed project area. Historic maps and aerial photographs were consulted to identify areas that were likely to have aboveground resources greater than 50 years of age. These areas, along with accessible public roads, were visited during the survey and photographs were taken of each resource older than 50 years. One previously evaluated aboveground resource (SHPO site number 3919 – Arrowhead Dairy) was revisited and three newly recorded aboveground resources (SHPO site numbers 3920 through 3922) were identified (Figures 1.2 and 1.3). Additionally, photographs were taken from the NRHP-eligible resources associated with the Red River community (SHPO site numbers 1541 through 1558) to verify existing viewshed intrusions.

### *5.2.1 Arrowhead Dairy (SHPO site number 3919)*

Arrowhead Dairy (SHPO site number 3919), located at 2258 Nations Ford Road, is a house and former dairy farm complex that is adjacent to and within the northwestern portion of the proposed project area (Figures 1.2 and 1.3). In 2018, a Preliminary Information Form (PIF) was submitted to the South Carolina SHPO to evaluate the NRHP eligibility of the Arrowhead Dairy; the PIF includes two early twentieth century barns that were part of the post-World War I dairy operations at Arrowhead Farm and the associated acreage, which covers approximately eight acres on two tax parcels. The PIF also notes that a nineteenth century farmhouse stands on the property but that it was significantly altered in the 1960s. In March 2018, the SHPO determined that Arrowhead Dairy is eligible for the NRHP under Criterion A, for its association with dairy farming in South Carolina, and under Criterion C, for the unique stone construction of the 1927 milk barn and the 1931 hay barn (Virginia Harness, SHPO, to Hiram Hutchinson III, letter, 21 March 2018).

S&ME revisited Arrowhead Dairy during the current survey. Although currently located on three separate tax parcels, the Arrowhead Dairy house (Hutchison House) and the associated agricultural and domestic outbuildings represent the longstanding Hutchison family ownership of the property and its operation as a farm, particularly as a dairy farm in the post-World War I period. The Arrowhead Dairy house (SHPO site number 3919.01) is located approximately 500 feet from the proposed project boundary and approximately 200 feet south of Nations Ford Road; associated with the house are six domestic and agricultural outbuildings located south and southeast of the house, closer to the proposed project area (Figures 1.2, 1.3, 5.26).

The house (SHPO site number 3919.01) is a nineteenth century I-house form, which was common for rural farm residences during the late 1800s and early 1900s, that has undergone significant expansion and alteration, primarily during the mid- to late twentieth century (Figures 5.27 through 5.31). The main section of the house, which has a side-gabled roof and rests on a brick foundation, appears to have been five bays wide, although based on the differences in window size openings and spacing it is possible that at least the eastern bay, and potentially the western bay, were later additions (Figure 5.27). The centrally located door has a five-light transom and three-light sidelights; it is flanked by two single nine-over-nine, double-hung, vinyl sash windows on either side. The upper story has a central door, opening to a small balcony with simple balustrade, flanked by two single eight-over-eight, double-hung, vinyl sash windows on either side. A monumental, three-bay, gabled porch that is supported by fluted metal columns has been added to the front façade, likely during the mid-twentieth century; applied dentil molding is located along the raking cornice and porch entablature (Figure 5.28). On the west elevation, which is one bay deep, the ground floor window has been replaced with a large 24-pane, vinyl framed picture window, while the second story window is a single eight-over-eight, double-hung, vinyl sash window (Figure 5.29). A single story, gabled addition, with single six-over-six, double-hung, vinyl sash windows, has been attached to the southwest corner of the house.

On the eastern elevation, a one-bay, two-story, side-gabled addition has been added to the main house; a formerly exterior stone chimney, that may date to the early twentieth century based on the similar construction to the early twentieth century barns, is visible at the junction of the main house and the addition (Figure 5.30). The east elevation is two bays deep, with two single eight-over-eight, double-hung, vinyl sash windows on the upper story; on the lower story, a single eight-over-eight, double-hung, vinyl sash window is located in the northern bay and the southern bay is covered by the attachment of a single story, gabled addition, which has single six-over-six, double-hung, vinyl sash windows. A large, two-story, gabled rear ell addition has been attached to the south elevation of the house, roughly centered in the original main house structure (Figure 5.31). This elevation has single eight-over-eight, double-hung, vinyl sash windows, and single and paired six-over-six, double-hung, vinyl sash windows. Along the west side of the rear addition, a brick chimney is visible. A shed-roofed porch spans the rear elevation of the house and extends to attach to the later addition, where it creates an open parking area that is supported by decorative metal posts. The house has a vinyl siding exterior and a composition shingle roof.

Based on aerial photographs of the property from the early to mid-1900s, the eastern addition had been built by 1941, but the porch and two-story rear addition do not appear to have been constructed until after 1965, although they're clearly visible on the 1973 and 1983 aerial photographs (Figures 3.6, 3.7, 5.32 through 5.34). The house has undergone significant modern alterations and has lost its integrity of design, materials, workmanship, and feeling, as well as its setting, since the area around it has changed from rural farmland to developed.

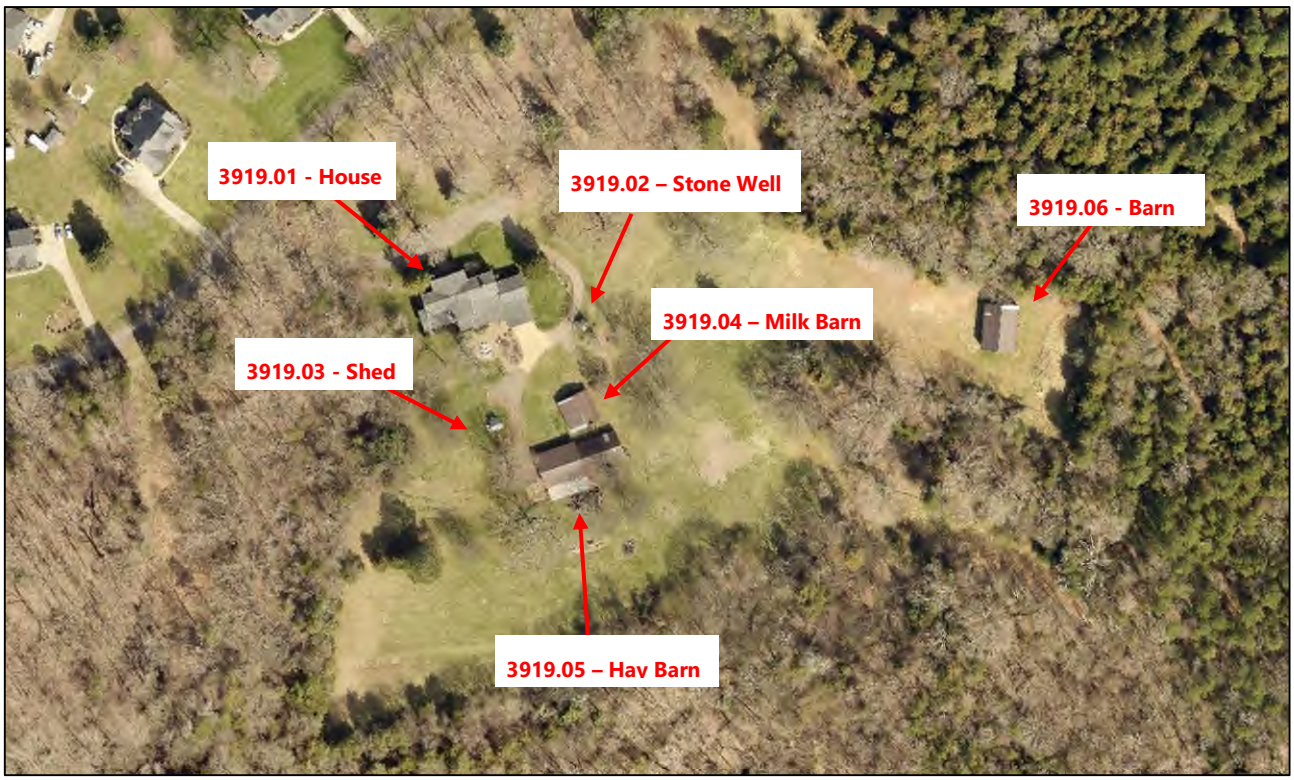



**Figure 5.26. Aerial photograph, showing location of Arrowhead Dairy structures.**

**Figure 5.27. Arrowhead Dairy, house (SHPO survey number 3919.01), facing south.**

**Figure 5.28. Arrowhead Dairy, house (SHPO survey number 3919.01), porch detail, facing south.**

**Figure 5.29. Arrowhead Dairy, house (SHPO survey number 3919.01), facing east.**

**Figure 5.30. Arrowhead Dairy, house (SHPO survey number 3919.01), facing southwest.**

**Figure 5.31. Arrowhead Dairy, house (SHPO survey number 3919.01), facing northwest.**

**Figure 5.32. USGS aerial photograph (1965), showing Arrowhead Dairy, house, (SHPO survey number 3919.01).**

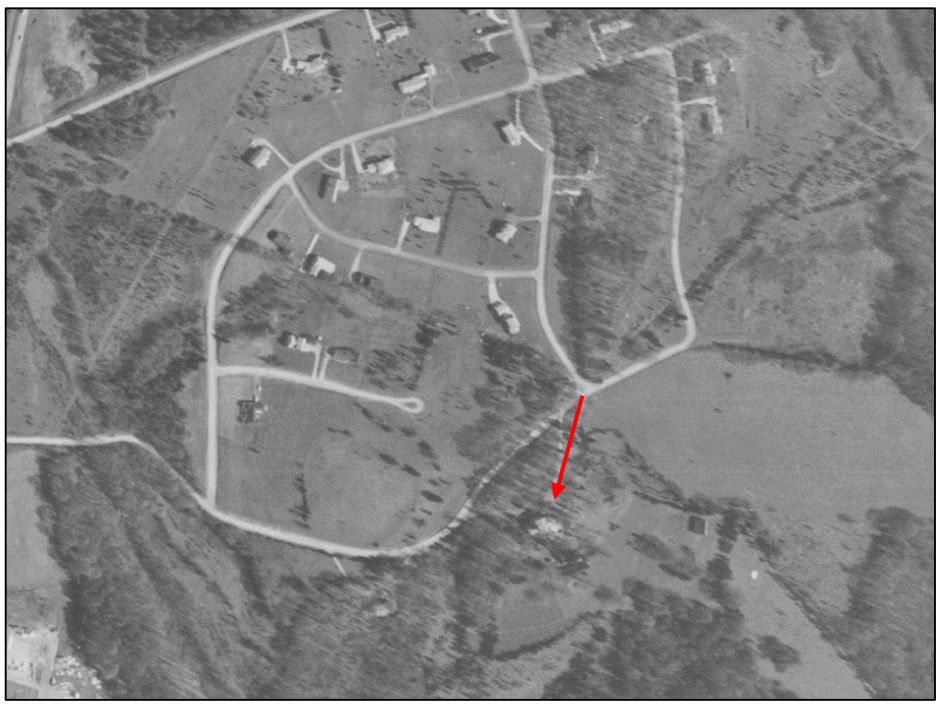


**Figure 5.33. USGS aerial photograph (1973), showing Arrowhead Dairy, house, (SHPO survey number 3919.01).**

**Figure 5.34. USGS aerial photograph (1983), showing Arrowhead Dairy, house, (SHPO survey number 3919.01).**

Southeast of the house is a stone well (SHPO site number 3919.02) which appears to be of similar construction to the early twentieth century barns and was likely built around the same period, dating it to the late 1920s to early 1930s. The well is roughly square, of stone masonry construction, with a wooden cap (Figures 5.35 and 5.36). At the eastern corner of the well is a rectangular box area. The well sits on a concrete pad, beneath an open gabled shelter that is supported by rough round posts; the roof is covered with standing-seam metal. The masonry on the well has apparently undergone repairs with modern cement mortar, specifically along the top, under the cap. Southwest of the house is a gabled brick masonry shed (SHPO site number 3919.03), which may have originally been used as a smokehouse or food storage area (Figures 5.37 through 5.40). The shed is of American common bond masonry construction, with a central doorway on the east elevation. The upper portion of the gable end is covered with standing-seam metal roofing, as is the roof of the structure, which has visible raftertails. The floor of the shed is currently poured concrete, although this is a later treatment and the original floor may have been dirt.

The brick of the shed appears to date the shed to the mid- to late nineteenth century, contemporaneous with the house. Although currently used as a shed, the building was likely originally a domestic or agricultural outbuilding associated with meat preparation or food storage.

South of the house are a 1927 milk barn (SHPO site number 3919.04) and a 1931 hay barn (SHPO site number 3919.05); these two barns were evaluated by the SHPO in the 2018 PIF for Arrowhead Dairy and were determined to be eligible for the NRHP under Criteria A and C. The milk barn is a single story, random rubble stone masonry structure, with beaded mortar joints (Figures 5.41 through 5.45). The western half of the milk barn is an enclosed structure, with a central doorway flanked by a single window on either side; the eastern side was originally open on the north elevation, likely to allow easy entry and exit for the dairy cattle, but is currently enclosed with

**Figure 5.35. Arrowhead Dairy, stone well (SHPO survey number 3919.02), facing south.**

**Figure 5.36. Arrowhead Dairy, stone well (SHPO survey number 3919.02), facing north.**

**Figure 5.37. Arrowhead Dairy, shed (SHPO survey number 3919.03), facing west.**

**Figure 5.38. Arrowhead Dairy, shed (SHPO survey number 3919.03), facing north.**

**Figure 5.39. Arrowhead Dairy, shed (SHPO survey number 3919.03), facing southeast.**

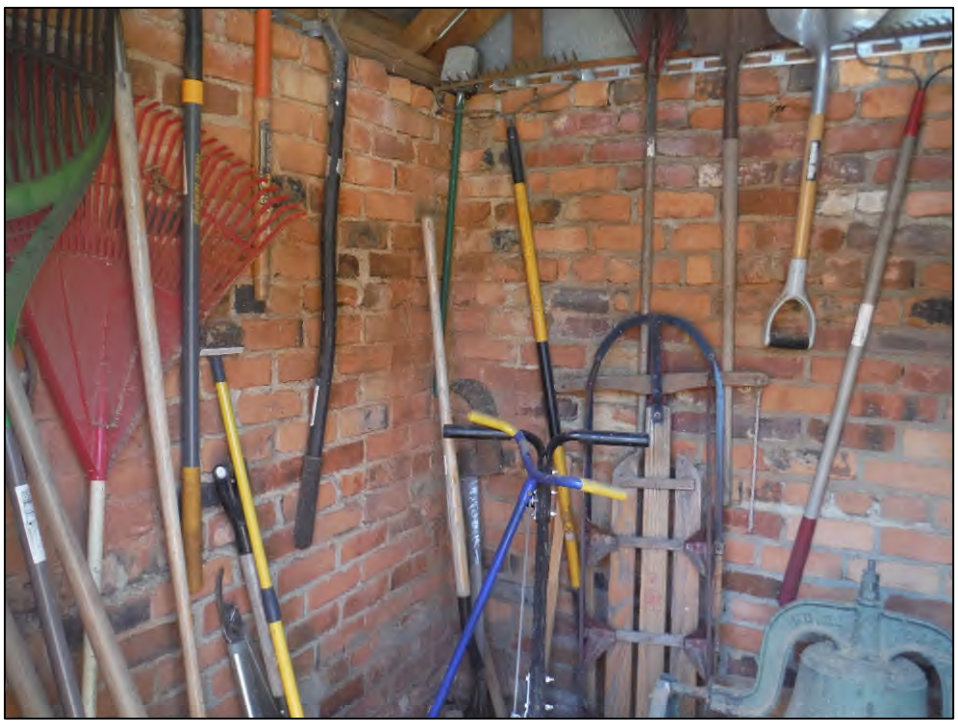


**Figure 5.40. Arrowhead Dairy, shed (SHPO survey number 3919.03), interior, facing southwest.**

**Figure 5.41. Arrowhead Dairy, milk barn (SHPO survey number 3919.04) and hay barn (SHPO survey number 3919.05), facing south.**

**Figure 5.42. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), facing southwest.**

**Figure 5.43. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), facing east.**

**Figure 5.44. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), facing west.**

**Figure 5.45. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), facing northwest.**

plywood panels (Figure 5.42). A dated cornerstone is located on the northern elevation, as is a white stone arrowhead centered within the gable end of the barn. Along the west elevation is the remains of a six-over-six, double-hung, wooden sash window and an entry door, while the eastern elevation has a pair of two-pane, horizontal sliding windows on the upper portion of the wall surface, toward the rear of the building (Figures 5.43 and 5.44). The southern elevation has an off-center door and two window openings, as well as a stone masonry chimney that is pulling away from the wall surface and has been shored with wooden and metal bracing (Figure 5.45). The interior of the barn is mostly open, with stucco covering a large portion of the interior walls and a fireplace along the south wall of the milking room (Figures 5.46 through 5.48).

The hay barn is oriented perpendicular to the milk barn, with the gable ends on an east-west access; it is also of random rubble stone masonry construction with beaded mortar joints, a carved and dated cornerstone, and a white stone arrowhead centered in the gable end of the west elevation (Figures 5.49 through 5.51). The western elevation has a central doorway, which is currently enclosed with a modern garage door; it is flanked by a single six-pane casement window on either side (Figure 5.49). The side elevations of the hay barn reveal that it is actually two separate buildings with slightly different roof heights that are connected (Figures 5.49 and 5.50). The western portion of the south elevation has a shed-roofed open projection that is supported by square posts and has five twelve-pane, wooden frame casement windows beneath it; the eastern portion has an entry door and four six-pane, wooden frame casement windows. The north elevation has window and door openings arranged the same as the south elevation, with no shed-roofed extension. The east elevation was originally an open bay with three sections and a loft opening on the upper story, but the two side sections have been covered with standing-seam metal roofing used as siding; the gable end is covered with horizontal wooden siding (Figure 5.51). The interior of the hay barn is mostly open and is currently used for storage (Figures 5.52 through 5.54). Both the milk barn and

**Figure 5.46. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), interior, facing north.**

**Figure 5.47. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), interior, facing south.**

**Figure 5.48. Arrowhead Dairy, milk barn (SHPO survey number 3919.04), interior, facing east.**

**Figure 5.49. Arrowhead Dairy, hay barn (SHPO survey number 3919.05), facing northeast.**

**Figure 5.50. Arrowhead Dairy, hay barn (SHPO survey number 3919.05), facing west.**

**Figure 5.51. Arrowhead Dairy, hay barn (SHPO survey number 3919.05), facing west.**

**Figure 5.52. Arrowhead Dairy, hay barn (SHPO survey number 3919.05), interior, facing southeast.**

**Figure 5.53. Arrowhead Dairy, hay barn (SHPO survey number 3919.05), interior, facing west.**

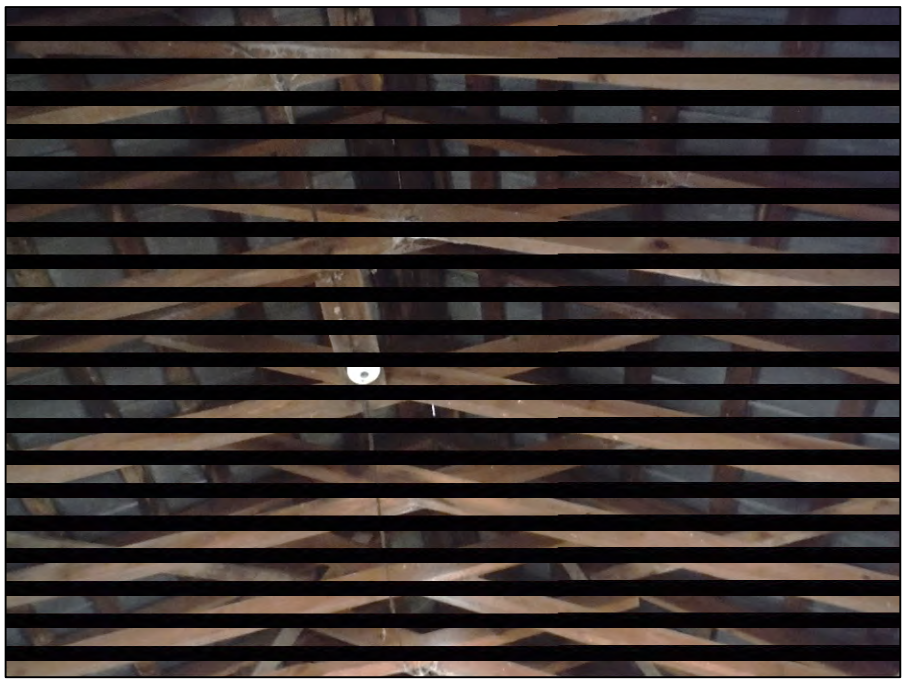


**Figure 5.54. Arrowhead Dairy, hay barn (SHPO survey number 3919.05), interior, roof trusses.**

hay barn have standing seam metal roofing and visible raftertails along the eaves. South of the hay barn is a small, metal silo (SHPO site number 3919.06). The silo is cylindrical, with curved steel panels and it currently has no roof structure (Figure 5.55). Based on its construction materials and form, the silo likely dates to the 1930s and was constructed in conjunction with the hay barn, to serve as storage for feed materials.

East of the house and other outbuildings is a storage barn (SHPO site number 3919.07) that dates to 1935 (Figures 5.56 through 5.57). Like the milk barn and hay barn, the storage barn is of random rubble stone masonry construction with beaded mortar joints, a carved and dated cornerstone, and a stone arrowhead on the upper story of the northern elevation. The south elevation of the barn has a central double doorway, with a loft-level window opening above it; the upper portion of the gable end is enclosed with open horizontal wooden siding, to allow for ventilation (Figure 5.56). The side elevations are asymmetrical in their arrangement of openings, with four window openings on the west elevation and five openings on the east elevation; the majority of the window openings have been covered on the interior with plywood, although frames of two-pane, casement windows are visible on the west elevation (Figures 5.57 and 5.58). The northern façade of the barn is being encroached upon by vegetation; it has a double entry door centered on both the upper and lower levels and symmetrical two-pane wooden window frames flanking the lower level door (Figure 5.59). It also has the wooden siding at the upper reaches of the gable, to allow ventilation. Like the milk barn and the hay barn, the storage barn has visible raftertails and a standing-seam metal roof.

Although a large amount of property associated with the former Arrowhead Dairy remains within the three parcels that contain the farm building, which together contain approximately 215 acres, most of the landscape features associated with the property's agricultural period, both as a dairy and before, have disappeared. The open pastures that are visible in the mid-twentieth century aerial photographs (Figures 3.6, 3.7, and 5.32) have been allowed to reforest and the open landscape necessary for dairy farming is no longer extant. Therefore, no landscape features associated with the Arrowhead Dairy were recorded during this survey.

**Figure 5.55. Arrowhead Dairy, silo (SHPO survey number 3919.06), facing north.**

**Figure 5.56. Arrowhead Dairy, storage barn (SHPO survey number 3919.07), facing northwest.**

**Figure 5.57. Arrowhead Dairy, storage barn (SHPO survey number 3919.07), facing northeast.**

**Figure 5.58. Arrowhead Dairy, storage barn (SHPO survey number 3919.07), facing southwest.**

**Figure 5.59. Arrowhead Dairy, storage barn (SHPO survey number 3919.07), facing southeast.**

Two of the Arrowhead Dairy structures, the milk barn and hay barn (SHPO site numbers 3919.04 and 3919.05) were determined eligible for the NRHP within the last two years and remain extant; S&ME concurs with the eligibility determination for these two Arrowhead Dairy structures. Additionally, S&ME recommends that the masonry shed (SHPO site number 3919.03), the metal silo (SHPO site number 3919.06), and the 1935 storage barn (SHPO site number 3919.07) are also eligible for inclusion in the NRHP under Criterion A, for their association with the Arrowhead Dairy, as additional representative structures from the early twentieth century rise in dairy farming in South Carolina, and under Criterion C, for their method of construction, as the brick masonry, stone masonry, and metal construction are each representative of the time period and function of these outbuildings.

## Balloon Survey

On January 8, 2020, S&ME completed a drone/balloon survey to determine if the viewshed of Arrowhead Dairy would be adversely affected by the construction of the complex associated with Project Inspector. S&ME flew a

drone, with three red balloons attached, to a height of 120 feet, the tallest point of the proposed complex, at two locations where the proposed building may be located (Figures 5.60 and 5.61).

### Location 1

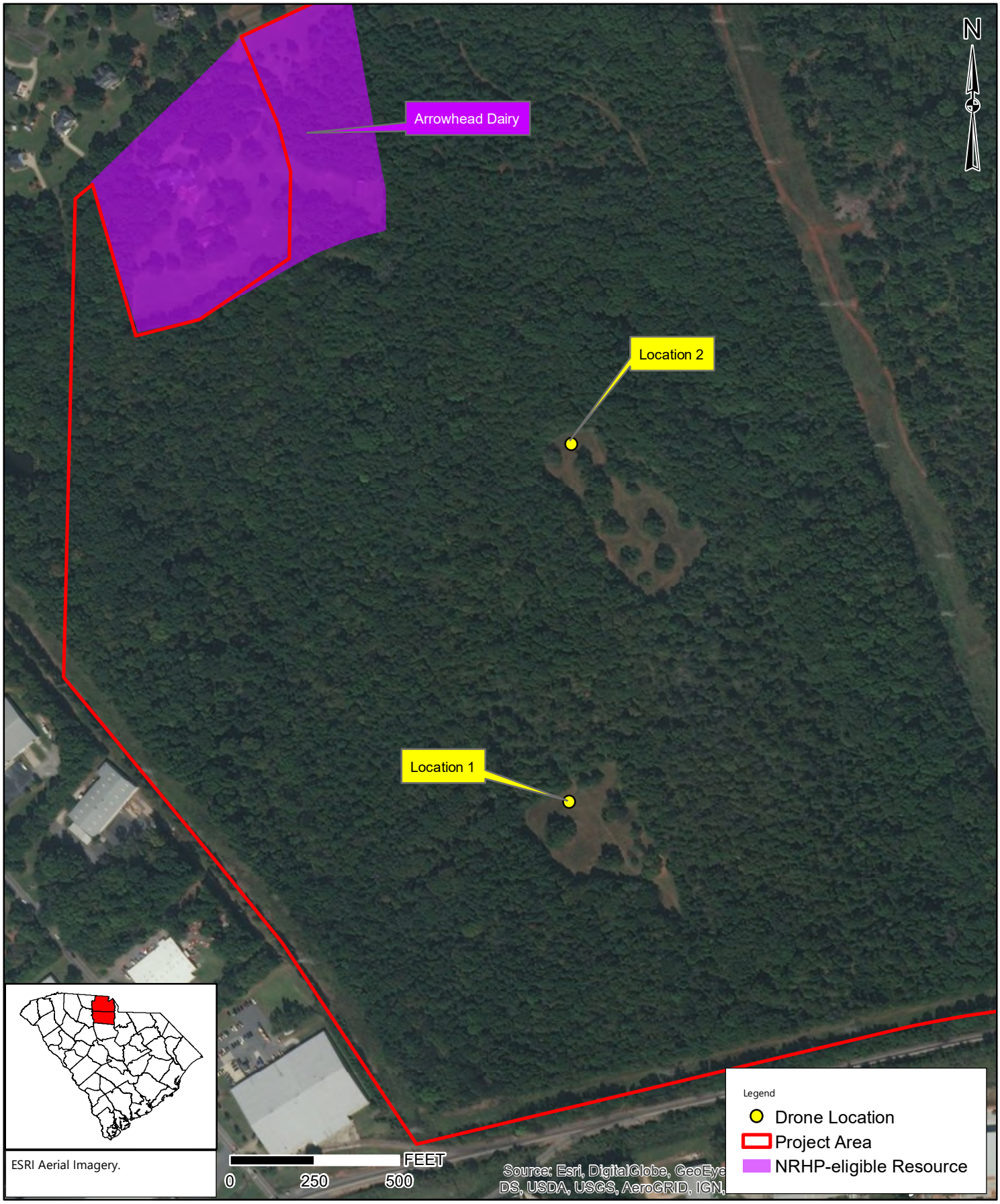
Location 1 is located approximately 0.4-mile south southeast of Arrowhead Dairy, in an area where the proposed building complex will be placed (Figure 5.60). Location 1 is at an elevation of 580 ft AMSL, which is 70 ft lower than Arrowhead Dairy, which is at an elevation of 650 ft AMSL. Due to the distance of the location from the resource, the change in elevation, and the vegetation surrounding the resource, the balloons and drone were not visible from Arrowhead Dairy (Figures 5.62 and 5.63).

### Location 2

Location 2 is located approximately 0.25 mile southeast of Arrowhead Dairy in an area where the proposed building complex will be placed (Figure 5.60). Location 2 is at an elevation of 620 ft AMSL, which is 30 ft lower than Arrowhead Dairy, which is at an elevation of 650 ft AMSL. Due to the distance from the resource, the change in elevation, and the vegetation surrounding the resource, the balloons and drone were not visible from Arrowhead Dairy (Figures 5.64 and 5.65).

## Recommendations for Arrowhead Dairy

Construction on the proposed site has the potential to affect the NRHP-eligible structures of the Arrowhead Dairy. One of the parcels that contain Arrowhead Dairy structures abuts the current project area, one is less than 150 feet from the project area boundary, and the third parcel, which contains the 1935 storage barn (SHPO site number 3919.07), is part of the proposed project area. The drone/balloon survey indicated that the project, as currently planned will not have an adverse effect on the viewshed of the NRHP-eligible structures. However, other effects remain possible. Therefore, S&ME recommends that the 1935 storage barn be retained on the property and avoided during construction activities. Additionally, the storage barn and the other eligible buildings may be indirectly affected by construction traffic and vibrations. S&ME recommends that construction traffic access the project area via a route away from the Arrowhead Dairy structures, that low-vibration construction methods be employed during site work in the project area. If these measures to minimize effects are incorporated into the project plans, the project would have no adverse effect on the NRHP-eligible Arrowhead Dairy structures. If construction traffic cannot avoid the Arrowhead Dairy for project access, low-vibration construction methods cannot be employed, or the storage barn cannot be avoided, additional consultation may be necessary with the SHPO and other consulting parties to minimize or mitigate potential adverse effects. Additionally, if project plans change and the height or location of the proposed complex structure changes, additional consultation with the SHPO will be necessary.

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| PROJECT NO: | 4261-19-077 |
| DRAWN BY: | KJN |
| DATE: | 1/17/2020 |

**Drone/Balloon Location Map**

Project Inspector Project Area

Chester and York Counties, South Carolina

FIGURE NO.

5.60

Drawing Path: T:\Projects\2019\ENV\4261-19-077_SCDOC_Project_Inspector_Rock Hill\Working_Documents\Phase 440 Cultural Resources\GIS\Figures\Figure 5-60 drone locations.mxd plotted by KNagle 01-17-2020

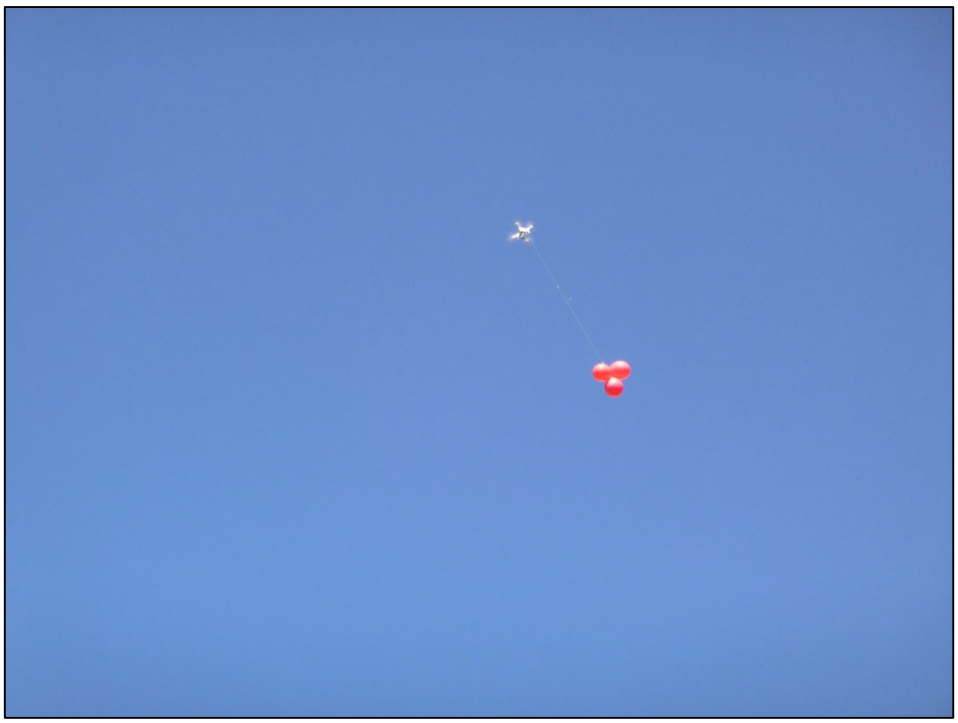


**Figure 5.61. Image of drone and balloons in flight.**

**Figure 5.62. Looking toward Location 1 from Arrowhead Dairy, facing south southeast.**

**Figure 5.63. Zoomed in image looking toward Location 1 from Arrowhead Dairy, facing south southeast.**

**Figure 5.64. Looking toward Location 2 from Arrowhead Dairy, facing southeast.**

**Figure 5.65. Zoomed in image looking toward Location 2 from Arrowhead Dairy, facing southeast.**

### *5.2.2 Hutchinson Place (SHPO site number 3920)*

The Hutchinson Place neighborhood (SHPO site number 3920) is located northwest of the proposed project area (Figures 1.2 and 1.3). It is bounded on the south by Nations Ford Road, on the north by Eden Terrace, and on the east and west by Blossom Drive; also within the neighborhood are Arrowhead Drive, Cornwell Drive, Quail Drive, and Shamrock Court (Figure 5.66). Currently, the neighborhood includes 77 residential structures, located along curvilinear streets. Hutchinson Place was originally platted in 1964, on former Hutchinson family lands. Construction began on houses shortly after it was platted and continued through the early 2000s; by 1973 there were 25 residences completed within the neighborhood and three years later there were 30 (Figures 3.10, 3.11, and 5.67 through 5.69). The houses in the southern and eastern portions of the neighborhood were the most recently constructed.

Curvilinear subdivision, while not unique to the mid-twentieth century, became a popular design choice for Post World War II residential neighborhoods. As the demand for single family housing increased, the layouts of these new clusters of housing was influenced by the minimum property requirements set forth by the Federal Housing Authority (FHA) and the Community Builder's Handbook of the Urban Land Institute. The preferred standards of the FHA, which was responsible for financing and low-cost mortgages for new homeowners, stressed integration of topographic and natural features into subdivision landscapes, wide enough streets to accommodate traffic,

**Figure 5.66. Aerial photograph, showing Hutchinson Place (SHPO survey number 3920) and example architectural styles within the subdivision (SHPO survey numbers 3920.01 through 3920.07).**

**Figure 5.67. U.S. Air Force aerial photograph, 1964, showing Hutchinson Place (SHPO survey number 3920).**

**Figure 5.68. USGS. aerial photograph, 1965, showing Hutchinson Place (SHPO survey number 3920).**

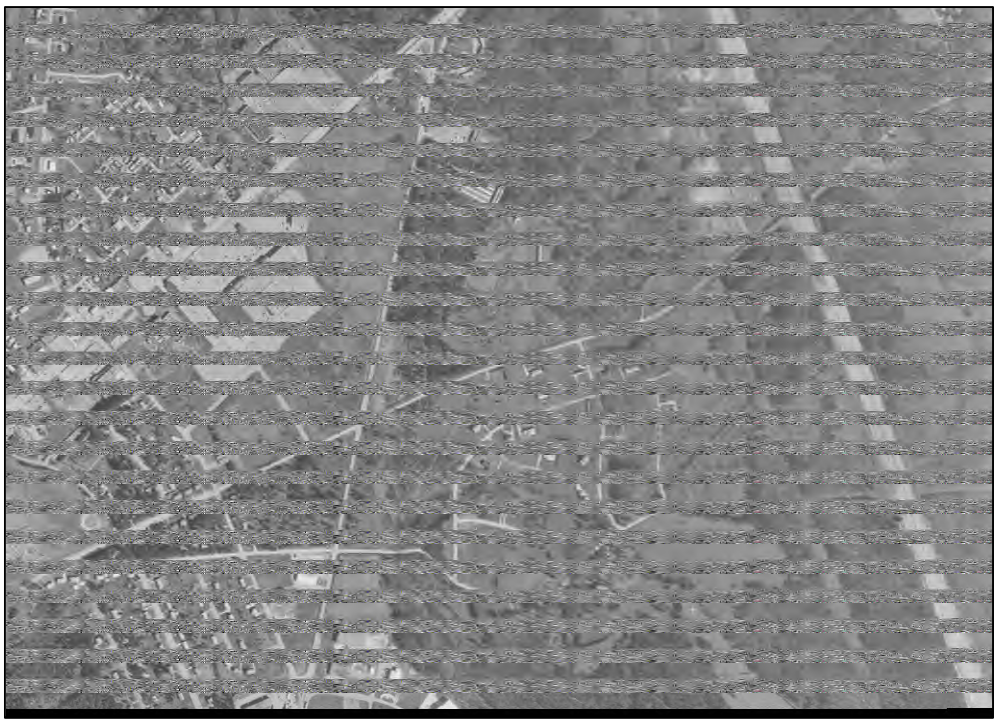


**Figure 5.69. USGS. aerial photograph, 1973, showing Hutchinson Place (SHPO survey number 3920).**

avoidance of sharp corners and dangerous intersections, and large lots. By 1947, these standards were incorporated into the Urban Land Institute's first handbook, which was the most widely used community planning resource of the time (Ames and McClelland 2002). For post-World War II residential subdivisions, significant landscape and planning features included driveways, sidewalks, curb cuts, street trees, street patterns, parking patterns, open spaces, setbacks, building placement, and building orientation. Hutchinson Place conforms with the standard planning concepts for residential subdivisions that were popular during the mid-1960s, including large lots, curving streets, mature vegetation, deep setbacks, and houses generally oriented laterally to the streets (Figures 5.70 through 5.72).

Within the Hutchinson Place neighborhood there are a number of different house styles and plans, although they generally conform to three broad categories: rectangular plan Ranch houses, U-shaped Ranch houses, and two-story Colonial Revival houses. The rectangular plan Ranch-style residences are divided into two subgroups, those with hipped roofs and those with side-gabled roofs. An example of a hip-roofed rectangular Ranch is located at 2272 Eden Terrace (SHPO site number 3920.01), which dates to pre-1965 (Figure 5.73). The house is brick veneer, with an off-center front door located beneath a hip-roofed portico; the fenestration includes two-over-two, wooden sash windows and a tripartite picture window. A garage is integrated into the western side of the house, beneath the main roofline. Side-gabled rectangular plan Ranches are the most common type of house style within the neighborhood, with examples located at 2270 Blossom Drive (SHPO site number 3920.02) and 967 Arrowhead Drive (SHPO site number 3920.03), both pre-1968 structures with brick veneer exteriors (Figures 5.74 and 5.75). The house at 2270 Blossom Drive has an inset front door, along with single and paired six-over-six, wooden sash windows and a curved bay window. The house at 967 Arrowhead Drive is a stylized Ranch, with Colonial Revival detailing, including a gabled portico supported by Tuscan columns; there is an off-center door and the windows are single six-over-six, wooden sash windows with wooden panels beneath.

**Figure 5.70. Streetscape along Arrowhead Road, Hutchinson Place (SHPO survey number 3920), facing south.**

**Figure 5.71. Streetscape along Arrowhead Road, Hutchinson Place (SHPO survey number 3920), facing north.**

**Figure 5.72. Streetscape along Arrowhead Road, Hutchinson Place (SHPO survey number 3920), facing north.**

**Figure 5.73. House at 2272 Eden Terrace (SHPO survey number 3920.01), facing south.**

**Figure 5.74. House at 2270 Blossom Drive (SHPO survey number 3920.02), facing east.**

**Figure 5.75. House at 967 Arrowhead Drive (SHPO survey number 3920.03), facing southwest.**

Two examples of U-shaped Ranch-style houses, with cross-gabled rooflines, are located at 2304 Eden Terrace (SHPO site number 3920.04) and 2283 Blossom Drive (SHPO site number 3920.05), both pre-1973, with brick veneer (Figures 5.76 and 5.77). The house at 2304 Eden Terrace has an inset front door and two front-gabled projections; the fenestration includes paired one-over-one, vinyl sash windows. The house at 2283 Blossom Drive also has an inset door and two front-gabled projections; the windows are single and paired six-over-six, vinyl sashes. A screen room has been added to the west side and a garage has been attached via a breezeway. The two-story, Colonial Revival residences, which were between 1964 and 1973, are the second most common type of house, including those located at 960 Arrowhead Drive (SHPO site number 3920.06) and 923 Arrowhead Drive (SHPO site number 3920.07) (Figures 5.78 and 5.79). The house at 960 Arrowhead Drive has a brick veneer exterior and a symmetrical front elevation, with central door located beneath a gabled portico; the windows are paired six-over-six, vinyl sashes, with a single six-over-six, vinyl sash above the door. A screened addition is located on the south elevation and a single story, side-gabled extension on the north elevation. The house at 923 Arrowhead Road is also brick veneer, with a central door beneath a hip-roofed portico; the windows are paired six-over-six, vinyl sashes, with a single six-over-six, vinyl sash above the door. Single story wings are located on both the north and south elevations.

Although Hutchinson Place (SHPO survey number 3920) is an example of a mid-twentieth century residential subdivision that was platted with a commonly used curvilinear plan and it contains good examples of both Ranch and Colonial Revival style residences, the continued construction of modern houses within the neighborhood into the early 2000s and the alterations, including replacement windows, to some of the original houses have compromised the neighborhood's integrity of design, materials, and feeling; the increased commercial development on the surrounding lands has altered the setting. Therefore, S&ME recommends Hutchinson Place (SHPO survey number 3920) as ineligible for inclusion in the NRHP; additionally, none of the individual properties are significant examples of a particular architectural style or are associated with important people, events, or patterns of history and are not recommended as individual eligibility for the NRHP.

### *5.2.3 Commercial Building (SHPO survey number 3921)*

SHPO survey number 3921 is a commercial building located at 520 Mt. Gallant Road, approximately 365 feet west of the proposed project area (Figures 1.2 and 1.3). The building is a circa 1970, rectangular, metal frame commercial building (Figure 5.80). The building has a low-pitched, front-gabled roofline and a three-bay, gabled portico that is supported by metal posts. The central entry door has a broken pediment surround; it is flanked by four one-over-one, double-hung, vinyl sash windows on either side. The south elevation has a shed-roofed porch, with a concrete floor and triangular metal post supports, that shades a garage door bay. The exterior of the building is covered with vertical metal siding. The building was constructed between 1968 and 1973, based on USGS topographic maps and historic aerial photographs (Figures 3.10, 3.11, and 5.69). The building is a common mid- to late twentieth century commercial structure that does not represent a significant event or period of history; it is not associated with a significant person; it is not an example of a particular architectural style or method of construction; and it will not increase the knowledge of history or construction methods. Therefore, S&ME recommends the commercial building (SHPO survey number 3921) as ineligible for inclusion in the NRHP.

**Figure 5.76. House at 2304 Eden Terrace (SHPO survey number 3920.04), facing southeast.**

**Figure 5.77. House at 2283 Blossom Drive (SHPO survey number 3920.05), facing north.**

**Figure 5.78. House at 960 Arrowhead Drive (SHPO survey number 3920.06), facing east.**

**Figure 5.79. House at 923 Arrowhead Drive (SHPO survey number 3920.07), facing southwest.**

**Figure 5.80. Commercial Building (SHPO survey number 3921), facing north.**

### *5.2.4 Southern Railway Corridor (SHPO survey number 3922)*

The former Southern Railway Corridor (SHPO survey number 3922) runs along the southern boundary of the project area (Figures 1.2 and 1.3). The corridor is along the original 1852 route of the Charlotte and South Carolina Railroad, which was the second rail line constructed in South Carolina. To the east of the project line, the rail line crosses the Catawba River at the location of the old Nations Ford; it was here that the crucial railroad bridge was burned in 1865 and then rebuilt following the Civil War. The line had stops at Fort Mill, the Catawba River, Ebenezerville, and Rock Hill. In 1869, the Charlotte and South Carolina Railroad merged with the Columbia and Augusta Railroad to form the Charlotte, Columbia, and Augusta Railroad; nine years later, the line was acquired by the Richmond and Danville Railroad and it was officially merged into the new system in 1882. In 1894, the Southern Railway was created from the merger of the Richmond and Danville Railroad and the East Tennessee, Virginia, and Georgia Railroad; for nearly 100 years, the Southern Railway operated until its 1982 merger with Norfolk and Western Railway to form the Norfolk Southern Railway (Loy, Hillman, and Cates 2004). The railroad is visible on the 1905 USDA soil survey map and on subsequent historic maps (Figure 3.4 through 3.11). Currently, the railroad corridor is located on a slight berm, which is covered with gravel, surrounded by trees and the tracks are modern materials (Figure 5.81). The corridor represents early railroad transportation in South Carolina and the important route between Charlotte and Columbia, however, the setting, materials, and workmanship of the railroad corridor have been altered through modern maintenance activities and large amounts of residential and commercial growth near the corridor. Therefore, S&ME recommends this portion of the Southern Railway Corridor (SHPO survey number 3922) as ineligible for the NRHP.

**Figure 5.81. Southern Railway Corridor (SHPO survey number 3922), facing west.**

### *5.2.5 Cross Roads Baptist Church Cemetery (SHPO survey number 3889)*

The Cross Roads Baptist Church Cemetery (SHPO survey number 3889) is located north of the Norfolk Southern railroad tracks, east of Interstate 77, on an approximately three-acre parcel owned by Cross Roads Baptist Church and a portion of a parcel owned by a development company (Figures 1.2 and 1.3). The parcel is currently forested, and the cemetery is unmaintained; it is approximately 230 meters northeast/southwest by 140 meters northwest/southeast and contains nine marked burials and a large number of unmarked interments (Figures 5.82 through 5.84). The marked burials in the Cross Roads Baptist Church Cemetery date from the 1880s through the 1930s; the markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers (Figures 5.85 through 5.88). Other graves are marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used (Figures 5.89 through 5.92). Depressions along the ground surface suggest unmarked burials (Figures 5.93 and 5.94).

The Cross Roads Baptist Church Cemetery is a late nineteenth through early twentieth century cemetery associated with the Cross Roads Baptist Church, which is currently located approximately one mile to the northwest of the cemetery, along Eden Terrace. The church is an African-American congregation that was organized in 1868, with its first sanctuary built in 1872, on a parcel of land near the cemetery. This building was destroyed by fire in 1931 and the church moved to its current location in 1932 and built a new sanctuary. The 1932 church building was damaged by a vehicle strike in 2007 and was demolished by 2010. After the church moved from its late nineteenth century location, they established a new cemetery near the new sanctuary building and this cemetery was abandoned. The area around the cemetery appears cleared on aerial photographs from 1938 and 1941, but during the late 1940s and into the 1950s, it was beginning to become overgrown; by 1965, it is no longer recognizable on aerial photographs (Figures 5.95 through 5.99).

Drawing Path: T:\Projects\2019\ENV\4261-19-077_SCDOC_Project_Inspector_Rock Hill\Working_Documents\Phase 440 Cultural Resources\GIS\Figures\Figure 5-76 cemetery.mxd plotted by KNagle 01-20-2020

| | | | |
|---|---|---|---|
| SCALE: | 1:3,248 | **Cemetery Map** | FIGURE NO. |
| PROJECT NO: | 4261-19-077 | Project Inspector Project Area | 5.76 |
| DRAWN BY: | KJN | | |
| DATE: | 1/20/2020 | Chester and York Counties, South Carolina | |

**Figure 5.83. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), facing north.**

**Figure 5.84. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), facing northeast.**

**Figure 5.85. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Lillie Bell Mayfield grave marker.**

**Figure 5.86. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Maggie Nash grave marker.**

**Figure 5.87. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Ira Campbell grave marker.**

**Figure 5.88. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Hattie A. Mayfield grave marker.**

**Figure 5.89. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), brick grave marker.**

**Figure 5.90. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), stone grave marker.**

**Figure 5.91. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), stone grave marker with initials.**

**Figure 5.92. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), unused crypt.**

**Figure 5.93. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), grave depression.**

**Figure 5.94. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), grave depression.**

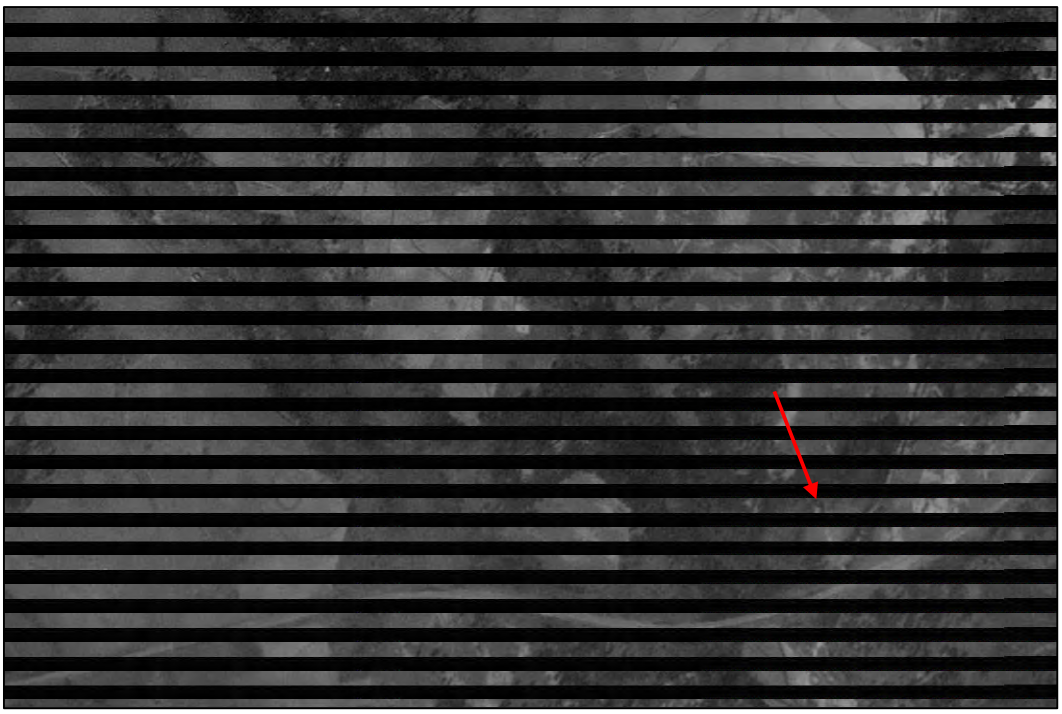


**Figure 5.95. USGS aerial photograph, 1938, showing location of the Crossroads Baptist Church Cemetery (SHPO survey number 3889).**

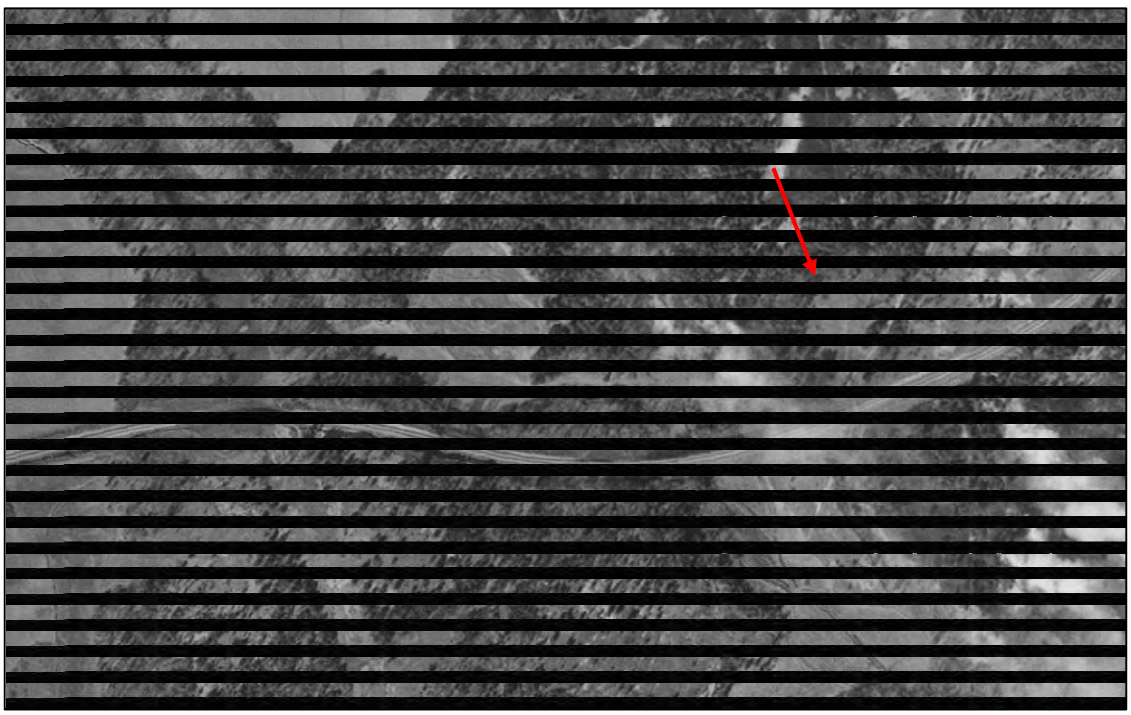


**Figure 5.96. USGS aerial photograph, 1941, showing location of the Crossroads Baptist Church Cemetery (SHPO survey number 3889).**

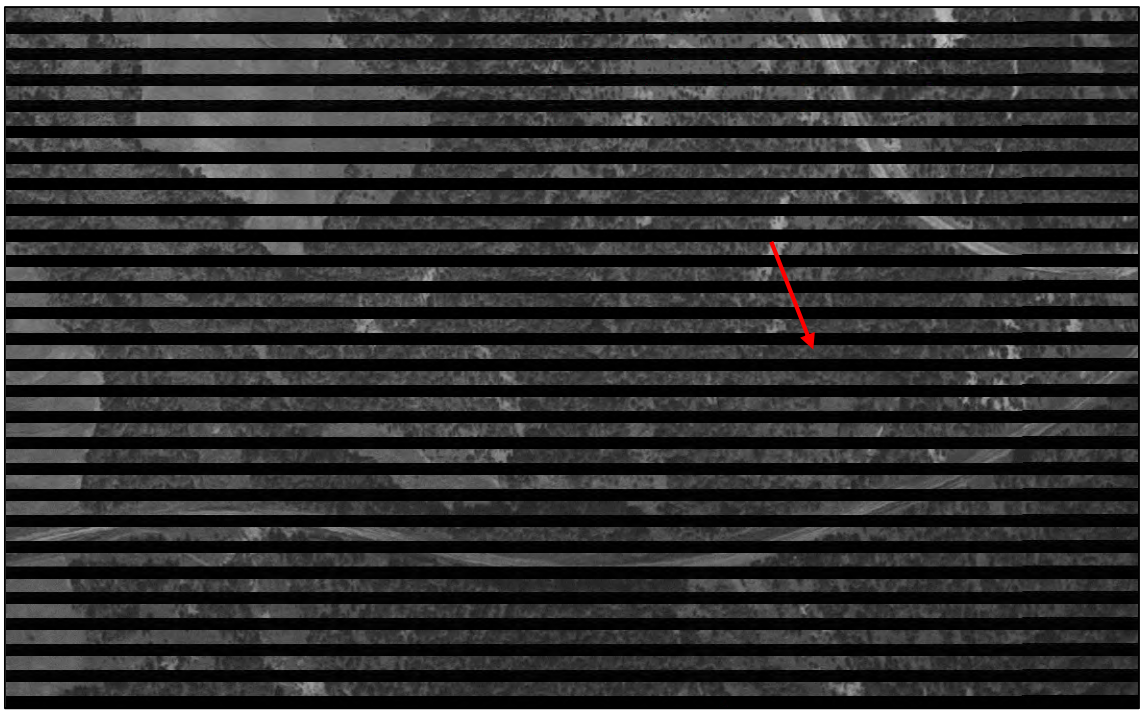


**Figure 5.97. USGS aerial photograph, 1949, showing location of the Crossroads Baptist Church Cemetery (SHPO survey number 3889).**

**Figure 5.98. USGS aerial photograph, 1954, showing location of the Crossroads Baptist Church Cemetery (SHPO survey number 3889).**

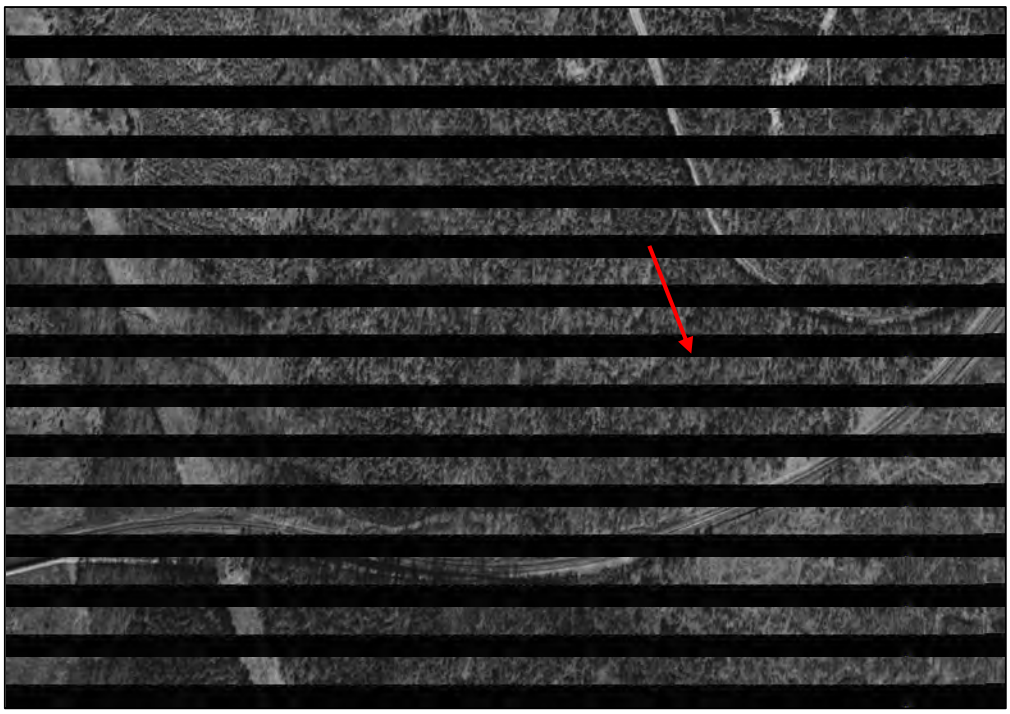


**Figure 5.99. USGS aerial photograph, 1965, showing location of the Crossroads Baptist Church Cemetery (SHPO survey number 3889).**

The interments in the Cross Roads Baptist Church Cemetery were probably those of church members and may date to as early as the church's founding in 1868, although no marked graves bear dates that early. Of the nine marked burials in the Cross Roads Baptist Church Cemetery, only two bear the same surname; these belong to Hattie A. Mayfield (1875–1919), who was the wife of Reverend Primus M. Mayfield, and Lillie Bell Mayfield (1906–1922), their daughter, both of whom died of tuberculosis (South Carolina Death Certificates 1919; North Carolina Death Certificates 1922; Figures 5.85 and 5.88). The earliest marked burial in the cemetery is Anderson Hall (1828–1888); two other marked burials, Maggie Nash (died 1889) and Grandison Springs (1795–1891) date to the nineteenth century (Figures 5.86, 5.100, and 5.101). The remaining four burials were interred between 1915 and 1931 (Figures 5.87, 5.102 through 5.104); it was in this year that the church at this location was destroyed by fire. Presumably, once the congregation moved to its new location, the burials in this cemetery ceased.

Cemeteries are not usually considered eligible for listing in the NRHP; however, they can be eligible under certain Criteria Considerations, usually Criteria Consideration D. Criteria Consideration D states that: "a cemetery is eligible if it derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events." From basic historic research, the people interred in the Cross Roads Baptist Church Cemetery are members the local African-American community, none of whom are of transcendent importance. The cemetery dates from the late nineteenth through the early twentieth century; although it has an affiliation with a local church, it has been abandoned and unkept for many years and is one of many rural cemeteries in the county and does not have an association with a specific historic event. The Cross Roads Baptist Church Cemetery has no distinctive design features, nor does it contain grave stones that unique or of artistic value. Therefore, it does not meet the conditions of Criteria Consideration D and is recommended as ineligible for the NRHP. The Cross Roads Baptist Church Cemetery is currently located outside of the proposed

**Figure 5.100. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Anderson Hall grave marker.**

**Figure 5.101. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Grandison Springs grave marker.**

**Figure 5.102. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Reverend J. L. Jennings grave marker.**

**Figure 5.103. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Ellie Hugh Good grave marker.**

**Figure 5.104. Cross Roads Baptist Church Cemetery (SHPO survey number 3889), Louisa Farrow grave marker.**

project area and the proposed project, as currently proposed, would not affect the cemetery. If project plans change and the cemetery cannot be avoided, please note that cemeteries are protected from disturbance and desecration under South Carolina state law (South Carolina Code of Laws 16-17-600).

### *5.2.6 Red River Community Structures (SHPO site numbers 1541–1547 and 1548–1558)*

Located northwest of the intersection of Celriver Road and the railroad tracks, approximately 0.35-mile southeast of the eastern portion of the project area, are 17 structures, associated with the Red River Community, that have been determined eligible for the National Register. This portion of the proposed project area follows Paragon Way, an existing roadway that provides access to an existing industrial park. Interchange improvements may take place at the intersection; however, the area has already been developed and new roadway improvements will have no adverse effect on the resources to the southeast (Figured 5.105 through 5.107).

**Figure 5.105. Structures within the Red River Community, facing north.**

**Figure 5.106. View toward the project area from Lynderboro Street, facing northwest.**

**Figure 5.107. View along Celriver Road, from Lynderboro Street, facing north.**

## 5.3 Mitigation Site Archaeological Survey Results

The mitigation site is approximately 484 acres in size and is located between Landsford Road and the Catawba River (Figures 1.4 and 1.5); approximately 129.1 acres and 1.4 miles of proposed access roads make up the LOD at the mitigation site. The LOD was the focus of the investigation, since the remaining portion of the mitigation site will remain unmodified. Work within the mitigation site will include a variety of activities including:

- **Access roads** – tree clearing and grading to construct new roads, erosion and sediment control, and stabilization of disturbed area;
- **Stream corridors** - grading eroding stream banks, excavating new stream channels, filling abandoned and incised stream channels, removal of select trees to facilitate stream construction, construction of in-stream habitat, erosion and sediment control, and replanting and stabilization of disturbed areas;
- **NRHP-listed Landsford Canal** – filling an existing drainage ditch, tree clearing, and replanting of disturbed areas; and
- **Aquatic resource buffers** – tree clearing and replanting of disturbed areas.

Vegetation within the mitigation site is a mix of hardwood stands, planted pine, and areas of mixed pine and hardwood (Figures 5.108 through 5.110). Slope greater than 15 percent surrounded the streams; the streams contained water and the banks were steep (Figures 5.111 through 5.115); these areas were pedestrian surveyed to see if artifacts were eroding into the stream bank or if artifacts were on the surface. The remaining portion of the LOD was shovel tested (Figure 4.2). The six archaeological sites (38CS425 through 38CS430) and eight isolated finds (IF-1 through IF-8) are discussed below.

**Figure 5.108. Mixed pine and hardwood within the mitigation site, facing north.**

**Figure 5.109. Planted pine within the mitigation site, facing east.**

**Figure 5.110. Typical dirt road within the mitigation site, facing southeast.**

**Figure 5.111. Tributary at southeastern corner of mitigation site, facing southwest.**

**Figure 5.112. Typical slope leading to streams in mitigation site, facing southeast.**

**Figure 5.113. Typical slope leading to streams in mitigation site, facing north.**

**Figure 5.114. Typical stream and stream bank condition in mitigation site, facing southeast.**

**Figure 5.115. Typical stream and stream bank condition in mitigation site, facing southeast.**

### *5.3.1 Site 38CS425*

| | |
|---|---|
| **Site Number**: 38CS425 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic scatter | **Elevation:** 580 ft AMSL |
| **Components:** Unidentified | **Landform:** Hillslope |
| **UTM Coordinates**: E508804, N3850684 (NAD 83) | **Soil Type**: Cecil sandy clay loam |
| **Site Dimensions**: 15 N/S x 15 E/W m | **Vegetation:** Mixed pine and hardwood |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 9/0 |

Site 38CS425 is a prehistoric lithic scatter, located on a hillslope along a dirt road (Figures 1.4 and 1.5). The site is located in an area of mixed pine and hardwoods and measures approximately 15 m north/south by 15 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.116 and 5.117).

A total of nine shovel tests were excavated in and around the site; a typical soil profile contained 10+ cm of strong brown (7.5YR 5/6) sandy clay subsoil (Figure 5.118). A total of three artifacts were recovered from the surface of the site, two quartz retouched flakes and one piece of shell (Appendix A). None of the artifacts are temporally diagnostic.

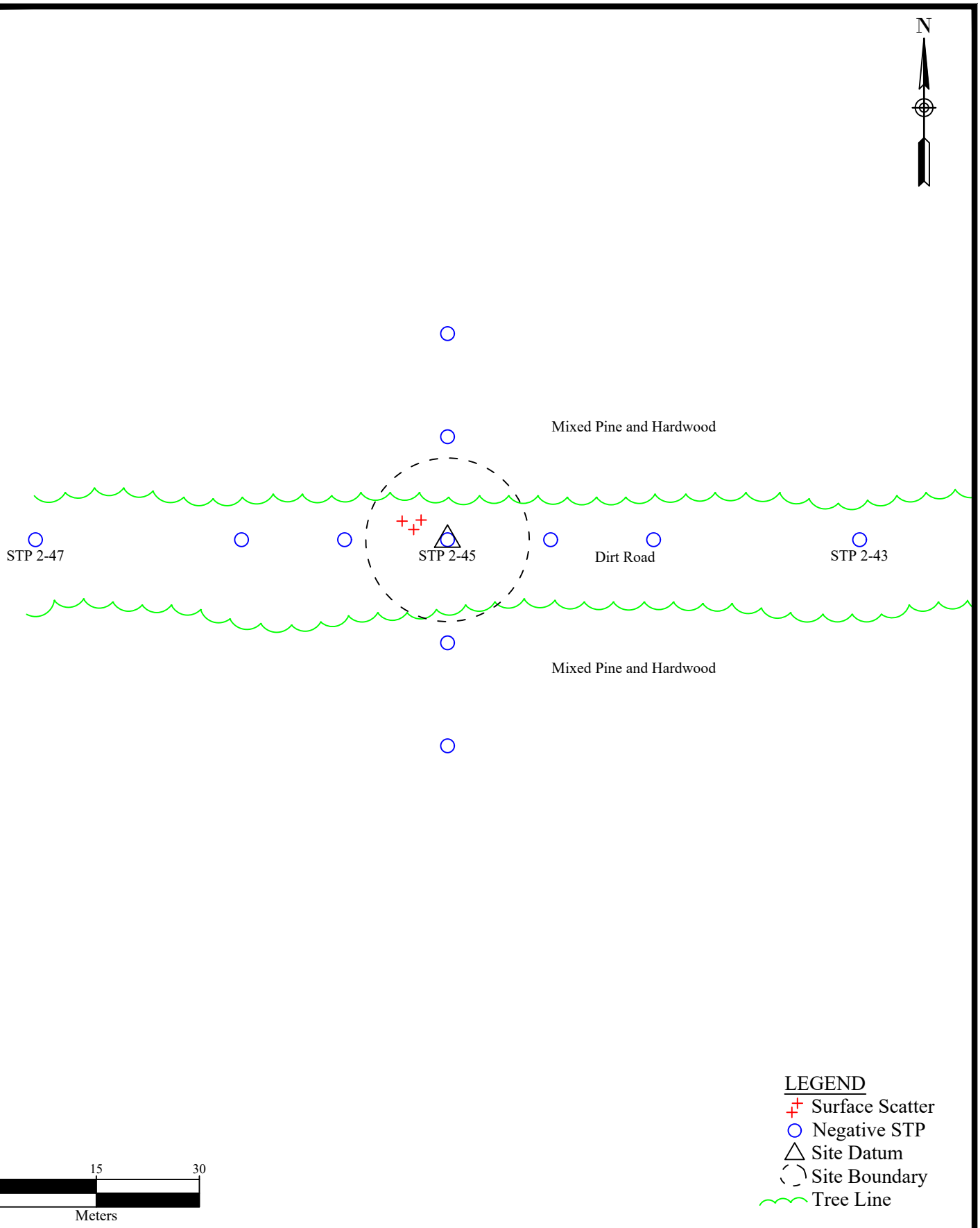
Site 38CS425 is a prehistoric lithic scatter, located on a hillslope along a dirt road. Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38CS425 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given the paucity of artifacts and artifact types and the lack of stratigraphy at the site, it is unlikely that site 38CS425 will yield significant information on the prehistory of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38CS425 is recommended ineligible for inclusion in the NRHP.

### *5.3.2 Site 38CS426*

| | |
|---|---|
| **Site Number**: 38CS426 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic isolate; Historic artifact scatter | **Elevation:** 570 ft AMSL |
| **Components:** Unidentified; 19th to 20th century | **Landform:** Hillslope |
| **UTM Coordinates**: E509226, N3850644 (NAD 83) | **Soil Type**: Cecil sandy clay loam |
| **Site Dimensions**: 20 N/S x 20 E/W m | **Vegetation:** Mixed pine and hardwood |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 9/0 |

Site 38CS426 is a prehistoric lithic isolate and nineteenth and twentieth century artifact scatter, located on a hillslope along a dirt road (Figures 1.4 and 1.5). The site is located in an area of mixed pine and hardwood and measures approximately 20 m north/south by 20 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.119 and 5.120).

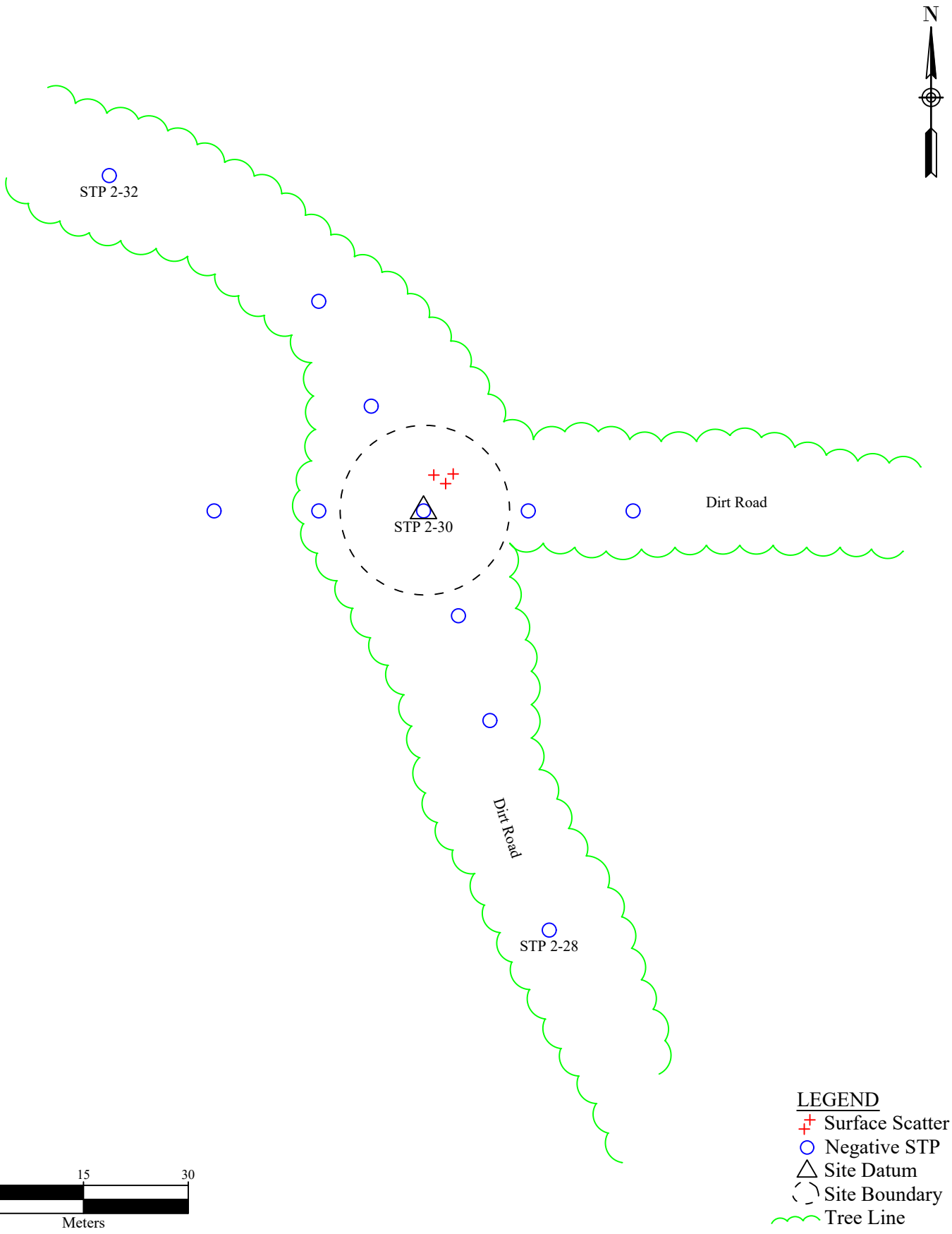
A total of nine shovel tests were excavated in and around the site; a typical soil profile contained 10+ cm of red (2.5YR 5/8) sandy clay subsoil (Figure 5.121). A total of eight artifacts were recovered from the surface of the site, one prehistoric and seven historic (Appendix A). The prehistoric artifact consists of a piece of quartz debitage; the




| | | | |
|---|---|---|---|
| | **Site Map - 38CS245** | SCALE: As Shown | FIGURE NO. **5.116** |
| | Phase I Cultural Resources Survey<br>Project Inspector Mitigation Site<br>York County, South Carolina | DATE: 01/13/2020<br>PROJECT NUMBER 4261-19-077 | |

**Figure 5.117. Overview of site 38CS425, facing west.**

**Figure 5.118. Typical shovel test profile at site 38CS425.**




| | | | |
|---|---|---|---|
| | **Site Map - 38CH426** | SCALE: As Shown | FIGURE NO. **5.119** |
| | Phase I Cultural Resources Survey<br>Project Inspector Mitigation Site<br>York County, South Carolina | DATE: 01/13/2020<br>PROJECT NUMBER 4261-19-077 | |

**Figure 5.120. Overview of site 38CS426, facing northeast.**

**Figure 5.121. Typical shovel test profile at site 38CS426.**

historic artifacts include one piece of blue transfer print whiteware, one piece of plain whiteware, four pieces of plain porcelain, and one piece of clear glass. Historic maps show no structures in this location; the plain whiteware dates from 1815–present and the blue transfer print whiteware dates from 1815–1915, while the remaining artifacts are not temporally diagnostic.

Site 38CS426 is a prehistoric lithic isolate and nineteenth and twentieth century artifact scatter, located on a hillslope along a dirt road. Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38CS426 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38CS426 will yield significant information on the prehistory or history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38CS426 is recommended ineligible for inclusion in the NRHP.

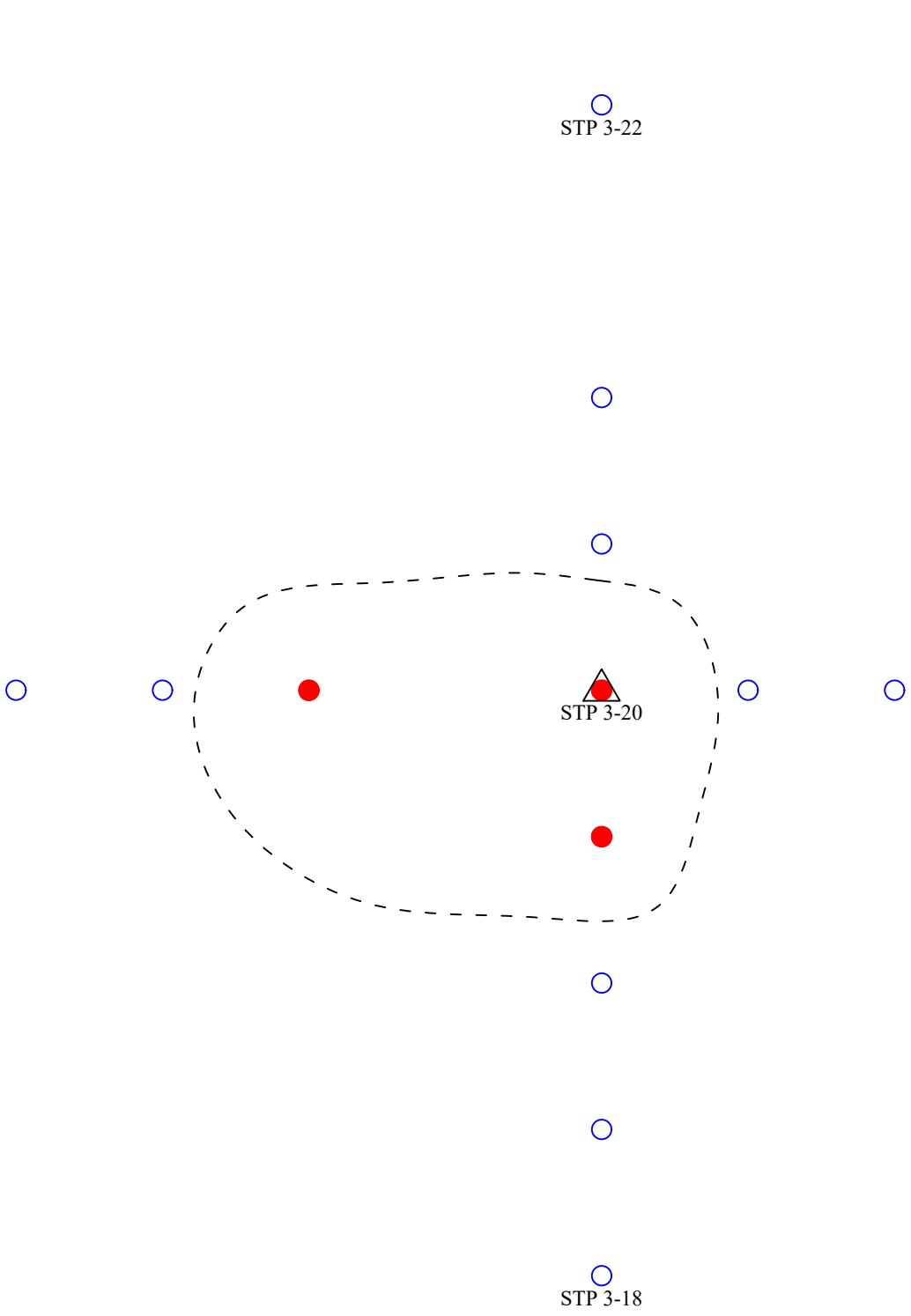
### *5.3.3 Site 38CS427*

| | |
|---|---|
| **Site Number:** 38CS427 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Historic artifact scatter | **Elevation:** 580 ft AMSL |
| **Components:** 19th/20th Century | **Landform:** Hillslope |
| **UTM Coordinates**: E508902, N3851133 (17N, NAD 83) | **Soil Type**: Pacolet sandy loam |
| **Site Dimensions**: 45 m E/W x 20 m N/S | **Vegetation:** Mixed pine and hardwoods |
| **Artifact Depth**: 0–10 cmbs | **No. of STPs/Positive STPs:** 11/3 |

Site 38CS427 is a nineteenth and twentieth century artifact scatter, located on a hillslope along a proposed roadway corridor (Figures 1.4 and 1.5). The site is located in mixed pine and hardwoods, measures approximately 45 m east/west by 20 m north/south, and is bounded by two negative shovel tests to each of the four cardinal directions (Figures 5.122 and 5.123).

Eleven shovel tests were excavated in and around site 38CS427; a typical shovel test consisted of 10 cm of yellow (10YR 7/8) silty sandy, terminating with 10+ cm (10–20+ cmbs) of red (2.5YR 5/8) sandy clay subsoil (Figure 5.124). A total of seven artifacts were recovered from three shovel tests; the artifacts include two pieces of glazed stoneware, two pieces of plain whiteware, one piece of amethyst/solarized glass, one piece of clear glass, and one piece of milk glass (Appendix A). No signs of a structure or foundation was present at the site and historic maps show no structures in this location; the plain whiteware dates from 1815 to present, the amethyst/solarized glass dates from 1880–1915, and the remaining artifacts are not temporally diagnostic.

Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38CS427 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and,

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| | **Site Map - 38CS427** | SCALE: As Shown | FIGURE NO. **5.122** |
| | Phase I Cultural Resources Survey<br>Project Inspector Mitigation Site<br>York County, South Carolina | DATE: 01/13/2020<br>PROJECT NUMBER 4261-19-077 | |

**Figure 5.123. Overview of site 38CS427, facing north.**

**Figure 5.124. Typical shovel test profile at site 38CS427.**

therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38CS427 will yield significant information on the history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38CS427 is recommended ineligible for inclusion in the NRHP.

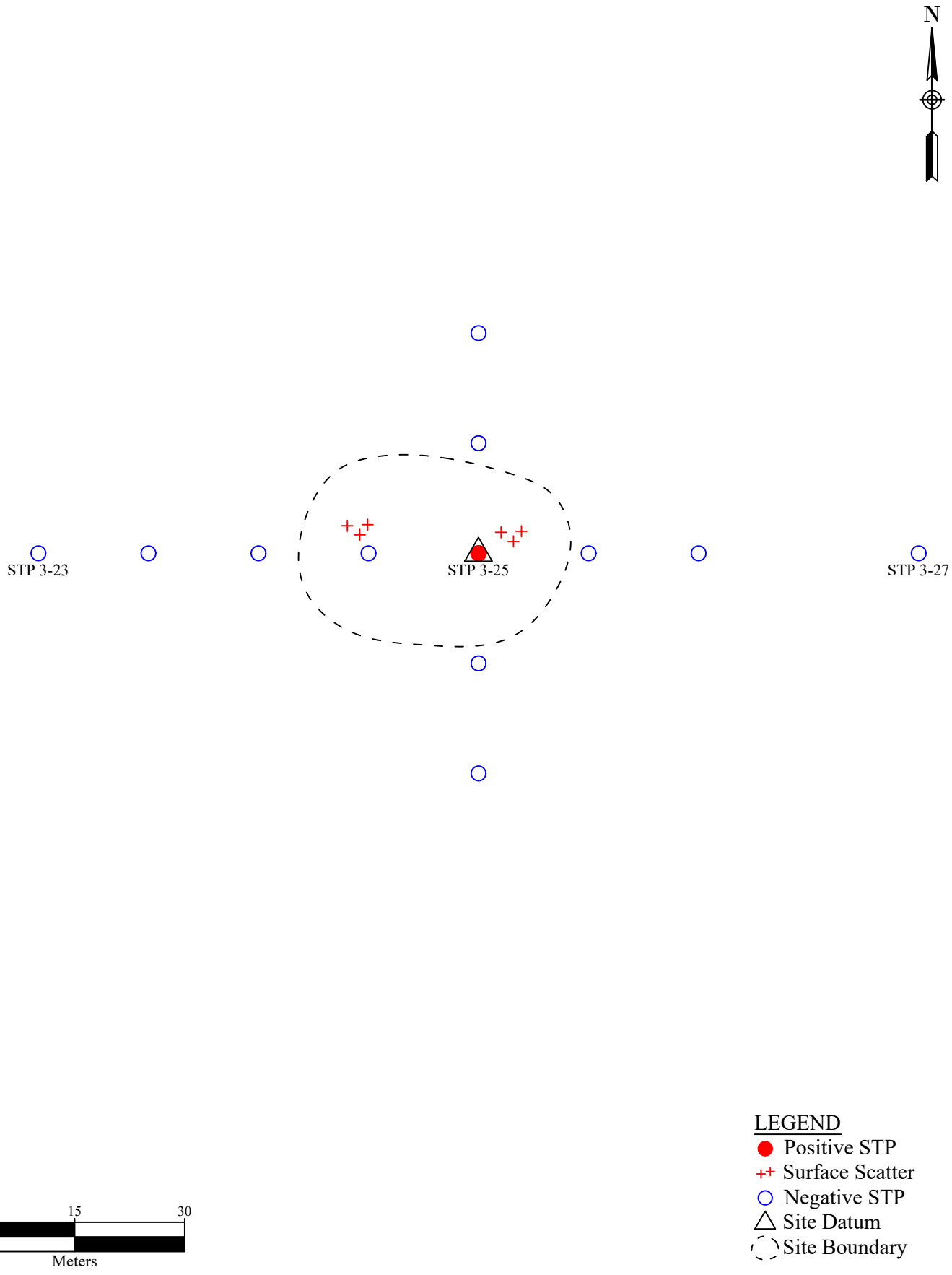
### *5.3.4 Site 38CS428*

| | |
|---|---|
| **Site Number**: 38CS428 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic scatter | **Elevation:** 580 ft AMSL |
| **Components:** Unidentified | **Landform:** Hillslope |
| **UTM Coordinates**: E509038, N3851226 (NAD 83) | **Soil Type**: Cecil sandy loam |
| **Site Dimensions**: 20 N/S x 20 E/W m | **Vegetation:** Mixed pine and hardwood |
| **Artifact Depth**: Surface; 0–20 cmbs | **No. of STPs/Positive STPs:** 10/1 |

Site 38CS428 is a prehistoric lithic scatter, located on a hillslope along a proposed roadway (Figures 1.4 and 1.5). The site is located in an area of mixed pine and hardwoods and measures approximately 20 m north/south by 20 m east/west; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.125 and 5.126).

A total of 10 shovel tests were excavated in and around the site; a typical soil profile contained 10 cm of yellow (10YR 7/8), terminating with 10+ cm (10–20+ cmbs) of red 27.5YR 5/8) sandy clay subsoil (Figure 5.127). A total of six artifacts were recovered from the site, one from a single shovel test and five from the surface of the site. The artifacts consist of one quartz biface fragment, one quartz retouched flake, one quartz utilized flake, and three pieces of lithic debitage (two quartz and one rhyolite) (Appendix A). None of the artifacts are temporally diagnostic.

Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38CS428 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given the paucity of artifacts and the lack of stratigraphy at the site, it is unlikely that site 38CS428 will yield significant information on the prehistory of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38CS428 is recommended ineligible for inclusion in the NRHP.

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|---|---|---|---|
| | **Site Map - 38CS428** | SCALE: As Shown | FIGURE NO. **5.125** |
| | Phase I Cultural Resources Survey<br>Project Inspector Mitigation Site<br>York County, South Carolina | DATE: 01/13/2020<br>PROJECT NUMBER 4261-19-077 | |

**Figure 5.126. Overview of site 38CS428, facing southwest.**

**Figure 5.127. Typical shovel test profile at site 38CS428.**

### *5.3.5 Site 38CS429*

| | |
|---|---|
| **Site Number**: 38CS429 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** Prehistoric lithic scatter; Historic artifact scatter | **Elevation:** 550 ft AMSL |
| **Components:** Unidentified; 20th century | **Landform:** Hilltop |
| **UTM Coordinates**: E509169, N3850292 (NAD 83) | **Soil Type**: Cecil sandy clay loam |
| **Site Dimensions**: 45 NE/SW x 20 NW/SE m | **Vegetation:** Grass |
| **Artifact Depth**: Surface | **No. of STPs/Positive STPs:** 10/0 |

Site 38CS429 is a prehistoric lithic scatter and twentieth century artifact scatter, located on a hilltop adjacent to a dirt road (Figures 1.4 and 1.5). The site is located in a grassy area and measures approximately 45 m northeast/southwest by 20 m northwest/southeast; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.128 and 5.129).

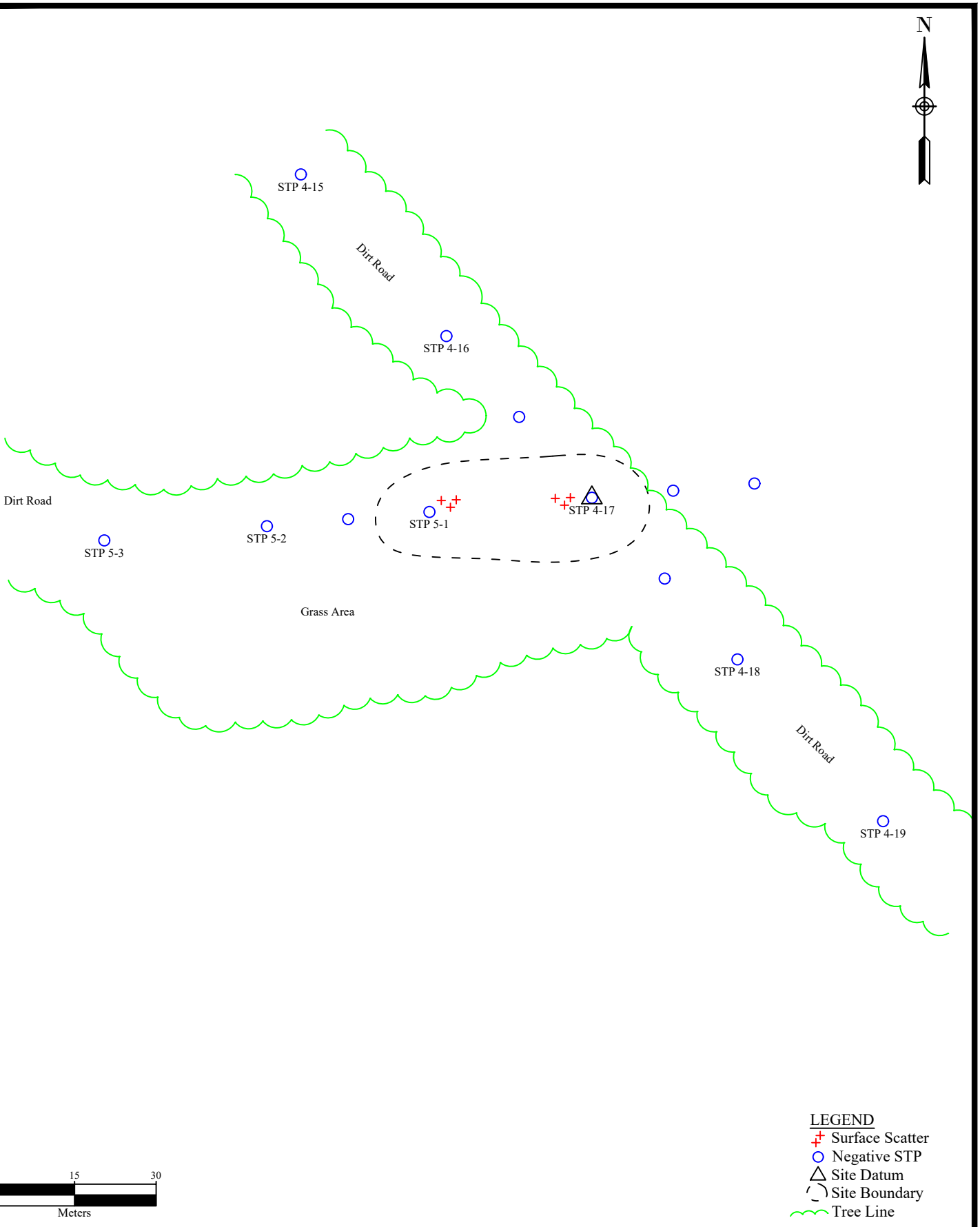
A total of 10 shovel tests were excavated in and around the site; a typical soil profile contained 15 cm of brown (10YR 4/6) silty sand, terminating with 10+ cm (15–25+ cmbs) of red (2.5YR 5/8) sandy clay subsoil (Figure 5.130). A total of eight artifacts were recovered from the surface of the site, five prehistoric and three historic (Appendix A). The prehistoric artifacts consist of one rhyolite retouched flake and four pieces of lithic debitage (two quartz and two rhyolite); the historic artifacts include two pieces of clear glass and one piece of milk glass. Historic maps show no structures in this location and none of the artifacts are temporally diagnostic.

Based on the information presented, it is S&ME's opinion that the site is not known to be associated with events that have made a significant contribution to the broad patterns of history and is not eligible for inclusion in the NRHP under Criterion A; the site is not associated with the lives of significant persons in the past and is not eligible for inclusion in the NRHP under Criterion B. Site 38CS429 does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction and, therefore, is recommended not eligible for inclusion in the NRHP under Criterion C. Given that there is no evidence of a structure at this location, the apparent lack of subsurface features, and the lack of intact stratigraphy, it is unlikely that site 38CS429 will yield significant information on the prehistory or history of the area and is recommended not eligible for inclusion in the NRHP under Criterion D. As such, site 38CS429 is recommended ineligible for inclusion in the NRHP.

### *5.3.6 Site 38CS430*

| | |
|---|---|
| **Site Number**: 38CS430 | **NRHP Recommendation**: Not Eligible |
| **Site Type:** House site | **Elevation:** 540 ft AMSL |
| **Components:** 20th century | **Landform:** Hillslope |
| **UTM Coordinates**: E509356, N3850225 (NAD 83) | **Soil Type**: Cecil sandy clay loam |
| **Site Dimensions**: 50 NW/SE x 20 NE/SW m | **Vegetation:** Hardwoods |
| **Artifact Depth**: Surface; 0–20 cmbs | **No. of STPs/Positive STPs:** 10/1 |

Site 38CS430 is a twentieth century house site, located on a hillslope adjacent to a dirt road (Figures 1.4 and 1.5). The site is located in an area of hardwoods and measures approximately 50 m northwest/southeast by 20 m northeast/southwest; it is bounded by two negative shovel tests to each of the cardinal directions (Figures 5.131 and 5.132).



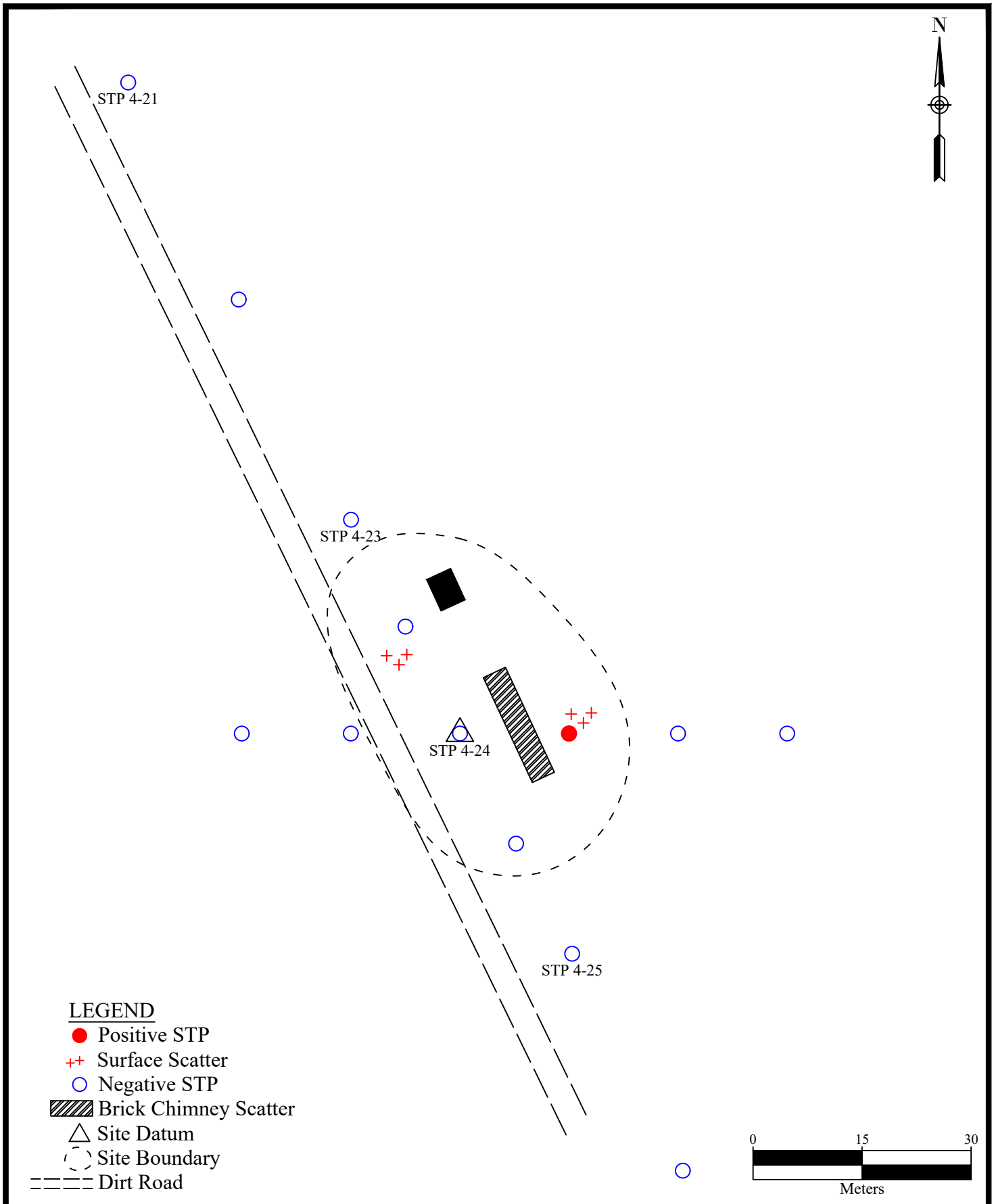

# Site Map - 38CH429

Phase I Cultural Resources Survey
Project Inspector Mitigation Site
York County, South Carolina

| SCALE: | FIGURE NO. |
|---|---|
| As Shown | 5.128 |
| DATE: | |
| 01/13/2020 | |
| PROJECT NUMBER | |
| 4261-19-077 | |

**Figure 5.129. Overview of site 38CS429, facing west.**

**Figure 5.130. Typical shovel test profile at site 38CS429.**

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| | **Site Map - 38CH430** | SCALE: As Shown | FIGURE NO. 5.131 |
| | Phase I Cultural Resources Survey<br>Project Inspector Mitigation Site<br>York County, South Carolina | DATE: 01/13/2020<br>PROJECT NUMBER 4261-19-077 | |

**Figure 5.132. Overview of site 38CS430, facing west.**

A total of 10 shovel tests were excavated in and around the site; a typical soil profile contained 5 cm of brown (10YR 4/4) silty sand, terminating with 10+ cm (5–15+ cmbs) of red (2.5YR 5/8) sandy clay subsoil (Figure 5.133). A total of five artifacts were recovered from the site, four from a single shovel test and one from the surface. The artifacts include one piece of plain whiteware, one piece of plain porcelain, two pieces of clear glass, and one piece of unidentified metal (Appendix B). In addition to the artifacts, two brick piles (one a collapsed chimney) and two possible stone footers are present (Figures 5.134 and 5.135). The historic maps show no structure in the vicinity of this location; the plain whiteware dates from 1815 to the present, and the remaining artifacts are not temporally diagnostic.

Site 38CS430 is a twentieth century house site, located on a hillslope adjacent to a dirt roadway. Given that the building has been razed, the apparent lack of subsurface features, and the minimal variety and quantity of artifacts recovered from the site, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the history of the area (Criterion D). As such, site 38CS430 is recommended ineligible for inclusion in the NRHP.

**Figure 5.133. Typical shovel test profile at site 38CS430.**

**Figure 5.134. Possible collapsed brick chimney at site 38CS430, facing southeast.**

**Figure 5.135. Stone footer at site 38CS430, facing north.**

### *5.3.7 Isolated Finds*

**Isolated Find 1 (IF-1)** consists of a single piece of quartz debitage collected from the surface, in an area of planted pine along a dirt road, at UTM coordinates E508588 N3849968 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-1 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 2 (IF-2)** consists of a single quartz utilized flake collected from the surface, in an area of mixed pine and hardwood along a dirt road, at UTM coordinates E509271 N3850535 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction; represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-2 is recommended ineligible for

inclusion in the NRHP.

**Isolated Find 3 (IF-3)** consists of a single piece of quartz debitage collected from the surface, in an area of mixed pine and hardwood along a dirt road, at UTM coordinates E509482 N3850515 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master; possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-3 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 4 (IF-4)** consists of a quartz utilized flake and a piece of rhyolite debitage collected from the surface, in an area of mixed pine and hardwood along a dirt road, at UTM coordinates E509656 N3850542 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-4 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 5 (IF-5)** consists of a single piece of rhyolite debitage collected from the surface, in an area of mixed pine and hardwood along a dirt road, at UTM coordinates E509386 N3850548 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-5 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 6 (IF-6)** consists of a single piece of light green glass collected from the surface, in an area of planted pine along a dirt road, at UTM coordinates E508779 N3850547 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic values, or represent a significant

and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-6 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 7 (IF-7)** consists of two pieces of clear glass collected from the surface, in an area of planted pine along a dirt road, at UTM coordinates E509042 N3850389 (NAD 83) (Figures 1.4 and 1.5). A total of 10 shovel tests were excavated at and around the initial surface finds at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-7 is recommended ineligible for inclusion in the NRHP.

**Isolated Find 8 (IF-8)** consists of a single piece of window glass found in a shovel test from 0–5 cmbs, in an area of planted pine along a dirt road, at UTM coordinates E508765 N3850202 (NAD 83) (Figures 1.4 and 1.5). A total of nine shovel tests were excavated at and around the initial surface find at 15- and 30-m intervals in each of the cardinal directions. None of the shovel tests contained artifacts and no other artifacts were identified on the surface. Based on the information presented, it is S&ME's opinion that the site is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A); is not associated with the lives of significant persons in the past (Criterion B); does not embody the distinctive characteristics of a type, period, or methods of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and is unlikely to yield significant information on the prehistory of the area (Criterion D). As such, IF-8 is recommended ineligible for inclusion in the NRHP.

## 5.4 Mitigation Site Architectural Survey Results

As part of the cultural resource investigation of the mitigation site, the potential effects of the activities that will take place at the site on previously recorded NRHP-eligible and listed aboveground resources was assessed. A portion of the NRHP-listed Landsford Canal (SHPO site number 0008) is located in the eastern portion of the mitigation site, while the NRHP-eligible Old Stone Graveyard (SHPO site number 0044) is adjacent to the southwest corner of the mitigation site (Figures 1.4 and 1.5). Each of these resources is discussed below.

### *5.4.1 Landsford Canal (SHPO Site Number 0008)*

The NRHP-listed Landsford Canal covers approximately 925 acres and is primarily focused on the canal itself, which was completed in 1832 and was an important transportation link along the Catawba River. In addition to the canal and associated structures, the historic area includes a ford crossing the river and was involved in military movement during the Revolutionary War and Civil War. The northern portion of the Landsford Canal extends into the mitigation site; specific project activities that will take place within the portion of the LOD within the Landsford Canal NRHP-listed boundary include filling in a ditch, cutting down trees, and replanting disturbed areas (Figures 5.136 through 5.140).

**Figure 5.136. Overview of vegetation and Catawba River in the NRHP-listed portion of the LOD, facing northeast.**

**Figure 5.137. Ditch to be infilled in the NRHP-listed portion of the LOD, facing west.**

**Figure 5.138. Ditch to be infilled in the NRHP-listed portion of the LOD, facing east.**

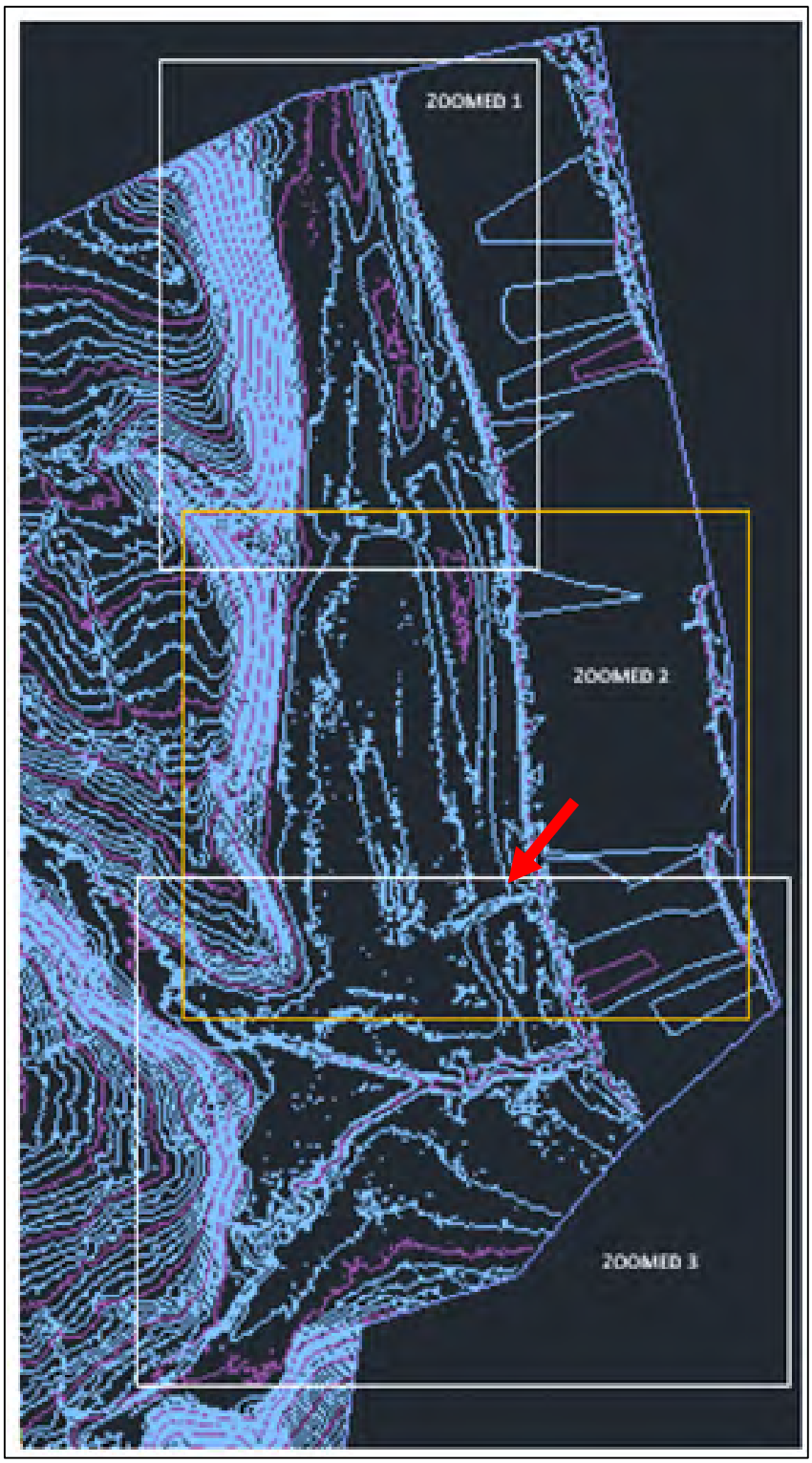


**Figure 5.139. Lidar imagery showing NRHP-listed portion of LOD and ditch; red arrow showing ditch location.**

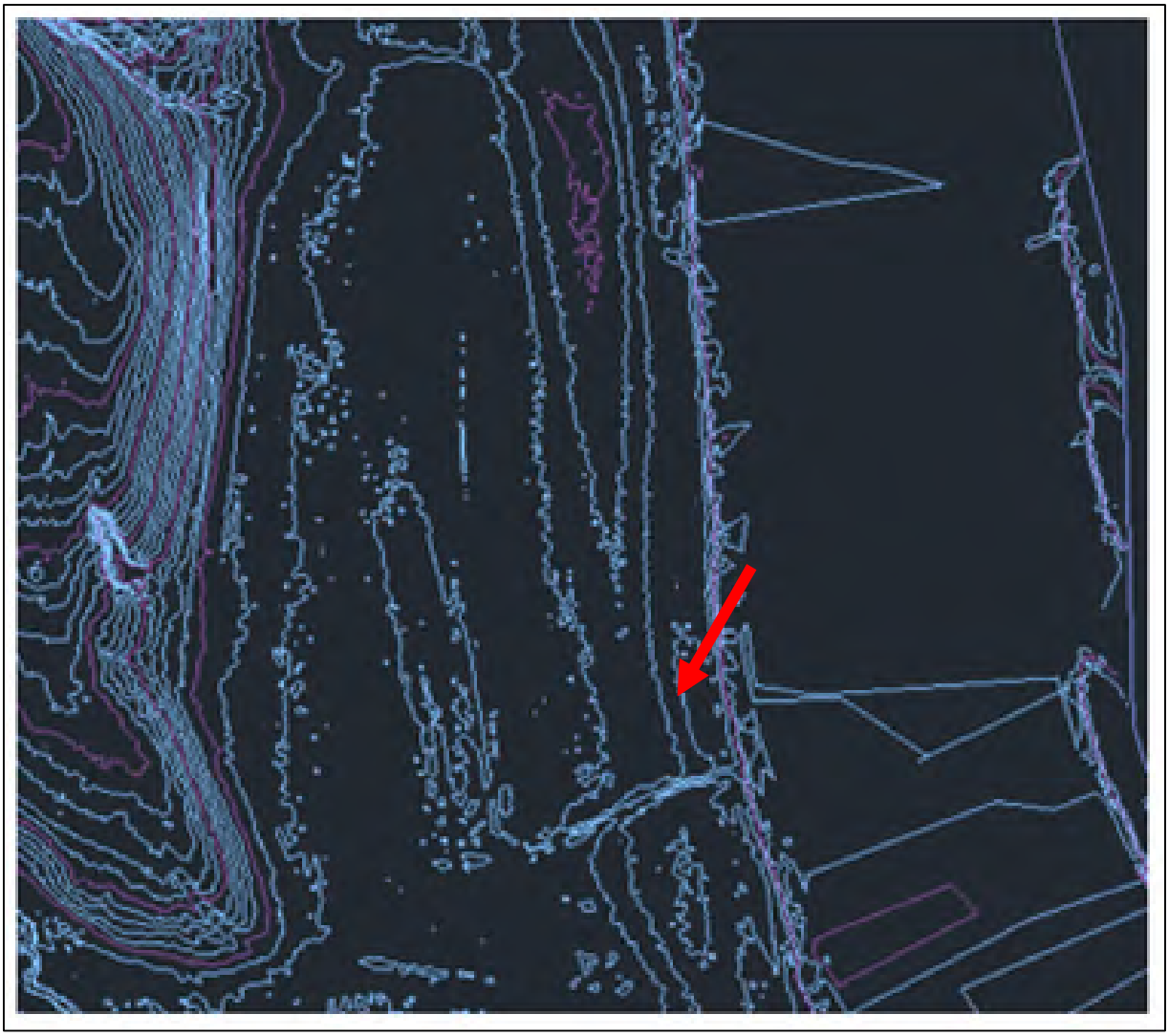

**Figure 5.140. Zoomed in lidar imagery showing NRHP-listed portion of LOD and ditch; red arrow showing ditch location.**

S&ME contacted Matt Lawson, Chief of Resource Management and Al James, Landsford Canal Park Manager, with the South Carolina State Park system were contacted regarding the work to be completed, pictures of the ditch, a description of the activities to be completed within the historic property, and a map were provided. Mr. Lawson and Mr. James, in a phone conversation with Kimberly Nagle with S&ME on January 8, 2020, commented that they felt the ditch that will be infilled is not related to the canal and is not a contributing feature to the NRHP-listed resource, this along with the tree clearing and replanting of disturbed areas will not have an adverse effect on the NRHP-listed Landsford Canal. If project plans change, additional consultation with SHPO and the South Carolina State Park system will be necessary.

### *5.4.2 Old Stone Graveyard (SHPO Site Number 0044)*

The Old Stone Graveyard is located adjacent to the southwest corner of the mitigation site. The rock wall surrounding the cemetery measures approximately 260 ft northwest/southeast by approximately 140 ft northeast/southwest, there are roughly 130 marked graves with death dates ranging from 1777 to 1920 within the rock walls along with some hand carved fieldstone and/or unmarked fieldstone graves (Figures 5.141 through 5.146). The area surrounding the rock wall was pedestrian surveyed and probed to determine in unmarked graves are present outside the known boundaries; no graves were identified during the investigation. Although no unmarked graves were identified outside the stone wall, this does not ensure that graves are not present outside the wall, as such, a 25 ft buffer is recommended to protect potential unmarked graves that were not identified (Figure 1.7). The closest portion of the LOD to the cemetery and 25 ft buffer is 330-ft to the northwest. The activities proposed at the mitigation site will have no effect on the Old Stone Graveyard. The buffer should be added to plans and mapping as an environmentally sensitive area where no ground disturbance should take place.

**Figure 5.141. Stone wall and headstones at Old Stone Graveyard, facing northeast.**

**Figure 5.142. Overview of Old Stone Graveyard, facing northwest.**

**Figure 5.143. Most recent interment noted at Old Stone Graveyard, facing west.**

**Figure 5.144. Oldest interment noted Old Stone Graveyard, facing west.**

**Figure 5.145. Carved fieldstone marker at Old Stone Graveyard, facing west.**

**Figure 5.146. Carved fieldstone marker at Old Stone Graveyard, facing west.**

# 6.0 Conclusions and Recommendations

On behalf of SCDOC, S&ME has completed cultural resource investigations of the proposed project area associated with Project Inspector in York County, South Carolina and of the proposed Project Inspector mitigation site in Chester County, South Carolina (Figures 1.1 through 1.5). The project area spans the east and west sides of I-77, with the east side consisting of a proposed interchange at I-77 and associated road infrastructure (turn lanes, on/off ramps, existing road widening, land acquisition, etc.) with access to the interchange; the western portion of the project area is comprised of approximately 256 acres of wooded property that extends between Eden Terrace to the north and the Norfolk Southern railroad to the south (Figure 1.2 and 1.3). The mitigation site is approximately 484 acres in size and is located between Landsford Road and the Catawba River (Figures 1.4 and 1.5); approximately 129.1 acres and 1.4 miles of proposed access roads make up the LOD at the mitigation site. The LOD is what was surveyed during these investigations, the remaining portion of the mitigation site will remain unmodified.

The purpose of the survey was to assess the project area's and mitigation site's potential for containing significant cultural resources and to make recommendations regarding additional work that may be required pursuant to Section 106 of the National Historic Preservation Act, as amended, and other pertinent federal, state, or local laws. This work was done in anticipation of federal permitting by the USACE, as well as funding from the FHWA, and was carried out in general accordance with S&ME Proposal Number 42-1900437, dated May 31, 2019, and Change Order 2, dated December 18, 2019.

Fieldwork for the project was conducted from July 8 through 12, 2019, October 15, 2019, and January 6 through 10, 2020. This work included the excavation of 672 shovel tests within the project area, 351 shovel tests within the mitigation site, an architectural survey of structures within the project area and within a 0.5-mile search radius, an evaluation of effects on NRHP-eligible and listed resources, and a balloon/drone survey to assess effects on the NRHP-eligible Arrowhead Dairy.

### *Project Area Results of Investigations*

As a result of the investigations, six archaeological sites (38YK607 through 38YK612), three isolated finds (IF-1 through IF-3), one previously evaluated aboveground resource (SHPO site number 3919 – Arrowhead Dairy) was revisited, three newly recorded aboveground resources (SHPO site numbers 3920 through 3922), and one previously unrecorded cemetery (SHPO site number 3889) were identified (Figures 1.2 and 1.3; Table 1.1). The archaeological sites, isolated finds, newly recorded aboveground resources, and the cemetery are recommended as not eligible for the inclusion in the NRHP.

Arrowhead Dairy (SHPO site number 3919) is a circa 1920s dairy, including three barns of stone construction, that are located adjacent to and within the northwest corner of the proposed project area. The 1927 milk barn (SHPO site number 3919.04 and 1931 hay barn (SHPO site number 3919.05) have been determined eligible for inclusion in the National Register under Criterion A, for their association with the dairy farming industry in South Carolina, and under Criterion C, for the architecture of the barns. Although the Arrowhead Dairy house (SHPO site number 3919.01) has been significantly altered since its original nineteenth century construction and is recommended as ineligible for the NRHP, three additional outbuildings associated with the Arrowhead Dairy, a nineteenth-century brick shed (SHPO site number 3919.03), a circa 1930s metal silo (SHPO site number 3919.06), and a 1935 storage barn (SHPO site number 3919.07) are also recommended eligible for the NRHP under Criterion A and C.

A balloon/drone survey indicated that the project, as currently planned will not have an adverse effect on the viewshed of the NRHP-eligible structures. However, based on the location of the NRHP-eligible Arrowhead Dairy structures, which includes the 1935 storage barn located on the proposed project are and the remaining structures located less than 150 feet from the boundary of the proposed project area, construction on the proposed site has the potential to adversely affect the NRHP-eligible Arrowhead Dairy structures. S&ME recommends avoidance of the 1935 storage barn, use of an access route for construction traffic that is away from the Arrowhead Dairy property, and the use of low-vibration construction methods,.

There are NRHP-eligible aboveground resources located to the southeast of the project area, associated with the community of Red River; they are located roughly 0.35-mile from the Celriver Road and Paragon Way intersection. This portion of the proposed project area follows Paragon Way, an existing roadway that provides access to an existing industrial park. Interchange improvements may take place at the intersection; however, the area has already been developed and new roadway improvements will have no adverse effect on the resources to the southeast.

### *Mitigation Site Results of Investigations*

As a result of the investigations, six archaeological sites (38CS425 through 38CS430) and eight isolated finds (IF-1 through IF-8) were recorded, the effects of the proposed activities on the NRHP-listed Landsford Canal (SHPO site number 0008) were assessed, and NRHP-eligible Old Stone Graveyard (SHPO site number 0044) was revisited (Figures 1.4 and 1.5; Table 1.2). The archaeological sites and isolated finds are recommended as not eligible for the inclusion in the NRHP. The portion of the NRHP-listed Landsford Canal within the LOD will not be adversely affected by the tree clearing, replanting of disturbed areas, or filling of the drainage ditch within the resource. The Old Stone Graveyard is located southwest of the mitigation site boundary and is roughly 330 feet from the closest LOD area; although no graves appear to be outside the stone wall surrounding the cemetery, a 25-ft buffer around the stone wall is recommended to avoid disturbing possible unmarked graves (Figure 1.7). The project as currently proposed will have no effect on the cemetery.

### *Overall Conclusions and Recommendations*

Given the results of this survey, it is the opinion of S&ME that the project area will have no adverse effect on significant resources, as long as the recommended measures to avoid direct and indirect effects on the Arrowhead Dairy NRHP-eligible structures are included in the project plans, and no further cultural resources investigations should be required for the current project area or mitigation site. However, if the potential effects to the NRHP-eligible Arrowhead Dairy structures cannot be avoided, project activities change within the NRHP-listed Landsford Canal, and/or the LOD shifts within the boundary proposed around NRHP-eligible Old Stone Graveyard, additional consultation with the SHPO and other consulting parties may be necessary to minimize or mitigate potential adverse effects.

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# 8.0 Appendix A – Artifact Catalog

# Appendix A - Project Inspector Project Area Artifact Catalog

| Site # | Cat. # | Provenience | Depth (cmbs) | Count | Weight (g) | Class | Category | Sub-Category | Type/Description | Material | Portion | Size Grade | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38YK0607 | 1.01 | STP 4-1 | 0-20 | 1 | 9.6 | Lithic | Chipped Stone | Biface | Late Stage | Quartz | Tip/Mid | | |
| 38YK0607 | 2.01 | STP 4-6 | Surface | 1 | 7.7 | H. Ceramic | Ref. Earthenware | Whiteware | Polychrome Underglaze Decal | | Rim | | 1897-present |
| 38YK0607 | 2.02 | STP 4-6 | Surface | 1 | 31.7 | H. Ceramic | Ref. Earthenware | Whiteware | Polychrome Underglaze Decal with Makers Mark | | Base | | Edwin M. Knowles China Co. Makers Mark 1930s |
| 38YK0607 | 2.03 | STP 4-6 | Surface | 1 | 148.7 | Glass | Machine Molded | Bottle | Clear | | Base | | Two pieces refit |
| 38YK0607 | 3.01 | STP 4-7 | 0-15 | 1 | 12.6 | H. Ceramic | Porcelain | Hard Paste | Plain | | Base | | |
| 38YK0607 | 3.02 | STP 4-7 | 0-15 | 1 | 0.8 | Glass | Machine Molded | Unid. Vessel | Clear | | Body | | |
| 38YK0607 | 3.03 | STP 4-7 | 0-15 | 1 | 3.0 | Metal | Hardware/Tools | Nail | Galvinized | | | | |
| 38YK0607 | 4.01 | STP 26-1 | 0-20 | 4 | 26.8 | Glass | Machine Molded | Canning Lid Insert | Milk | | Rim | | |
| | | | | | | | | | | | | | |
| 38YK0608 | 1.01 | STP 1-4 | Surface | 1 | 6.9 | Glass | Machine Molded | Unid. Vessel | Purple | | Body | | |
| 38YK0608 | 1.02 | STP 1-4 | Surface | 1 | 0.6 | Glass | Machine Molded | Unid. Vessel | Cobalt Blue | | Body | | |
| 38YK0608 | 1.03 | STP 1-4 | Surface | 1 | 3.4 | Glass | Machine Molded | Canning Lid Insert | Milk | | Rim | | |
| 38YK0608 | 1.04 | STP 1-4 | Surface | 1 | 0.4 | Glass | Window Glass | | | | | | |
| 38YK0608 | 1.05 | STP 1-4 | Surface | 1 | 10.6 | Glass | Machine Molded | Bottle | Clear | | Body | | |
| 38YK0608 | 1.06 | STP 1-4 | Surface | 2 | 6.9 | Glass | Machine Molded | Dish | Lt. Green | | Body | | |
| | | | | | | | | | | | | | |
| 38YK0609 | 1.01 | STP 3-1 | Surface | 1 | 1.3 | H. Ceramic | Ref. Earthenware | Whiteware | Plain | | Body | | 1815- present |
| 38YK0609 | 1.02 | STP 3-1 | Surface | 2 | 1.9 | Glass | Machine Molded | Unid. Vessel | Cobalt Blue | | Body | | |
| 38YK0609 | 1.03 | STP 3-1 | Surface | 1 | 13.0 | Lithic | Chipped Stone | Projectile Point | Contracting Stem | Quartz | Body | 1 | |
| 38YK0609 | 1.01 | STP 3-1+30mN | Surface | 1 | 3.0 | Glass | Machine Molded | Bottle | Cobalt Blue | | Body | | |
| 38YK0609 | 1.02 | STP 3-1+30mN | Surface | 1 | 11.0 | H. Ceramic | Stoneware | Salt Glazed | | | Rim | | |
| 38YK0609 | 1.03 | STP 3-1+30mN | Surface | 1 | 5.4 | Glass | Machine Molded | Bottle | Brown | | Body | | |
| | | | | | | | | | | | | | |
| 38YK0610 | 1.01 | STP 5-4 | Surface | 1 | 1.0 | Lithic | Debitage | Non-cortical | | Quartzite | | 3 | |
| 38YK0610 | 1.02 | STP 5-4 | Surface | 1 | 5.5 | Glass | Machine Molded | Bottle | Lt. Green | | Body | | |
| 38YK0610 | 1.03 | STP 5-4 | Surface | 1 | 3.0 | Lithic | Debitage | Non-cortical | | Quartzite | Body | 2 | |
| 38YK0610 | 1.04 | STP 5-4 | Surface | 5 | 3.8 | Lithic | Debitage | Non-cortical | | Quartz | Body | 3 | |
| 38YK0610 | 1.05 | STP 5-4 | Surface | 1 | 0.2 | Lithic | Debitage | Non-cortical | | Quartz | Body | 4 | |
| | | | | | | | | | | | | | |
| 38YK0611 | 1.01 | STP 22-4 | Surface | 1 | 3.0 | Lithic | Chipped Stone | Scraper | | Quartz | Body | 2 | |
| 38YK0611 | 1.02 | STP 22-4 | Surface | 1 | 0.8 | Lithic | Debitage | Non-cortical | | Quartz | Body | 3 | |
| 38YK0611 | 1.03 | STP 22-4 | Surface | 1 | 2.4 | Glass | Machine Molded | Unid. Vessel | Clear | | Body | | |
| 38YK0611 | 1.04 | STP 22-4 | Surface | 1 | 0.5 | Lithic | Debitage | Non-cortical | | Rhyolite | Body | 3 | |
| | | | | | | | | | | | | | |
| 38YK0612 | 1.01 | STP 29-1 | 0-5 | 4 | 2.7 | Glass | Window Glass | | | | | | |
| 38YK0612 | 1.02 | STP 29-1 | 0-5 | 1 | 0.5 | Glass | Machine Molded | Unid. Vessel | Clear | | | | |
| 38YK0612 | 1.01 | STP 29-1+30mE | 0-25 | 1 | 2.0 | Metal | Hardware/Tools | Screw | | | | | |
| 38YK0612 | 1.02 | STP 29-1+30mE | 0-25 | 2 | 3.6 | H. Ceramic | Ref. Earthenware | Whiteware | Plain | | Body | | |
| 38YK0612 | 1.03 | STP 29-1+30mE | 0-25 | 1 | 0.2 | Other | Personal Item | Button | | | | | 2 Hole |
| 38YK0612 | 1.04 | STP 29-1+30mE | 0-25 | 5 | 38.5 | Metal | Hardware/Tools | Nail | Cut | | | | 1790- |
| 38YK0612 | 1.05 | STP 29-1+30mE | 0-25 | 1 | 1.0 | Metal | Hardware/Tools | Staple | | | | | |
| 38YK0612 | 1.06 | STP 29-1+30mE | 0-25 | 1 | 14.1 | Metal | Hardware/Tools | Nail | Wire | | | | 1850- |
| 38YK0612 | 1.07 | STP 29-1+30mE | 0-25 | 1 | 107.6 | Metal | Other | Unid. Metal | | | | | |
| 38YK0612 | 1.08 | STP 29-1+30mE | 0-25 | 2 | 1.9 | H. Ceramic | Ref. Earthenware | Porcelain | Annular, Gold | | Rim | | |
| 38YK0612 | 1.09 | STP 29-1+30mE | 0-25 | 1 | 0.9 | H. Ceramic | Ref. Earthenware | Porcelain | Overglaze, Decal | | Body | | |
| 38YK0612 | 1.10 | STP 29-1+30mE | 0-25 | 4 | 3.0 | Glass | Machine Molded | Unid. Vessel | Clear | | Body | | |
| 38YK0612 | 1.11 | STP 29-1+30mE | 0-25 | 1 | 8.1 | Glass | Machine Molded | Unid. Vessel | Clear | | Body | | |

# Appendix A - Project Inspector Project Area Artifact Catalog

| Site # | Cat. # | Provenience | Depth (cmbs) | Count | Weight (g) | Class | Category | Sub-Category | Type/Description | Material | Portion | Size Grade | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38YK0612 | 1.12 | STP 29-1+30mE | 0-25 | 1 | 10.7 | H. Ceramic | Coarse Earthenware | Lead Glazed | Black | | Rim | | |
| 38YK0612 | 1.13 | STP 29-1+30mE | 0-25 | 4 | 4.5 | Glass | Window Glass | | | | | | |
| 38YK0612 | 1.14 | STP 29-1+30mE | 0-25 | 3 | 1.3 | Glass | Window Glass | | | | | | |
| 38YK0612 | 1.15 | STP 29-1+30mE | 0-25 | 1 | 19.9 | Other | Masonry | Brick | Machine Made | | | | |
| 38YK0612 | 1.01 | STP 29-1+45E | 0-20 | 1 | 3.6 | H. Ceramic | Ref. Earthenware | Whiteware | Plain | | Body | | |
| 38YK0612 | 1.02 | STP 29-1+45E | 0-20 | 1 | 0.2 | Glass | Indeterminate | | Burnt | | | | |
| 38YK0612 | 1.03 | STP 29-1+45E | 0-20 | 1 | 19.3 | Glass | Machine Molded | Jar | Clear | | Body | | |
| | | | | | | | | | | | | | |
| IF-1 | 1.01 | STP 7-10 | Surface | 1 | 6.1 | Lithic | Chipped Stone | Projectile Point | Unid. Stemmed | Quartz | Base | | |
| | | | | | | | | | | | | | |
| IF-2 | 1.01 | STP 3-3 | Surface | 1 | 2.5 | Lithic | Debitage | Non-cortical | | Quartz | | 3 | |
| IF-2 | 1.02 | STP 3-3 | Surface | 1 | 3.5 | Glass | Machine Molded | Unid. Vessel | Milk | | Body | | |
| | | | | | | | | | | | | | |
| IF-3 | 1.01 | STP 19-4 | Surface | 1 | 1.8 | Lithic | Debitage | Non-cortical | | Rhyolite | | 3 | |
| | | | | | | | | | | | | | |

**Appendix A - Project Inspector Mitigation Site Artifact Catalog**

| Site # | Cat. # | Provenience | Depth (cmbs) | Count | Weight (g) | Class | Category | Sub-Category | Type/Description | Material | Portion | Temper | Lithic Size Grade | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38CS425 | 1.01 | STP 2-45 | Surface | 1 | 2.5 | Lithic | Chipped stone | Retouched flake | | Quartz | | | 3 | |
| 38CS425 | 1.02 | STP 2-45 | Surface | 1 | 2.4 | Lithic | Chipped stone | Retouched flake | | Quartz | | | 3 | |
| 38CS425 | 1.03 | STP 2-45 | Surface | 1 | 0.6 | Faunal | Unmodified | Shell | Indeterminate | | | | | |
| 38CS426 | 1.01 | STP 2-30 | Surface | 1 | 12.3 | Glass | Machine Molded | Jar | Clear | | Base | | | |
| 38CS426 | 1.02 | STP 2-30 | Surface | 3 | 41.5 | H. Ceramic | Porcelain | Hard paste | Plain | | Body | | | |
| 38CS426 | 1.03 | STP 2-30 | Surface | 1 | 7.2 | H. Ceramic | Ref. Earthenware | Whiteware | Plain | | Body | | | 1815- present |
| 38CS426 | 1.04 | STP 2-30 | Surface | 1 | 16.2 | H. Ceramic | Porcelain | Hard paste | Plain | | Lid | | | Intact, small handle on top |
| 38CS426 | 1.05 | STP 2-30 | Surface | 1 | 4.2 | H. Ceramic | Ref. Earthenware | Whiteware | Transfer print | | Body | | | Blue, 1815-1915 |
| 38CS426 | 1.06 | STP 2-30 | Surface | 1 | 0.6 | Lithic | Debitage | Non- cortical | | Quartz | | | 3 | |
| 38CS427 | 1.01 | STP 3-20 | 0-10cmbs | 1 | 2.7 | Glass | Machine Molded | Unid. Vessel | Amethyst/Solarized | | Body | | | 1880-1915 |
| 38CS427 | 1.02 | STP 3-20 | 0-10cmbs | 1 | 19.5 | H. Ceramic | Stoneware | Glazed | Brown | | Body | | | Black paste, brown glazed interior/exterior |
| 38CS427 | 2.01 | STP 3-20 +15 S | 0-10cmbs | 1 | 1.7 | H. Ceramic | Stoneware | Glazed | White | | Body | | | White glazed exterior, brown glazed interior |
| 38CS427 | 2.02 | STP 3-20 +15 S | 0-10cmbs | 1 | 9.7 | Glass | Machine Molded | Botttle | Clear | | Body | | | |
| 38CS427 | 3.01 | STP 3-20 +30 W | 0-10cmbs | 1 | 3.4 | H. Ceramic | Ref. Earthenware | Whiteware | Plain | | Base | | | 1815- present |
| 38CS427 | 3.02 | STP 3-20 +30 W | 0-10cmbs | 1 | 0.8 | H. Ceramic | Ref. Earthenware | Whiteware | Plain | | Body | | | 1815- present |
| 38CS427 | 3.03 | STP 3-20 +30 W | 0-10cmbs | 1 | 0.3 | Glass | Machine Molded | Unid. Vessel | Milk | | Body | | | |
| 38CS428 | 1.01 | STP 3-25 | Surface | 1 | 4.0 | Lithic | Debitage | Cortical | | Rhyolite | | | 2 | |
| 38CS428 | 1.02 | STP 3-25 | Surface | 1 | 16.1 | Lithic | Chipped Stone | Biface fragment | | Quartz | | | | |
| 38CS428 | 1.03 | STP 3-25 | Surface | 1 | 0.1 | Lithic | Debitage | Non- cortical | | Quartz | | | 4 | |
| 38CS428 | 2.01 | STP 3-25 | 0-20cmbs | 1 | 0.1 | Lithic | Debitage | Non- cortical | | Quartz | | | 4 | |
| 38CS428 | 3.01 | STP 3-25 +15 W | Surface | 1 | 4.0 | Lithic | Chipped Stone | Utilized flake | | Quartz | | | 2 | |
| 38CS428 | 3.02 | STP 3-25 +15 W | Surface | 1 | 6.8 | Lithic | Chipped Stone | Retouched flake | | Quartz | | | 2 | |
| 38CS429 | 1.01 | STP 4-17 | Surface | 1 | 2.2 | Lithic | Debitage | Cortical | | Quartz | | | 2 | |
| 38CS429 | 1.02 | STP 4-17 | Surface | 2 | 2.0 | Glass | Machine Molded | Unid. Vessel | Clear | | Body | | | |
| 38CS429 | 1.03 | STP 4-17 | Surface | 1 | 6.7 | Lithic | Debitage | Cortical | | Rhyolite | | | 2 | |
| 38CS429 | 1.04 | STP 4-17 | Surface | 1 | 5.8 | Lithic | Chipped stone | Retouched flake | | Rhyolite | | | 2 | |
| 38CS429 | 1.05 | STP 4-17 | Surface | 1 | 2.6 | Lithic | Debitage | Cortical | | Rhyolite | | | 2 | |
| 38CS429 | 1.06 | STP 4-17 | Surface | 1 | 3.2 | Glass | Machine Molded | Unid. Vessel | White/milk | | Rim | | | Blue print, possible modern Corelle ware |
| 38CS429 | 2.01 | STP 5-1 | Surface | 1 | 0.1 | Lithic | Debitage | Non- cortical | | Quartz | | | 4 | |
| 38CS430 | 1.01 | STP 4-24 +15NW | Surface | 1 | 5.6 | Glass | Machine Molded | Bottle | Clear | | Neck | | | |
| 38CS430 | 2.01 | STP 4-24 +15E | 0-20 cmbs | 1 | 3.5 | H. Cermanic | Ref. Earthenware | Whiteware | Plain | | Body | | | 1815- present |
| 38CS430 | 2.02 | STP 4-24 +15E | 0-20 cmbs | 1 | 2.3 | H. Cermanic | Porcelain | Hard paste | Plain | | Rim | | | Molded edge design |
| 38CS430 | 2.03 | STP 4-24 +15E | 0-20cmbs | 1 | 2.8 | Metal | Other | Unid. Metal | | | | | | |
| 38CS430 | 2.04 | STP 4-24 +15E | 0-20cmbs | 1 | 10.9 | Glass | Machine Molded | Bottle | Clear | | Body | | | |
| IF-1 | 1.01 | STP 1-4 | Surface | 1 | 0.2 | Lithic | Debitage | Non- cortical | | Quartz | | | 3 | |
| IF-2 | 1.01 | STP 2-26 | Surface | 1 | 1.5 | Lithic | Chipped stone | Utilized flake | | Quartz | | | 3 | |
| IF-3 | 1.01 | STP 2-19 | Surface | 1 | 0.5 | Lithic | Debitage | Non- cortical | | Quartz | | | 3 | |
| IF-4 | 1.01 | STP 2-13 | Surface | 1 | 1.3 | Lithic | Debitage | Cortical | | Rhyolite | | | 3 | |
| IF-4 | 1.02 | STP 2-13 | Surface | 1 | 6.9 | Lithic | Chipped Stone | Utilized flake | | Quartz | | | 2 | |
| IF-5 | 1.01 | STP 2-22 | 0-5cmbs | 1 | 1.0 | Lithic | Debitage | Non- cortical | | Rhyolite | | | 3 | |
| IF-6 | 1.01 | STP 4-2 | Surface | 1 | 3.4 | Glass | Machine Molded | Unid. Vessel | Lt. Green | | Body | | | |
| IF-7 | 1.01 | STP 4-12 | Surface | 1 | 19.0 | Glass | Machine Molded | Jar | Clear | | Body | | | |
| IF-7 | 2.01 | STP 4-13 | Surface | 1 | 1.3 | Glass | Machine Molded | Unid. Vessel | Clear | | Body | | | |
| IF-8 | 1.01 | STP 5-20 | 0-5cmbs | 1 | 0.7 | Glass | Window glass | | | | | | | |

Artifact measurements in mm

# 9.0 Appendix B – Draft Structure Cards

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Source(s) of Information:

Historic aerial maps, topographic maps, county tax assessor
Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

## Digital Photo ID(s)

| File Name: | View: | Other: |
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| 03889002 | Facing Northwest | Cemetery overview |
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| 03889006 | Facing Southwest | Cemetery overview |
| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

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City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

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Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

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| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

LOUISA FARROW
JULY 22 1840
MAR 6

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

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Historical Information:

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| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

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State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

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### Identification

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City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
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| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

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# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
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Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

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Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

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| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

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| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

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Architect(s)/Builder(s):

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Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

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| Other: | | Foundation: | | | |
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Architect(s)/Builder(s):

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| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

The Cross Roads Baptist Church Cemetery is a late 19th through early 20th century cemetery associated with the Cross Roads Baptist Church, currently located approximately one mile to the northwest of the cemetery (on Eden Terrace). The church is an African-American congregation, organized in 1868, with its first sanctuary built in 1872, on land near the cemetery. This building was destroyed by fire in 1931; the church moved to its current location in 1932. The 1932 church building was damaged by a vehicle strike in 2007 and was demolished by 2010. After the church moved from its late nineteenth century location, a new cemetery was established and this one was abandoned.

Source(s) of Information:

Historic aerial maps, topographic maps, county tax assessor
Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

## Digital Photo ID(s)

| File Name: | View: | Other: |
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| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Source(s) of Information:

Historic aerial maps, topographic maps, county tax assessor
Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

OWHEAD
FARM
P S

PARKING

A.E. & H.B. HUTCHISON
1927

ARROW HEAD
HUTCHISON FARM
193

CHEVROLET

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889006 | Facing Southwest | Cemetery overview |
| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Historic aerial maps, topographic maps, county tax assessor
Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Source(s) of Information:

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Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Source(s) of Information:

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Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889007 | Other | Lillie Bell Mayfield marker |
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| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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## Program Management

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| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
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| Other: | | Porch Width: | | | |

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Alterations (include date(s), if known):

Architect(s)/Builder(s):

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| 03889007 | Other | Lillie Bell Mayfield marker |
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## Program Management

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| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

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Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
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| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

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Architect(s)/Builder(s):

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Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889006 | Facing Southwest | Cemetery overview |
| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# Statewide Survey of Historic Properties

State Historic Preservation Office
South Carolina Department of Archives and History
8301 Parklane Road
Columbia, SC 29223-4905 (803) 896-6100

Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

The Cross Roads Baptist Church Cemetery is a late 19th through early 20th century cemetery associated with the Cross Roads Baptist Church, currently located approximately one mile to the northwest of the cemetery (on Eden Terrace). The church is an African-American congregation, organized in 1868, with its first sanctuary built in 1872, on land near the cemetery. This building was destroyed by fire in 1931; the church moved to its current location in 1932. The 1932 church building was damaged by a vehicle strike in 2007 and was demolished by 2010. After the church moved from its late nineteenth century location, a new cemetery was established and this one was abandoned.

Source(s) of Information:

Historic aerial maps, topographic maps, county tax assessor
Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

## Digital Photo ID(s)

| File Name: | View: | Other: |
|---|---|---|
| 03889001 | Facing North | Cemetery overview |
| 03889002 | Facing Northwest | Cemetery overview |
| 03889003 | Facing South | Cemetery overview |
| 03889004 | Facing Southeast | Cemetery overview |
| 03889005 | Facing Northeast | Cemetery overview |
| 03889006 | Facing Southwest | Cemetery overview |
| 03889007 | Other | Lillie Bell Mayfield marker |
| 03889008 | Other | Hattie A Mayfield marker |
| 03889009 | Other | Rev. JL Jennings marker |
| 03889010 | Other | Ellie Hugh Good marker |

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Site No. 3889 Status U Revisit

Quadrangle Name: Rock Hill East

Tax Map No. 6620701096

## SURVEY FORM

### Identification

Historic Name: Cross Roads Baptist Church Cemetery

Common Name:

Address/Location: N of railroad tracks, approx. 0.85-mi W of SC 50 (Celriver Rd); 0.15-mi E of I-77

City: Rock HIll ✔ Vicinity of County: York

Ownership: Private Category: Site Other:

Historical Use: Funerary

Current Use: Funerary

SHPO National Register Determination of Eligibility: Not Eligible

### Property Description

| | | | | | |
|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

Historical Information:

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Historic aerial maps, topographic maps, county tax assessor
Nagle, Kimberly, and Heather Carpini, Cultural Resources Intensive Survey, Project Inspector, York County, South Carolina, 2019.

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| 03889007 | Other | Lillie Bell Mayfield marker |
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| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

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Ownership: Private Category: Site Other:

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|---|---|---|---|---|---|
| Construction Date: | c. 1888-1931 | Construction: | | Other: | |
| Historic Core Shape: | Irregular | Exterior Walls: | Other | | None |
| Other: | | Foundation: | | | |
| Commercial Form: | | Roof Shape: | | | |
| Other: | | Roof Material: | | | |
| Stories: | | Porch Shape: | | | |
| Other: | | Porch Width: | | | |

Description/Significant Features:

The cemetery is located within a wooded area, with no identifiable boundaries. It contains contains nine marked burials and a large number of unmarked interments. The markers are made of a variety of materials, from local stone and concrete to marble and represent a number of styles of grave markers. Other graves marked with single bricks or stones, most with no distinctive markings; there is also a concrete above-ground rectangular structure that may have a vault that was constructed but never used. Depressions along the ground surface suggest unmarked burials. It is associated with the Cross Roads Baptist Church, formerly located nearby.

Alterations (include date(s), if known):

Architect(s)/Builder(s):

Unknown

## Historical Information

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| 03889010 | Other | Ellie Hugh Good marker |

## Program Management

| Recorded by: | Organization: | Date Recorded: |
|---|---|---|
| Heather L. Carpini | S&ME, Inc. | 10/15/2019 |

# 10.0 Appendix C – SHPO Correspondence

EST. 1905
SOUTH CAROLINA DEPARTMENT OF
ARCHIVES & HISTORY

October 4, 2019

Amanda L. Heath
Chief, Special Projects Branch
Department of the Army
Charleston District, Corps of Engineers
69A Hagood Avenue
Charleston, South Carolina 29403-5107

Re: Project Inspector
(SAC-2019-00924)
York County, South Carolina
SHPO Project No. 19-KL0350

Dear Amanda Heath:

Thank you for your letter of September 19, 2019 regarding the subject-referenced project. We also received the draft report, *Cultural Resources Intensive Survey Project Inspector, York County, South Carolina* as supporting documentation for this undertaking. The State Historic Preservation Office (SHPO) is providing comments to the U.S. Army Corps of Engineers (Corps) pursuant to Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR 800. Consultation with the SHPO is not a substitution for consultation with Tribal Historic Preservation Offices, other Native American tribes, local governments, or the public.

As noted in your letter, the Corps and the Federal Highway Administration (FHWA) are assisting the South Carolina Department of Commerce (SCDOC) with the federal permit application process for this project and the Corps will be leading consultation with our office. The Corps will review all cultural resources reports and documentation prepared for the project and evaluate historic significance and National Register eligibility of identified properties in consultation with SHPO and any tribes that attach religious or cultural significance to the properties.

The Corps and FHWA have reviewed the draft report and found it to be sufficient for SHPO review. The Corps notes, however, that they will not make or request concurrence with any formal determination of effect for the project until a completed permit application is received. The Corps asks that SHPO review the report and provide any relevant comments.

The intensive cultural resources survey of the approximately 256 acre project area resulted in the identification of six newly recorded archaeological sites (38YK0607-38YK0612), three isolated finds, and three newly recorded above-ground resources (SHPO Site Nos. 3920-3922). Additionally, one previously evaluated above-ground resource, Arrowhead Dairy (SHPO Site No. 3919), was revisited. Sites 38YK0607-38YK0612, SHPO Site Nos. 3920-3922, and the three isolated finds are recommended as not eligible for listing in the National Register of Historic Places (NRHP). Two stone barns associated with Arrowhead Dairy (SHPO Site No. 3919) were determined to be eligible for listing in the NRHP by our office in 2018.

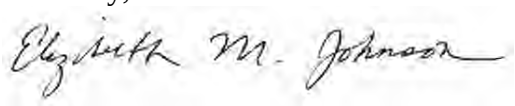
Our office recommends recording and evaluating Arrowhead Dairy as a district and/or complex. See the Historic District Methodology and Site Numbering sections in our Survey Manual. SHPO site number 3919 should be used to represent and describe the district and/or complex on a new survey form, with District being checked under the Category field on the form. The house, the other stone barn recorded by S&ME, the previously determined eligible 1927 milk barn and 1931 hay barn, and any other above-ground architectural or historic resources (including landscapes) should be recorded as sub-numbers and evaluated for the potential to contribute or not contribute to the district and/or complex. The resource name Arrowhead Dairy vs Arrowhead Dairy Farm needs to be reconciled.

We recommend consulting with the owner of Arrowhead Dairy pursuant to 36 CFR 800.3(f). Permission to enter the private property must be granted before further survey efforts begins. We also recommend that copies or summaries of any views provided by consulting parties and the public regarding the undertaking be provided to our office pursuant to 36 CFR 800.11(e).

Our office asks that the attached technical comments in a revised final report to be submitted to this office. Revised survey forms and photographs should be submitted as separate PDF and image files and do not need to be appended to the revised final report.

Please refer to SHPO Project Number 19-KL0350 in any future correspondence regarding this project. If you have any questions, please contact me at (803) 896-6181 or KLewis@scdah.sc.gov.

Sincerely,



Elizabeth M. Johnson
Director, Historical Services, D-SHPO
State Historic Preservation Office

## Technical Comments

Where Arrowhead Dairy is discussed in the report we recommend use of "previously evaluated" instead of "previously recorded". SHPO site number 3919 is newly assigned, and the Arrowhead Dairy resources recorded by this survey, the house and another stone barn, were not included in the Preliminary Information Form (PIF) submittal to this office and have not been previously evaluated for National Register eligibility.

Above-ground architectural or historic resources should be referred to throughout the report as, for example, "SHPO site number 3919", instead of just "3919". Sub-numbers should be referred to throughout the report and on survey forms as, for example, ".01", instead of just ".1". Please correct.

Hutchinson Place: Please provide a map in Section 5.2 of the potential district's boundaries as part of the survey report. Survey maps should include street names, show lot lines, and compass orientation. Each recorded resource in the district should be outlined on the map or a dot can indicate their locations.

p. 36, Section 5.0 Results- "three newly recorded aboveground resources (3920 through 3922 and 1857) were identified". Please remove 1857 or clarify why it was included here as it is not referenced throughout the remainder of the report.

Figure 5.9- Three positive shovel tests are cited at site 38YK0607, and included in the Artifact Catalog, but four are depicted in this figure. Additionally, the central shovel test in the figure is not labeled. Please correct and clarify the correct number of shovel tests.

Figure 5.9- Please provide additional context regarding the Phase I STPs and the CRIS STPs as depicted here. Does CRIS stand for Cultural Resources Intensive Survey? If so, how does this differ from the Phase I? Please provide additional information regarding the methodology used for the CRIS as compared to the Phase I.

p. 42, Section 5.1.1, Site 38YK607- Stated previously that "three artifacts were collected from the surface of the site and the remaining eight came from between 0-20 cmbs" (p. 36) and in the concluding paragraph that "Given the artifacts were recovered from the surface of the site." Please clarify as it is indicated that the majority of artifacts were from subsurface contexts at the site here and in the Artifact Catalog.

p. 57, Section 5.2.1- TYPO: "~~Vanessa~~ Virginia Harness". Please correct.

Artifact Catalog- Please include photograph of the projectile points (i.e. from 38YK0609, IF-1). As stated in the *South Carolina Standards and Guidelines for Archaeological Investigations*, "important artifacts should be illustrated either as line drawings or photographs." (p. 27).

Survey Forms--

You may enter a recommended eligibility determination on survey forms in the SHPO National Register Determination of Eligibility field.

Enter the name of the Cultural Resource Survey report title, author, and date that is associated with the property recorded on the survey form in the Sources of Information field.

Please ensure all Digital Photo IDs view fields are completed for each photo provided.

SHPO site number 3919: This resource can be re-numbered to a sub-number. The Historic Name field should read Arrowhead Dairy; House. Please try to complete all fields more accurately or state in the Description field the reasons this information is unknown or not visible.

SHPO site number 3919.01: The Historic Name field should read Arrowhead Dairy; Barn (enter a barn type or name if possible). The Property Description fields need to be revisited. For example, the Historic Core Shape field should be Rectangular, the Stories field should be 1 story (as described in the Description field), the Construction field should be Masonry, the Foundation field should be Stone, the Roof Material field should be Raised Seam Metal, and there appears to be no porch.

SHPO site number 3920: The Category field should be District. The Property Description fields need to be revisited. These are not essential for the District form, but it is fine for "Other" to be selected for these entries, with "multiple" used as you have done.

Please use one survey form to describe one resource. For example, 2770 Blossom Drive and 967 Arrowhead Drive each need to be recorded on their own form. Add "House" in the Historic Name field on each sub-number form after the typology.

SHPO site number 3921: Please recheck the Property Description fields such as Historic Core Shape, Stories, and Porch Width.

SHPO site number 3922: Enter an Address/Location in accordance with our Survey Manual instructions. The Category field should be Structure. The Use fields should be Transportation. Please clear the Property Description fields if not applicable.

# APPENDIX B

# CONSERVATION EASEMENT

| | | |
|---|---|---|
| **STATE OF SOUTH CAROLINA** | **)** | **CONSERVATION EASEMENT** |
| | **)** | **AND ACCEPTANCE** |
| **COUNTY OF CHESTER** | **)** | |

THIS GRANT OF CONSERVATION EASEMENT AND ACCEPTANCE (this "Conservation Easement") is made this _____ day of _____, 2020, by and between Open Space Institute Land Trust, Inc. ("Grantor") of New York, New York and Katawba Valley Land Trust, Inc. ("Grantee") of Lancaster, South Carolina.

RECITALS:

WHEREAS, Grantor is the owner in fee simple of certain real property containing approximately 109.48 acres located in Chester County, South Carolina, more particularly depicted on Exhibit A: *PROPERTY OWNED BY OPEN SPACE INSTITUTE LAND TRUST, INC. CONSERVATION EASEMENT BOUNDARY SURVEY FOR "LANDSFORD MITIGATION SITE" CHESTER COUNTY, SOUTH CAROLINA* and further described in Exhibit A legal description (hereafter the "Protected Property");

WHEREAS, Grantor desires to convey to the Grantee a conservation easement placing certain limitations and affirmative obligations on the Protected Property for the protection of wetlands, scenic, resource, environmental, and other values, and in order that the Protected Property shall remain substantially in its natural condition forever;

WHEREAS, Grantee is qualified to hold a conservation easement, and is a qualified land trust, the purposes or powers of which include one or more of the purposes set forth in subsections (a) - (e) listed below;

WHEREAS, the purposes of this Conservation Easement include one or more of the following:

(a) retaining or protecting natural, scenic, or open-space aspects of real property;
(b) ensuring the availability of real property for recreational, educational, or open-space use;
(c) protecting natural resources;
(d) maintaining or enhancing air or water quality; or
(e) preserving the historical, architectural, archaeological, or cultural aspects of real property;

WHEREAS, Grantor and Grantee intend this document to be a "conservation easement" as such term is defined in the South Carolina Conservation Easement Act of 1991, S.C. Code Section 27-8-10, et seq. (the "Conservation Easement Act");

WHEREAS, the Protected Property is considered to have certain "Conservation Values" which are defined as natural habitats determined to be of significance or importance pursuant to scientific scrutiny. The Conservation Values of the Protected Property include the following:

(a) relatively natural habitat and biological diversity;
(b) preservation of ecological functions of a vegetated riparian corridor;
(c) preservation or enhancement of downstream water quality on the Catawba River; and
(d) preservation of scenic views of the Protected Property from South Carolina State Road 327A and from the publicly accessible Catawba River;

WHEREAS, Grantor and Grantee agree that third-party rights of enforcement, as separate and distinct from the enforcement rights of Grantee, described in Section "E. GENERAL PROVISIONS" shall be held solely by the U.S. Army Corps of Engineers, Charleston District (the "Corps") and the S.C. Department of Health and Environmental Control ("SCDHEC") (collectively the "Third-Parties," to include any successor agencies), and may be exercised through the appropriate enforcement agencies of the United States and the State of South Carolina, and that these rights are in addition to, and do not limit, the rights of enforcement under Department of the Army Permit No. SAC-2019-00924 dated _____ including any amendments ("Permit"), or any permit or certification issued by the Third-Parties;

WHEREAS, Grantor and Grantee represent that it is common practice for land trusts to hold their fee simple property interests in limited liability companies;

NOW THEREFORE, in consideration of the above Recitals, which Recitals form a substantive part of this Conservation Easement, and the mutual covenants, terms, conditions and restrictions contained in this Conservation Easement, and intending to be legally bound hereby, Grantor hereby voluntarily, unconditionally and absolutely grants and conveys to Grantee, its successors and permitted assigns, a conservation easement in perpetuity over the Protected Property of the nature and character and to the extent hereinafter set forth. Grantee hereby accepts the grant of such conservation easement and agrees to hold the same exclusively for the protection of the Conservation Values and to enforce the terms of the restrictive covenants set forth in this Conservation Easement.

## COVENANTS, TERMS, CONDITIONS, AND RESTRICTIONS

## A. PURPOSE

1. The purpose of this Conservation Easement is to ensure the Protected Property will be preserved in a "Natural Condition", as defined herein, in perpetuity and to prevent any use of the Protected Property that will materially impair or interfere with that objective (collectively herein, the "Purpose"). Grantor intends that this Conservation Easement will confine the use of the Protected Property to such activities, including without limitation, those involving the restoration, enhancement, and/or preservation of aquatic resources, in a manner consistent with the Purpose of this Conservation Easement. Grantor and Grantee recognize the traditional uses of the Protected Property for forestry, wildlife management, hunting and other naturalistic purposes, which uses have fostered and preserved the Conservation Values described herein.

2. The term "Natural Condition," as referenced in the preceding paragraph and other portions of this Conservation Easement, shall mean the condition of the Protected Property, as it exists at the time this Conservation Easement is executed and documented in the Baseline Document Report, as hereinafter defined. Natural Condition also includes future

restoration, enhancement, or other changes to the Protected Property that occur directly as a result of the compensatory mitigation measures required by Permit No. SAC-2019-00924 pursuant to the "Landsford Tract Final Permittee-Responsible Mitigation Plan" dated April 17, 2020 prepared for the South Carolina Department of Commerce (the "Plan"), including implementation, maintenance, and monitoring activities (collectively, "Compensatory Mitigation"). The cover page and Executive Summary of the Plan are attached as Exhibit B. Natural Condition also includes the natural succession and maturation of landcover types documented in the Baseline Document Report. The updated Natural Condition of the Protected Property after Compensatory Mitigation is completed shall be documented as described in Section A.4 below in a Current Conditions Report.

3. **Baseline Document Report**. The current conditions of the Protected Property shall be documented in the "Baseline Document Report," prepared by Grantee or its subcontractor(s) and certified to be true and accurate to Grantee, Grantor, Third-Parties and the Permittee. Grantee shall circulate the Baseline Document Report to Grantor, Third-Parties and the Permittee on or before April 17, 2020. The purpose of the Baseline Document Report is to accurately document the condition of the Protected Property prior to commencement of the Compensatory Mitigation activities pursuant to the Plan. The Baseline Document Report shall include, but is not limited to:

(a) a current aerial photograph of the Protected Property at an appropriate scale taken as close as possible to the date of this conveyance;
(b) on-site photographs taken at representative locations on the Protected Property, including of major, distinct natural features, and all existing man-made structures, improvements, features; and,
(c) a surveyed plat of the Protected Property showing all relevant property lines and features, as shown on Exhibit A attached hereto and incorporated herein by reference, and recorded in the Office of the Chester County, South Carolina Register of Deeds in Plat Book _____ at Page _____.

4. **Current Conditions Report**. After the completion of the Compensatory Mitigation activities on the Protected Property, Grantor, Grantee, and Third-Parties agree that the Baseline Document Report shall be supplemented to reflect the new conditions of the Protected Property. Such supplemental documentation ("Current Conditions Report") shall be provided to Grantor, Grantee, Third-Parties and the Permittee. If substantial modification of the Protected Property is required by the Third-Parties to obtain final certification of satisfactory performance standards, after the Baseline Document Report has been supplemented/updated, additional supplemental documentation shall be prepared and provided to Grantor, Grantee, Third-Parties and the Permittee.

5. **Grantor Certification**. Grantor certifies to Third-Parties and Grantee that to Grantor's actual knowledge, there are no previously granted easements existing on the Protected Property that materially interfere or conflict with the Purpose of this Conservation Easement, as evidenced by the Title Report attached as Exhibit C.

6. **Current Liens**. At the time of conveyance of this Conservation Easement, the Protected Property is not subject to a Mortgage.

## B. PROHIBITED USES

Any activity on or use of the Protected Property inconsistent with the Purpose of this Conservation Easement is prohibited. The Protected Property shall be maintained in its natural, scenic and open condition and be restricted from any development that would impair or interfere with the Conservation Values of the Protected Property. These restrictions, which are more fully described in the list below (the "Restrictions") shall run with the land and bind Grantor's successors, administrators, assigns, lessees, or other occupiers and users, and are subject to the Reserved Rights which follow. Use of the Protected Property by Grantor, Grantee, their respective guests, agents, assigns, employees, representatives, successors, and third-parties are expressly restricted by the following terms except as otherwise provided in this Conservation Easement, or specifically provided for in the Permit and any amendments thereto, the Plan, and any easements and reservations of rights in the chain of title to the Protected Property at the time of this conveyance (as set forth on Exhibit C):

1. **General**. There shall be no filling, flooding, excavating, mining or drilling; no removal of natural materials; no dumping of materials; and, no alteration of the topography or hydrology in any manner.

2. **Waters and Wetlands**. In addition to the General restrictions above, there shall be no draining, dredging, damming or impounding; no changing the grade or elevation, impairing the flow or circulation of waters, reducing the reach of waters; and, no other discharge or activity requiring a permit under applicable clean water or water pollution control laws and regulations, as amended.

3. **Trees/Vegetation**. There shall be no clearing, burning, cutting or destroying of trees or vegetation, except as expressly authorized in the Reserved Rights; there shall be no planting or introduction of non-native and/or invasive species of trees or vegetation.

4. **Activities**. No industrial, commercial, or agricultural activities (including livestock grazing) shall be undertaken or allowed on the Protected Property.

5. **Structures**. There shall be no construction, erection, or placement of buildings, billboards, or any other structures, nor any additions to existing structures.

6. **New Roads**. There shall be no construction of new roads, trails, or walkways without the prior written approval of the Grantee and Third-Parties, including the manner in which they are constructed.

7. **Utilities**. There shall be no construction or placement of utilities or related facilities without the prior written approval of Grantee and Third-Parties.

8. **Chemical Controls**. There shall be no application of pesticides or biological controls without prior written approval from the Third-Parties.

9. **Subdivision**. There shall be no legal or de facto division, subdivision or portioning of the Protected Property. All present and future development rights allocated, implied, reserved or inherent in the Protected Property are hereby terminated and extinguished, and may not be used or transferred.

10. **Mining.** Grading, filling, excavation, dredging or mining, including surface mining, and recovery of any oil, gas or minerals, is prohibited on the Protected Property.

11. **Animals.** There shall be no destruction of animal life (including birds, insects and fish) or their habitats.

12. **Other Prohibitions**. Any other use of, or activity on, the Protected Property which is or may become inconsistent with the Purpose of this Conservation Easement is prohibited.

## C. GRANTEE'S RIGHTS

To accomplish the Purpose of this Conservation Easement, Grantor, its successors and assigns, hereby grants and conveys the following rights to Grantee and Third-Parties.

1. To preserve and protect the Conservation Values and Natural Condition of the Protected Property in perpetuity, including enforcing the terms of this Conservation Easement.

2. To enter upon the Protected Property at reasonable times in order to monitor compliance with and to otherwise enforce the terms of this Conservation Easement. To traverse existing and proposed roads as depicted on Exhibit D to the extent reasonably necessary to gain access to the Protected Property for the reasons set forth herein.

3. Subject to Sections E.6 and E.19 of this Conservation Easement, to prevent any activity on or use of the Protected Property that is inconsistent with the Purpose of this Conservation Easement and to require the restoration of such areas or features of the Protected Property that may be damaged by any act, failure to act, or any use that is inconsistent with the Purpose of this Conservation Easement.

4. The right to enforce the terms and conditions of this Conservation Easement, including, without limitation, by injunctive relief.

## D. GRANTOR'S RESERVED RIGHTS

Notwithstanding the foregoing Restrictions, and rights of the Grantee and Third-Parties, Grantor reserves for Grantor, its successors, administrators, and assigns the following "Reserved Rights." All Reserved Rights are considered to be consistent with the conservation purposes of this Conservation Easement and, except as specifically stated otherwise herein, require no prior notification to or approval by Grantee. Notwithstanding the foregoing, Grantor and Grantee have no right to agree to any activity that would result in the termination of this Conservation Easement.

1. **Landscape Management**. Landscaping by Grantor to prevent erosion or damage to the Protected Property or portions thereof, or significant detriment to existing or permitted uses, is allowed with prior written notice to the Grantee and Third-Parties, and provided that such landscaping must be generally consistent with preserving the Conservation Values and Natural Condition of the Protected Property.

2. **Forest Management**. Harvesting and management of timber by Grantor is limited to the extent necessary to:

(i) Protect the natural environment in areas where the forest is damaged by natural forces such as fire, flood, storm, insects or infectious organisms.

Such timber harvesting and management shall be carried out in accordance with a Forest Management Plan and Best Management Practices approved by the South Carolina Forestry Commission or successor agency, as amended.

3. **Walking Trails and Recreation**. Grantor reserves the right to authorize any outdoor, non-commercial recreational activities, including, but not limited to, hunting, fishing, and general wildlife observation, with cumulatively minor impacts, and which are consistent with preserving the Conservation Values and Natural Condition of the Protected Property. A trail and pedestrian bridge crossing over the unnamed creek constituting the southern property line may be added and maintained as necessary to facilitate access, pending approval of the Grantee and Third-Parties. Notwithstanding the foregoing, no other trails shall be located within the Protected Property without the prior written approval of the Grantee and Third-Parties.

4. **Road Maintenance**. This Conservation Easement shall be subject to all existing roads as of the date hereof (the "Existing Roads"), and as depicted on Exhibit D, incorporated herein by reference. Maintenance of Existing Roads is permitted, provided that such maintenance is limited to: removal or pruning of dead or hazardous vegetation; application of permeable materials (*e.g.*, sand, gravel) necessary to correct or impede erosion; grading; and maintenance of roadside ditches.

5. **New Roads and Trails**. New roads and trails ("New Roads/Trails") depicted in Exhibit D may be added and maintained, provided that the addition and maintenance of such New Roads/Trails is consistent with preserving the Conservation Values and Natural Condition of the Protected Property. No New Roads/Trails, other than those specified on Exhibit D, shall be constructed without the prior written approval of the Grantee and Third-Parties. Further, maintenance and New Roads/Trails (either depicted in Exhibit D or otherwise pre-approved in writing by the Grantee and Third-Parties) is permitted, provided that such maintenance is limited to: removal or pruning of dead or hazardous vegetation; application of permeable materials (*e.g.*, sand, gravel) necessary to correct or impede erosion; grading; maintenance of roadside ditches; and maintenance of any other crossings that facilitate access to the Protected Property. No expansion of New Roads/Trails (either depicted in Exhibit D or otherwise pre-approved in writing by the Grantee and Third-Parties) shall be conducted without the prior written approval of the Grantee and Third-Parties.

6. **Vegetation, Debris, and Non-Native/Invasive Species Removal**. Grantor reserves the right to engage in the removal or trimming of vegetation downed or damaged due to natural disaster, removal of man-made debris, removal of parasitic vegetation (as it relates to the health of the host plant) and removal of non-native/invasive plant or animal species.

7. **Construction of Structures and Signs**. Installation and replacement signage for informational or directional/interpretive signage for non-commercial use or regulating access to and use of any portion of the Protected Property, no trespassing signs, signs identifying the owner of the Protected Property, and signs identifying specific areas within the Protected Property, are permitted provided that such signs or structures are consistent with

preserving the Conservation Values and Natural Condition of the Protected Property. Subject to further legal restrictions which may apply, hunting or observation blinds or elevated stands which are portable by a single individual may be used temporarily upon any portion of the Protected Property.

8. **Existing Structures**. As of the date of this Conservation Easement, no structures are present on the Protected Property.

9. **Compensatory Mitigation**. Grantor, and its authorized agents, reserves the right to perform any restoration, enhancement, and other wetland mitigation activities required by the Permit and/or the Plan, including the use of all equipment necessary to successfully complete any mitigation requirements contained therein.

10. **Threatened and Endangered Species Management.** Management for Federally listed threatened or endangered species, as well as State recognized rare, threatened or endangered species, shall be permitted, provided that such management is in accordance with the Plan and recommended management practices and/or recovery plans and is consistent with preserving the Conservation Values and Natural Condition of the Protected Property. Threatened and endangered species management activities that are not otherwise provided in the Plan may be allowed with the prior written approval of Grantee and Third-Parties.

11. **Scientific Data Collection.** The Grantor may conduct and/or permit the collection of scientific data, including, but not limited to, the installation of monitoring wells and weather stations, provided such installation and collection are consistent with preserving the Conservation Values and Natural Condition of the Protected Property. Non-permanent/temporary scientific collecting devices such as temporary wildlife cameras or audio recorders require no prior notification to or approval by Grantee and Third-Parties. However, data collection involving the permanent installation of structures such as a weather station or monitoring wells requires prior written approval from the Grantee and Third-Parties. Any permissions or licenses issued for data collection shall be limited in time and shall require the permittee stated therein to be the party responsible for maintenance and removal of monitoring wells, weather data collection stations and/or any other associated data collection equipment.

12. **Waters and Wetlands.** Grantor shall be permitted to create or extend the reach of waters or wetlands beyond that called for in the Plan as long as the aquatic resources (e.g., delineated wetlands) of the Protected Property are not adversely affected or reduced in any manner, and provided that such construction may take place only for the provision of fish and wildlife habitat enhancement and only after obtaining the prior written approval of Grantee and Third-Parties, and after obtaining and providing Grantee and Third-Parties copies of all applicable local, state and federal and approvals necessary for such activity.

13. **Quiet Enjoyment.** Grantor reserves to itself, its agents, representatives, successors and assigns, all rights accruing from its ownership of the Protected Property, including the right to engage in or permit or invite others, including, at the election of the then-current owner, the general public, to engage in all uses of the Protected Property that are not expressly prohibited or restricted herein and are not inconsistent with the Purpose of this Conservation Easement. Without limiting the generality of the foregoing, Grantor expressly

reserves the right of access to the Protected Property and the right of quiet enjoyment of the Protected Property.

14. **Other Reserved Rights**. Grantor reserves the right to engage in all acts or uses not prohibited by the terms of this Conservation Easement, and which are not inconsistent with the Purpose of this Conservation Easement.

## E. GENERAL PROVISIONS

Except as otherwise provided herein, the following "General Provisions" shall be binding upon, and inure to the benefit of, Grantor, Grantee and Third-Parties, and the successors, administrators, assigns, lessees, licensees and agents of each:

1. **Marking of Property.** Grantor shall install and maintain permanent signs saying "Protected Natural Area" as shown on Exhibit E or establish an equivalent, permanent, marking system along the boundary of the Protected Property, including upland buffers, riparian zones, and/or aquatic resources.

2. **Rights of Access and Entry**. Grantee and Third-Parties shall have the right to enter and go upon the Protected Property upon providing reasonable notice to Grantor for purposes of inspection, and to take actions necessary to verify compliance with the Restrictions. No right of access or entry by the general public to any portion of the Protected Property is conveyed by this Conservation Easement; however, Grantor, its successors and assigns, may allow public access at its discretion and declare the Protected Property as a wildlife management area under South Carolina law and in accordance with applicable uses and policies governed by public natural resource agencies.

3. **Enforcement**. In the event of a breach of the Restrictions by Grantor, the Grantee or one of the Third-Parties must notify Grantor in writing of the breach. Grantor shall have thirty (30) days after receipt of such notice to undertake actions that are reasonably calculated to swiftly correct the conditions constituting the breach. If Grantor fails to take such corrective action within thirty (30) days, or fails to complete the necessary corrective action, the Grantee and/or the Third-Parties may undertake such actions, including legal proceedings, as are necessary to achieve such corrective action. Among other relief, Grantee and/or Third-Parties shall be entitled to a complete restoration for any breach of this Conservation Easement. Breaches of General Provisions of this Conservation Easement shall be actionable without notice. The costs of a breach, correction or restoration, including the Grantee's expenses, court costs, and attorneys' fees, shall be paid by Grantor, provided Grantor is determined to be responsible for the breach and subject to Section E.19. Enforcement shall be at the discretion of the Grantee and/or Third-Parties, and no omission or delay in acting shall constitute a waiver of any enforcement right. As between each other, Grantee and Third-Parties acknowledge the discretionary nature of the inspection and enforcement rights and the potential which exists for reasonable differences of opinion with respect to enforcing the terms of the Conservation Easement. These enforcement rights are in addition to, and shall not limit, enforcement rights available to Grantee or Third-Parties, including the U.S. Department of Justice, under other provisions of law or equity, or under any applicable permit or certification. This Conservation Easement may only be enforced by the parties hereto, and their respective successors and assigns, and no general third-party beneficiary rights, including but not limited

to third party rights of enforcement, are created hereby, except as to the Third-Parties named and defined herein.

4. **Events Beyond Grantor's Control**. Nothing herein shall be construed to authorize the Grantee or Third-Parties to institute any proceedings against Grantor for any changes to the Protected Property from causes or circumstances determined to have been beyond Grantor's control, including, without limitation, changes caused by acts of God, earthquake, fire, flood, storm, war, civil disturbance, strike, the unauthorized acts of third persons, or similar causes, or from any prudent action taken in good faith by Grantor under emergency conditions to prevent, abate or mitigate significant injury to life, damage to property or harm to the Protected Property resulting from such causes.

5. **Obligations of Ownership**. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Protected Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Protected Property. Nothing herein shall relieve Grantor of the obligation to comply with federal, state or local laws, regulations and permits which may apply to the exercise of the Reserved Rights.

6. **Indemnification**. Grantor agrees to release, hold harmless, defend and indemnify the Grantee and their respective officers, directors, employees, agents and contractors (the "Indemnified Parties") from any and all liabilities including injury, losses, damages, judgments, penalties, costs, expenses, and fees (including reasonable attorney's fees) arising from or in any way connected to any injury, including death, to any person or physical damage to any part of the Protected Property, resulting from any act, omission, condition, or other matter related to or occurring on or about the Protected Property, regardless of cause, unless due to the negligence or willful act of any of the Indemnified Parties. Any such negligence on the part of an Indemnified Party shall only prevent the negligent Indemnified Party from recovery and shall in no way affect the indemnification rights of any other non-negligent Indemnified Party. This Section E.6 is controlled by Section E.19 as it relates to the State, as defined therein.

7. **Long-Term Management**. Grantor shall accomplish the long-term management activities identified in Section 4.10 of the Plan, as excerpted in Exhibit F.

8. **Extinguishment**. In the event that changed conditions render impossible the continued use of the Protected Property for conservation purposes, this Conservation Easement may only be extinguished, in whole or in part, by judicial proceeding.

9. **Eminent Domain**. Whenever all or part of the Protected Property is taken in the exercise of eminent domain so as to substantially abrogate the Restrictions imposed by this Conservation Easement, Grantor and Grantee shall join in appropriate actions at the time of such taking to (i) promptly notify the Third-Parties, and (ii) recover the full value of the taking, and all incidental and direct damages due to the taking, including but not limited to alternative compensatory mitigation that is acceptable to the Third-Parties, and conforms with the requirements of 33 C.F.R. § 332.7(a)(3) and (4). Any proceeds recovered under this Section, including, without limitation, any proceeds generated from timber harvest or salvage, shall be placed in escrow by Grantor and Grantee to be held and controlled jointly, until such time as the funds can be utilized to acquire adjoining acreage or other suitable acreage that

fulfills the compensatory mitigation requirements set by the conditions of the Permit and in accordance with 33 C.F.R. Part 332.

10. **Disposal**. In accordance with the Plan, the South Carolina Department of Natural Resources ("SCDNR") is intended to accept fee simple title to the Protected Property by donation from Grantor. Following ownership of the Protected Property by SCDNR, in the event that all or part of the Protected Property becomes surplus government property or needs to be conveyed, disposed of, and/or transferred, SCDNR shall do so in conformity with the requirements of 33 C.F.R. § 332.7(a)(3) and (4). In such event, priority must be given for conveyance of the Protected Property to an entity qualifying as a Holder under the South Carolina Conservation Easement Act, S.C. Code Ann. § 27-8-20(2) and the Protected Property shall continue to be managed in accordance with the Plan and protected by this Conservation Easement. A 60-day advance notification to the Third-Parties is required before any action is taken to transfer title under this Section 10, or establish any other legal claims to or over, the Protected Property. Any such transfer shall be subject to this Conservation Easement. In the event SCDNR in unable or unwilling to accept title to the Protected Property, Grantor shall endeavor to convey said property to another entity qualifying as a Holder under the South Carolina Conservation Easement Act, S.C. Code Ann. § 27-8-20(2), or such other party as shall be approved by the Third-Parties, and the Protected Property shall continue to be managed in accordance with the Plan and protected by this Conservation Easement. A 60-day advance notification to the Third-Parties is required before any action is taken to transfer title under this Section 10, or establish any other legal claims to or over, the Protected Property. Any such transfer shall be subject to this Conservation Easement.

11. **Notification**. Any notice, request for approval, or other communication required under this Conservation Easement shall be sent by registered or certified mail, postage prepaid, to the following addresses (or such address as may be hereafter specified by notice pursuant to Section E.12):

To Grantor: Open Space Institute Land Trust Incorporated
1350 Broadway, Suite 201, New York, NY 10018

To Grantee: Katawba Valley Land Trust
Post Office Box 1776
Lancaster, SC 29721

To Third-Parties: U.S. Army Corps of Engineers
Attn: Regulatory Division
69A Hagood Avenue
Charleston, South Carolina 29403

SCDHEC
Bureau of Water
2600 Bull Street
Columbia, SC 29201

12. **Assignment**. This Conservation Easement is transferable, but only to a qualified holder under §501(c)(3) and §170(h) of the Internal Revenue Code as described herein. As a condition of such transfer, the transferee shall agree to all of the restrictions, rights,

and provisions herein, and to continue to carry out the Purposes of this Conservation Easement. Assignments shall be accomplished by amendment of this Conservation Easement under Section E.17. Grantee shall notify Grantor and Third-Parties at least 60 days prior to any such assignment or transfer.

13. **Failure of Grantee**. If at any time Grantee is unable or fails to enforce this Conservation Easement, or if Grantee ceases to be a qualified holder under §501(c)(3) and §170(h) of the Internal Revenue Code, and if within a reasonable period of time after the occurrence of one of these events the Grantee fails to make an assignment pursuant to Section E.12, then the Grantee's interest shall become vested in another qualified holder in accordance with an appropriate (*e.g., cy pres*) proceeding in a court of competent jurisdiction.

14. **Subsequent Transfer**. Grantor agrees to incorporate the terms of this Conservation Easement in any deed or other legal instrument which transfers any interest in all or a portion of the Protected Property. Grantor agrees to provide written notice of such transfer to Grantee and Third-Parties at least 60 days prior to the date of transfer. The failure of Grantor to comply with this Section E.14 shall not impair the validity or enforceability of this Conservation Easement.

15. **No Extinguishment Through Merger**. Grantor and Grantee herein agree that should Grantee, or any successor in interest to Grantee, come to own all or a portion of the fee interest in the Protected Property subject to this Conservation Easement, (i) said owner shall observe and be bound by the obligations and the restrictions imposed upon the Protected Property by this Conservation Easement; (ii) this Conservation Easement shall not be extinguished, in whole or in part, through the doctrine of merger in view of the public interest in its enforcement; and (iii) said owner as promptly as possible shall assign the Grantee interests in this Conservation Easement of record to another holder in conformity with the requirements of Section E.12. Any instrument of assignment of this Conservation Easement or the rights conveyed herein shall refer to the provisions of Section E.12, and shall contain language necessary to continue Section E.12 in force. Further, no deed, transfer, or assignment shall be effective if it will result in merger, until a like conservation easement has been granted to avoid merger.

16. **Control.** Nothing in this Conservation Easement shall be construed as giving rise to any right or ability of Grantee to exercise physical or managerial control over day-to-day operations of the Protected Property, or any of Grantor's activities on the Protected Property, or otherwise to become an operator with respect to the Protected Property within the meaning of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended.

17. **Amendment**. This Conservation Easement may be amended, but only in writing signed by all parties hereto, and provided such amendment must be consistent with the Purpose of this Conservation Easement and the status of the Grantee under any applicable laws, including S.C. Code Title 27, Chapter 8.

18. **Severability**. Should any separable part of this Conservation Easement be found void or unenforceable by a court of competent jurisdiction, the remainder shall continue in full force and effect.

19. **Indemnification Provisions Not Applicable to the State.** In accordance with the terms of the Plan, SCDNR is intended to accept fee simple title to the Protected Property. Notwithstanding any language herein (preceding or following) to the contrary, no indemnification obligation or requirement or commitment to payment of Grantee's expenses, court costs, and attorneys' fees contained herein shall be applicable to, binding upon or enforceable against the State of South Carolina or any agency or governmental department or body of the State of South Carolina (collectively referred to hereinafter as the "State").

20. **Warranty**. Grantor warrants that it owns the Protected Property in fee simple, and that Grantor either owns all interests in the Protected Property which may be impaired by the granting of this Conservation Easement or that there are no outstanding mortgages, tax liens, encumbrances, or other interests in the Protected Property which have not been expressly subordinated to this Conservation Easement other than those which have disclosed by Grantor to Grantee. Grantor further warrants that Grantee shall have the use of and enjoy all the benefits derived from and arising out of this Conservation Easement. Grantor further warrants that it has no knowledge of the presence, release or threatened release of hazardous substances or wastes on the Protected Property and promises to defend and indemnify the Grantee against all litigation, claims, demands, penalties, and damages, including reasonable attorney's fees, arising from breach of this warranty.

21. **Habendum Clause**. To have and to hold, this Conservation Easement together with all and singular the appurtenances and privileges belonging or in any way pertaining thereto, either in law or equity, either in possession or expectancy, for the proper use and benefit of the Grantee, its successors and assigns, forever.

22. **Counterparts.** This Conservation Easement may be executed in counterparts, each of which shall be deemed to be an original, and taken together shall constitute one and the same instrument.

[*Signature Pages Follow*]

IN WITNESS WHEREOF, Grantor and Grantee have executed this Conservation Easement, and the Third-Parties have approved this Conservation Easement, on the date written above. By its execution and acceptance of this Conservation Easement, Grantee accepts the Third-Parties rights of enforcement herein.

SIGNED, SEALED AND
DELIVERED IN THE PRESENCE OF:

WITNESSES:

**GRANTOR**:

Open Space Institute Land Trust, Incorporated,
a New York not-for-profit corporation [SEAL]

_____ By:_____

_____ Its:_____

_____ And:_____

_____ Its:_____

STATE OF SOUTH CAROLINA )
) ACKNOWLEDGMENT
COUNTY OF CHESTER )

The foregoing instrument was acknowledged this _____ day of _____, 2020, before me the undersigned Notary, and I do hereby certify that the above named _____ and _____, duly authorized officers of the **Grantor** personally appeared before me and acknowledged the due execution of the foregoing instrument.

_____(SEAL)
(Signature of Notary)
Printed Name of Notary: _____
Notary Public for the State of South Carolina
My commission expires: _____

WITNESSES:

**GRANTEE**:

KATAWBA VALLEY LAND TRUST, INC., a South Carolina non-profit corporation [SEAL]

_____ By:_____

_____ Its:_____

_____ And:_____

_____ Its:_____

STATE OF SOUTH CAROLINA )
) ACKNOWLEDGMENT
COUNTY OF CHESTER )

The foregoing instrument was acknowledged this _____ day of _____, 2020, before me the undersigned Notary, and I do hereby certify that the above named _____ and _____, duly authorized officers of the **Grantee** personally appeared before me and acknowledged the due execution of the foregoing instrument.

_____(SEAL)
(Signature of Notary)
Printed Name of Notary: _____
Notary Public for the State of South Carolina
My commission expires: _____

Approval by Third-Parties:

U.S. Army Corps of Engineers, Charleston District

By: _____

_____
[type/print name]

Title: _____

Approval by Third-Parties:

S.C. Department of Health and Environmental Control

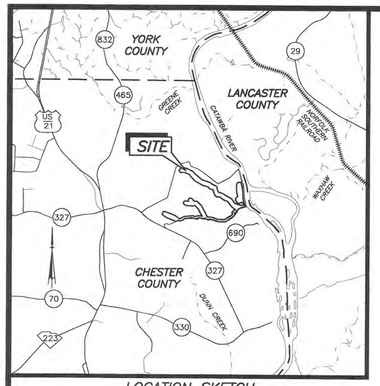
By: _____

_____
[type/print name]

Title: _____

EXHIBIT A

Conservation Easement Survey Plat and Legal Description of Protected Property




LOCATION SKETCH
SCALE: 1 INCH = 1 MILE

STATE GRID NORTH
BY GNSS
FROM SCVRS
NAD83 (2011)

## GEODETIC AND SC STATE GRID POINT DATA

HORIZONTAL DATUM: NAD83 (2011)
VERTICAL DATUM: NAVD 88

POINT NUMBER: 133
SC GRID COORDINATES
NORTH: 1,077,564.99'
EAST: 2,034,411.88'
GEODETIC COORDINATES:
LATITUDE: N 34°47'41.42649"
LONGITUDE: W 080°53'07.39224"

POINT NUMBER: 1012
SC GRID COORDINATES
NORTH: 1,076,467.73'
EAST: 2,029,248.93'
GEODETIC COORDINATES:
LATITUDE: N 34°47'30.62563"
LONGITUDE: W 080°54'09.30976"

COORDINATE DERIVATION: GNSS
COMBINED REDUCTION FACTOR: 0.999962395
MEASUREMENTS SHOWN ARE FIELD SURVEY DISTANCES.
ALL COORDINATES SHOWN HEREON ARE NAD83 (2011) GRID SCALE.

NOTE: THIS TIE DATA TO BE USED FOR LOCATION ONLY.

LEGEND

| | |
|---|---|
| RBS | REBAR SET |

(5019) 1/2" REBAR FOUND
NORTHING – 1,080,891.70'
EASTING – 2,030,239.33'
ELEVATION – 572.70'

(5025) 1/2" REBAR FOUND
NORTHING – 1,079,401.66'
EASTING – 2,032,549.10'
ELEVATION – 527.10'

(5126) 1/2" REBAR FOUND
NORTHING – 1,079,307.67'
EASTING – 2,034,131.69'
ELEVATION – 452.09'

(5044) 1/2" REBAR FOUND
NORTHING – 1,077,767.89'
EASTING – 2,034,443.60'
ELEVATION – 451.77'

(133) CORNER IN CREEK
GRID TIE POINT

(5002) MAG NAIL FOUND
NORTHING – 1,077,100.96'
EASTING – 2,026,650.23'
ELEVATION – 576.73'

(5008) RAILROAD SPIKE FOUND
NORTHING – 1,075,970.03'
EASTING – 2,028,449.01'
ELEVATION – 578.62'

(1012) 3/4" REBAR SET
POINT OF BEGINNING
GRID TIE POINT

(1011) 1/2" REBAR FOUND

S 62°50'08" W 327.83'
TIE (1012–1011)

RUN OF CREEK IS THE LINE
(133–164, 290, 165–224, 291, 225–276)

CONSERVATION EASEMENT
DEED: BOOK 950 PAGE 32
PLAT: CAD D SLIDE 112
PAGES 9 & 10

LANDSFORD ROAD
S 12-327A – 66' R/W
REF: SCDOT DOCKET NO. 12.379 SHEET 7

33' R/W
PROPOSED ROAD

EXISTING WOODS ROAD

PROPOSED ROAD

STREAM

1/2" REBAR FOUND (1010)

FLOW

CATAWBA RIVER

WETLAND

COUNTY BOUNDARY LINE

APPROXIMATE LOCATION OF FEMA FLOOD LINE PER FEMA GIS

ZONE "AE"

ZONE "X"

LANCASTER COUNTY

CHESTER COUNTY

OPEN SPACE INSTITUTE LAND TRUST, INC.
TMS# 162-00-00-001-000 (REMAINDER)
DEED: BOOK 1302 PAGES 304–311
PLAT: BOOK E74 PAGE 3

109.48 ACRES
TMS# 162-00-00-001-000
(PORTION)

STATE OF SOUTH CAROLINA DEPARTMENT OF PARKS, RECREATION, ET AL
TMS# 162-00-00-004-000

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
TMS# 162-00-00-003-000

NOTES:

1. SUBJECT PROPERTY REFERENCES:
"LANDSFORD MITIGATION SITE" (109.48 ACRES)
OWNER: OPEN SPACE INSTITUTE LAND TRUST, INC.
TMS # 162-00-00-001-000 (PORTION)
DEED: BOOK 1302 PAGES 304–311
PLAT: BOOK E74 PAGE 3
2. PROPOSED ROADS SHOWN ARE APPROXIMATE IN LOCATION BUT SHOWN TO DEPICT INTENT TO CONSTRUCT ROADS FOR TRAVEL INTERIOR TO PROPERTY OF OPEN SPACE INSTITUTE LAND TRUST, INC.
3. ACCORDING TO F.I.R.M. MAP NUMBER #45023C0120 D, DATED MAY 16, 2017, A PORTION OF THE PROPERTY SHOWN HEREON LIES IN FLOOD ZONE "AE". THE REMAINDER OF THE PROPERTY SHOWN HEREON IS IN ZONE "X" AND IS NOT IN A SPECIAL FLOOD HAZARD ZONE.
4. EXISTING WOODS ROADS SHOWN HEREON ARE AS TAKEN FROM AERIAL PHOTOGRAPHY AND HAVE NOT BEEN SURVEYED IN ENTIRETY. SOME SECTIONS OF THE ROADS MAY BE OVERGROWN.
5. SEE SHEET 2 FOR COURSE TABLE.
6. NO PRINT OR ELECTRONIC COPY OF THIS PLAT IS CERTIFIED BY GLENN ASSOCIATES SURVEYING, INC. UNLESS IT BEARS THE ORIGINAL SIGNATURE AND IMPRESSION SEAL OF THE RESPONSIBLE SURVEYOR SHOWN HEREON.

GLENN ASSOCIATES SURVEYING, INC.

DRAWING BY ADAM JANOWICZ

SURVEYOR'S SEAL — SOUTH CAROLINA REGISTERED LAND SURVEYOR 11606 MICHAEL R. MILLS

SURVEYOR'S SEAL — SOUTH CAROLINA REGISTERED PROFESSIONAL LAND SURVEYOR 11606 MICHAEL RALPH MILLS

C.O.A. SEAL — SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

| REVISION SCHEDULE | | | |
|---|---|---|---|
| NO. | DATE | DESCRIPTION | CHECKED |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

PROPERTY OWNED BY
# OPEN SPACE INSTITUTE LAND TRUST, INC.
CONSERVATION EASEMENT BOUNDARY SURVEY FOR
## "LANDSFORD MITIGATION SITE"
CHESTER COUNTY, SOUTH CAROLINA
JANUARY 16, 2020
SCALE: 1 INCH = 300 FEET

0 300' 600' 900' 1,200' 1,500' 1,800'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

MICHAEL R. MILLS, S.C.P.L.S. # 11606

I HEREBY STATE THAT TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION, AND BELIEF, THE SURVEY SHOWN HEREON WAS MADE IN ACCORDANCE WITH THE REQUIREMENTS OF THE STANDARDS OF PRACTICE MANUAL FOR SURVEYING IN SOUTH CAROLINA, AND MEETS OR EXCEEDS THE REQUIREMENTS FOR A CLASS "A" SURVEY AS SPECIFIED THEREIN.



14772-2

## LANDSFORD MITIGATION SITE
### 109.48 ACRES

| PT–PT | BEARING | DISTANCE |
|---|---|---|
| 1012–1008 | N 67°31'50" W | 292.12' |
| 1008–1007 | N 70°06'49" W | 176.77' |
| 1007–1006 | N 68°55'06" W | 210.55' |
| 1006–1005 | N 61°26'10" W | 161.50' |
| 1005–1004 | N 56°14'54" W | 189.58' |
| 1004–1003 | N 51°38'10" W | 124.84' |
| 1003–1013 | N 15°45'36" E | 98.58' |
| 1013–1014 | N 20°15'04" E | 105.71' |
| 1014–1015 | N 80°42'30" E | 139.69' |
| 1015–1016 | S 68°51'45" E | 210.68' |
| 1016–1017 | S 70°18'16" E | 187.33' |
| 1017–1018 | S 69°04'27" E | 205.98' |
| 1018–1019 | S 69°41'32" E | 188.64' |
| 1019–1020 | S 56°15'43" E | 190.21' |
| 1020–1021 | S 54°17'34" E | 160.60' |
| 1021–1022 | S 51°20'29" E | 99.10' |
| 1022–1023 | N 60°24'52" E | 165.86' |
| 1023–1024 | N 61°28'21" E | 204.69' |
| 1024–1025 | N 81°50'36" E | 142.28' |
| 1025–1026 | N 85°57'46" E | 138.67' |
| 1026–1027 | N 83°12'16" E | 132.45' |
| 1027–1028 | N 83°25'18" E | 228.12' |
| 1028–1029 | S 69°24'56" E | 187.85' |
| 1029–1030 | N 74°57'47" E | 247.88' |
| 1030–1031 | S 84°46'32" E | 146.21' |
| 1031–1032 | S 82°49'35" E | 145.68' |
| 1032–1033 | N 32°10'23" W | 189.13' |
| 1033–1034 | N 31°01'10" W | 176.59' |
| 1034–1035 | N 23°47'17" W | 231.87' |
| 1035–1036 | N 44°03'27" W | 174.70' |
| 1036–1037 | N 43°55'01" W | 172.14' |
| 1037–1038 | S 81°49'22" W | 161.47' |
| 1038–1039 | N 87°49'54" W | 206.04' |
| 1039–1040 | N 87°04'39" W | 205.50' |
| 1040–1041 | N 80°36'44" W | 94.57' |
| 1041–1042 | N 63°00'09" W | 184.34' |
| 1042–1043 | N 26°43'21" W | 101.47' |
| 1043–1044 | N 12°43'01" E | 118.27' |
| 1044–1045 | N 60°19'16" E | 134.36' |
| 1045–1046 | S 79°30'25" E | 235.82' |
| 1046–1047 | N 03°06'58" W | 157.40' |
| 1047–1048 | N 50°38'21" E | 139.47' |
| 1048–1049 | S 83°22'55" E | 140.65' |
| 1049–1050 | S 47°08'40" E | 125.08' |
| 1050–1051 | S 36°22'49" E | 173.45' |
| 1051–1052 | N 86°35'25" E | 208.68' |
| 1052–1053 | S 44°41'38" E | 211.50' |
| 1053–1054 | S 44°04'12" E | 142.34' |
| 1054–1055 | S 43°59'16" E | 142.58' |
| 1055–1056 | S 26°59'03" E | 220.11' |
| 1056–1057 | S 28°34'45" E | 194.28' |
| 1057–1058 | S 27°27'00" E | 186.28' |
| 1058–1060 | S 26°08'17" E | 142.18' |
| 1060–1061 | S 26°11'35" E | 159.79' |
| 1061–1062 | S 84°25'16" E | 231.53' |

## LANDSFORD MITIGATION SITE
### 109.48 ACRES (CONTINUED)

| PT–PT | BEARING | DISTANCE |
|---|---|---|
| 1062–1063 | S 80°02'21" E | 206.95' |
| 1063–1064 | S 68°20'12" E | 223.79' |
| 1064–1065 | S 73°14'17" E | 203.38' |
| 1065–1066 | N 89°32'56" E | 235.73' |
| 1066–1067 | S 87°36'36" E | 221.77' |
| 1067–1068 | N 56°43'01" E | 172.99' |
| 1068–1069 | N 53°51'52" E | 167.71' |
| 1069–1070 | N 65°09'35" E | 209.92' |
| 1070–1071 | N 44°03'24" E | 200.35' |
| 1071–1072 | N 30°40'21" W | 110.71' |
| 1072–1073 | N 28°27'51" E | 121.60' |
| 1073–1074 | N 52°44'44" E | 100.70' |
| 1074–1075 | N 53°33'55" E | 125.00' |
| 1075–1076 | N 54°13'53" W | 171.80' |
| 1076–1077 | N 52°49'18" W | 163.05' |
| 1077–1078 | N 35°40'42" W | 213.39' |
| 1078–1079 | N 37°52'14" W | 126.23' |
| 1079–1080 | N 36°34'54" W | 173.42' |
| 1080–1081 | N 76°04'08" W | 110.28' |
| 1081–1082 | N 73°53'14" W | 101.88' |
| 1082–1083 | N 56°44'15" W | 193.79' |
| 1083–1084 | N 54°43'40" W | 142.73' |
| 1084–1085 | N 55°08'19" W | 171.14' |
| 1085–1086 | S 79°53'48" W | 166.18' |
| 1086–1087 | N 56°57'05" W | 175.15' |
| 1087–1088 | N 24°01'33" W | 183.33' |
| 1088–1089 | N 16°14'22" W | 143.63' |
| 1089–1090 | N 16°00'26" W | 144.45' |
| 1090–1091 | N 72°52'35" W | 142.92' |
| 1091–1092 | N 72°15'57" W | 157.85' |
| 1092–1093 | N 32°12'44" W | 148.62' |
| 1093–1094 | N 74°00'25" W | 215.34' |
| 1094–1095 | N 73°27'32" W | 215.02' |
| 1095–1096 | N 60°42'16" W | 197.36' |
| 1096–1097 | N 58°52'00" W | 210.77' |
| 1097–1098 | N 61°32'32" W | 139.59' |
| 1098–1099 | N 57°43'14" W | 136.17' |
| 1099–1100 | N 45°45'23" W | 142.08' |
| 1100–1101 | N 42°29'20" W | 209.21' |
| 1101–1102 | N 42°18'16" W | 144.59' |
| 1102–1103 | N 31°29'12" W | 114.87' |
| 1103–1104 | N 67°19'39" W | 190.82' |
| 1104–1105 | N 65°28'22" W | 177.86' |
| 1105–1106 | S 86°03'19" W | 148.55' |
| 1106–1107 | S 88°25'20" W | 152.64' |
| 1107–1108 | N 43°26'07" W | 181.04' |
| 1108–1109 | N 24°49'21" E | 177.28' |
| 1109–1110 | N 71°36'10" E | 262.82' |
| 1110–1111 | S 74°53'54" E | 141.42' |
| 1111–1112 | S 75°07'39" E | 126.64' |
| 1112–1113 | S 66°15'41" E | 171.44' |
| 1113–1114 | S 63°22'36" E | 183.97' |
| 1114–1115 | S 64°46'23" E | 136.06' |
| 1115–1116 | S 43°14'53" E | 160.83' |
| 1116–1117 | S 43°07'11" E | 161.46' |

## LANDSFORD MITIGATION SITE
### 109.48 ACRES (CONTINUED)

| PT–PT | BEARING | DISTANCE |
|---|---|---|
| 1117–1118 | S 49°12'29" E | 203.12' |
| 1118–1119 | S 52°57'26" E | 205.39' |
| 1119–1120 | S 50°04'13" E | 195.80' |
| 1120–1121 | S 71°19'17" E | 212.48' |
| 1121–1122 | S 71°41'51" E | 186.09' |
| 1122–1123 | S 71°30'05" E | 218.77' |
| 1123–1124 | S 49°20'41" E | 178.84' |
| 1124–1125 | S 64°09'45" E | 203.70' |
| 1125–1126 | S 65°06'51" E | 194.84' |
| 1126–1127 | S 13°33'47" E | 220.75' |
| 1127–1128 | S 17°22'04" E | 221.53' |
| 1128–1129 | S 69°49'39" E | 184.19' |
| 1129–1130 | S 72°09'03" E | 138.74' |
| 1130–1131 | S 60°57'26" E | 175.84' |
| 1131–1132 | S 60°10'40" E | 216.18' |
| 1132–1133 | S 60°33'41" E | 206.96' |
| 1133–1134 | S 60°47'03" E | 212.80' |
| 1134–1135 | S 33°36'24" E | 191.36' |
| 1135–1136 | S 34°25'30" E | 203.36' |
| 1136–1137 | S 70°07'16" E | 164.59' |
| 1137–1138 | S 70°19'56" E | 161.37' |
| 1138–1139 | S 72°13'00" E | 175.75' |
| 1139–1140 | N 83°35'38" E | 211.36' |
| 1140–1160 | N 11°38'04" W | 176.90' |
| 1160–1159 | N 68°50'02" W | 101.44' |
| 1159–1158 | S 67°06'22" W | 215.44' |
| 1158–1157 | N 77°02'38" W | 146.73' |
| 1157–1156 | N 36°46'54" W | 226.03' |
| 1156–1155 | N 04°02'34" E | 176.73' |
| 1155–1154 | N 48°46'04" E | 188.18' |
| 1154–1153 | N 13°50'40" W | 134.40' |
| 1153–1152 | N 16°01'07" W | 154.61' |
| 1152–1151 | N 01°16'38" W | 230.13' |
| 1151–1150 | N 03°33'09" W | 226.75' |
| 1150–1149 | N 04°04'38" E | 196.75' |
| 1149–1148 | N 34°27'09" E | 156.08' |
| 1148–738 | N 85°16'21" E | 212.66' |
| 738–297 | S 17°59'36" E | 184.08' |
| 297–296 | S 19°30'18" E | 105.63' |
| 296–295 | S 08°23'59" E | 413.09' |
| 295–294 | S 03°17'51" E | 517.24' |
| 294–293 | S 10°10'48" E | 316.00' |
| 293–1141 | S 17°47'59" E | 322.52' |
| 1141–133 | S 17°47'59" E | 54.82' |
| 133–134 | S 70°38'34" W | 7.64' |
| 134–135 | N 84°30'39" W | 99.25' |
| 135–136 | S 76°27'01" W | 56.14' |
| 136–137 | S 32°35'16" W | 42.50' |
| 137–138 | S 81°01'19" W | 38.02' |
| 138–139 | N 75°40'27" W | 42.23' |
| 139–140 | S 80°09'35" W | 77.59' |
| 140–141 | S 58°44'26" W | 151.03' |
| 141–142 | S 63°17'28" W | 56.80' |
| 142–143 | S 22°14'03" W | 76.32' |
| 143–144 | S 57°52'20" W | 58.26' |

## LANDSFORD MITIGATION SITE
### 109.48 ACRES (CONTINUED)

| PT–PT | BEARING | DISTANCE |
|---|---|---|
| 144–145 | S 24°12'00" W | 45.93' |
| 145–146 | S 88°58'10" W | 46.85' |
| 146–147 | S 37°35'22" E | 60.97' |
| 147–148 | S 03°13'41" E | 23.95' |
| 148–149 | S 46°48'14" W | 67.39' |
| 149–150 | N 36°48'43" W | 33.25' |
| 150–151 | S 57°17'04" W | 84.82' |
| 151–152 | N 65°50'17" W | 52.79' |
| 152–153 | S 07°48'54" E | 37.12' |
| 153–154 | S 42°50'16" E | 77.78' |
| 154–155 | N 58°05'37" E | 26.85' |
| 155–156 | S 69°26'39" E | 7.34' |
| 156–157 | S 25°20'20" E | 12.13' |
| 157–158 | S 53°30'35" W | 69.33' |
| 158–159 | S 38°46'53" W | 46.28' |
| 159–160 | S 24°53'48" W | 47.73' |
| 160–161 | S 40°36'31" W | 52.56' |
| 161–162 | S 45°57'44" W | 84.00' |
| 162–163 | S 39°04'03" W | 64.21' |
| 163–164 | S 58°57'53" W | 179.32' |
| 164–290 | S 54°09'37" W | 37.20' |
| 290–165 | S 89°07'23" W | 69.38' |
| 165–166 | S 30°06'28" W | 54.46' |
| 166–167 | S 41°46'19" E | 25.12' |
| 167–168 | S 02°48'24" E | 13.87' |
| 168–169 | S 73°17'27" W | 93.92' |
| 169–170 | S 54°32'44" W | 14.48' |
| 170–171 | S 24°32'10" W | 48.00' |
| 171–172 | N 02°15'10" W | 26.44' |
| 172–173 | S 59°44'55" W | 123.90' |
| 173–174 | S 57°02'37" W | 52.68' |
| 174–175 | S 80°51'17" W | 32.47' |
| 175–176 | S 89°27'11" W | 93.52' |
| 176–177 | N 81°23'29" W | 76.34' |
| 177–178 | N 66°00'16" W | 29.93' |
| 178–179 | S 83°07'08" W | 159.24' |
| 179–180 | N 81°05'54" W | 107.67' |
| 180–181 | S 81°12'55" W | 21.89' |
| 181–182 | N 51°49'28" W | 21.42' |
| 182–183 | N 74°13'29" W | 19.64' |
| 183–184 | N 70°45'24" W | 124.51' |
| 184–185 | S 73°38'30" W | 25.94' |
| 185–186 | N 82°43'45" W | 49.81' |
| 186–187 | N 64°44'44" W | 42.29' |
| 187–188 | N 56°29'28" W | 42.47' |
| 188–189 | N 80°23'15" W | 42.52' |
| 189–190 | N 83°20'57" W | 31.77' |
| 190–191 | N 70°45'22" W | 26.15' |
| 191–192 | S 71°08'55" W | 11.07' |
| 192–193 | N 03°39'13" E | 33.10' |
| 193–194 | S 87°04'19" W | 18.59' |
| 194–195 | S 84°03'09" W | 61.62' |
| 195–196 | N 80°12'24" W | 40.95' |
| 196–197 | N 60°01'32" W | 44.48' |
| 197–198 | N 69°34'35" W | 64.41' |

## LANDSFORD MITIGATION SITE
### 109.48 ACRES (CONTINUED)

| PT–PT | BEARING | DISTANCE |
|---|---|---|
| 198–199 | S 19°06'30" W | 30.31' |
| 199–200 | N 59°01'52" W | 50.28' |
| 200–201 | S 61°57'21" W | 43.27' |
| 201–202 | S 42°08'51" W | 11.40' |
| 202–203 | S 29°29'35" W | 28.13' |
| 203–204 | N 39°16'47" W | 53.55' |
| 204–205 | S 55°27'51" W | 49.78' |
| 205–206 | N 61°56'51" W | 62.15' |
| 206–207 | N 48°56'07" W | 20.50' |
| 207–208 | N 72°27'34" W | 25.61' |
| 208–209 | N 63°01'56" W | 48.67' |
| 209–210 | N 40°35'55" W | 55.10' |
| 210–211 | S 31°05'24" W | 22.12' |
| 211–212 | S 23°19'38" E | 18.68' |
| 212–213 | S 67°36'29" W | 54.42' |
| 213–214 | S 78°54'06" W | 39.86' |
| 214–215 | N 67°44'44" W | 41.43' |
| 215–216 | S 78°52'03" W | 32.52' |
| 216–217 | N 66°19'21" W | 18.51' |
| 217–218 | N 13°59'23" W | 36.13' |
| 218–219 | N 88°53'19" W | 57.41' |
| 219–220 | N 87°29'18" W | 36.06' |
| 220–221 | S 88°08'05" W | 17.69' |
| 221–222 | N 63°14'07" W | 28.00' |
| 222–223 | N 84°15'59" W | 19.91' |
| 223–224 | N 76°29'09" W | 36.63' |
| 224–291 | N 86°30'54" W | 59.19' |
| 291–225 | N 89°10'02" W | 32.10' |
| 225–226 | S 16°23'38" W | 16.36' |
| 226–227 | S 40°07'56" W | 19.21' |
| 227–228 | S 76°00'37" W | 34.67' |
| 228–229 | S 60°38'14" W | 21.39' |
| 229–230 | N 41°25'19" W | 23.46' |
| 230–231 | S 49°52'19" W | 31.60' |
| 231–232 | S 20°51'33" E | 46.31' |
| 232–233 | S 66°50'32" W | 30.80' |
| 233–234 | N 72°43'08" W | 40.49' |
| 234–235 | N 71°03'18" W | 67.66' |
| 235–236 | N 74°17'59" W | 44.52' |
| 236–237 | S 71°13'37" W | 15.97' |
| 237–238 | N 69°04'13" W | 40.62' |
| 238–239 | N 77°59'07" W | 79.98' |
| 239–240 | N 69°00'32" W | 66.98' |
| 240–241 | N 78°10'10" W | 38.78' |
| 241–242 | S 55°41'30" W | 33.02' |
| 242–243 | S 56°10'07" W | 29.57' |
| 243–244 | N 27°43'41" W | 15.74' |
| 244–245 | N 11°59'05" W | 14.89' |
| 245–246 | S 78°06'09" W | 17.48' |
| 246–247 | N 13°42'56" E | 19.99' |
| 247–248 | S 68°02'59" W | 64.05' |
| 248–249 | N 88°06'44" W | 19.50' |
| 249–250 | S 56°20'20" W | 39.27' |

## LANDSFORD MITIGATION SITE
### 109.48 ACRES (CONTINUED)

| PT–PT | BEARING | DISTANCE |
|---|---|---|
| 250–251 | N 74°20'59" W | 45.58' |
| 251–252 | S 89°21'20" W | 40.98' |
| 252–253 | S 87°22'42" W | 33.32' |
| 253–254 | S 69°50'22" W | 74.14' |
| 254–255 | N 57°25'32" W | 19.69' |
| 255–256 | N 81°47'55" W | 36.03' |
| 256–257 | S 66°36'38" W | 38.15' |
| 257–258 | S 89°48'33" W | 24.41' |
| 258–259 | S 70°06'40" W | 33.20' |
| 259–260 | N 85°58'49" W | 26.44' |
| 260–261 | S 33°35'35" W | 29.54' |
| 261–262 | S 75°42'30" W | 24.54' |
| 262–263 | S 55°15'42" W | 51.54' |
| 263–264 | S 40°30'09" W | 64.18' |
| 264–265 | S 83°22'48" W | 23.59' |
| 265–266 | S 60°06'27" W | 23.24' |
| 266–267 | S 49°03'14" W | 13.01' |
| 267–268 | S 56°47'38" W | 47.62' |
| 268–269 | S 77°58'29" W | 18.60' |
| 269–270 | S 81°23'51" W | 70.47' |
| 270–271 | N 89°00'20" W | 39.29' |
| 271–272 | S 71°36'10" W | 43.13' |
| 272–273 | N 45°40'20" W | 16.87' |
| 273–274 | N 75°08'25" W | 48.42' |
| 274–275 | N 70°06'06" W | 48.53' |
| 275–276 | N 44°49'00" W | 13.62' |
| 276–1010 | S 62°58'53" W | 22.13' |
| 1010–1012 | S 62°58'56" W | 147.21' |

PROPERTY OWNED BY
OPEN SPACE INSTITUTE LAND TRUST, INC.
CONSERVATION EASEMENT BOUNDARY SURVEY FOR
"LANDSFORD MITIGATION SITE"
CHESTER COUNTY, SOUTH CAROLINA
JANUARY 16, 2020

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345–5297

MICHAEL R. MILLS; S.C.P.L.S. # 11606

I HEREBY STATE THAT TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION, AND BELIEF, THE SURVEY SHOWN HEREON WAS MADE IN ACCORDANCE WITH THE REQUIREMENTS OF THE STANDARDS OF PRACTICE MANUAL FOR SURVEYING IN SOUTH CAROLINA, AND MEETS OR EXCEEDS THE REQUIREMENTS FOR A CLASS "A" SURVEY AS SPECIFIED THEREIN.

DRAWING BY ADAM JANOWICZ

SURVEYOR'S SEAL — LICENSED PROFESSIONAL ENGINEER — LAND SURVEYOR — 11606 — MICHAEL RALPH MILLS — 01 SURVEYOR

SURVEYOR'S SEAL — SOUTH CAROLINA REGISTERED LAND SURVEYOR — 11606 — MICHAEL R. MILLS

C.O.A. SEAL — SOUTH CAROLINA — GLENN ASSOCIATES SURVEYING INC. No.C02238 — CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

| NO. | DATE | DESCRIPTION | CHECKED |
|---|---|---|---|
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GLENN ASSOCIATES SURVEYING, INC.

**LANDSFORD TRACT MITIGATION SITE**

**LEGAL DESCRIPTION**

ALL that certain piece, parcel or tract of land, situate, lying and being in the County of Chester, State of South Carolina, containing 109.48 acres, more or less, and shown and designated as "109.48 ACRES TMS# 162-00-00-001-000 (PORTION)" on a plat thereof prepared by Michael R. Mills, S.C.P.L.S. No. 11606, of Glenn Associates Surveying, Inc., entitled "PROPERTY OWNED BY OPEN SPACE INSTITUTE LAND TRUST, INC. CONSERVATION EASEMENT BOUNDARY SURVEY FOR "LANDSFORD MITIGATION SITE" CHESTER COUNTY, SOUTH CAROLINA" dated January 16, 2020 and recorded _____, 2020 in the Register of Deeds Office for Chester County, South Carolina in Plat Book _____, at Page _____ (the "Plat"). Said tract having such size, shape, location, buttings, boundings, courses and distances as by reference to said Plat will more fully appear.

EXHIBIT B

Cover Page of Landsford Tract Final Permittee-Responsible Mitigation Plan

# LANDSFORD TRACT
# FINAL PERMITTEE-RESPONSIBLE MITIGATION PLAN

**PROJECT:**

**PROJECT INSPECTOR**
**YORK COUNTY, SOUTH CAROLINA**

**APPLICANT:**

**SOUTH CAROLINA DEPARTMENT OF COMMERCE**

**SUBMITTED TO:**

**UNITED STATES ARMY CORPS OF ENGINEERS**
**CHARLESTON DISTRICT, REGULATORY**

**PREPARED BY:**

**PALUSTRINE GROUP, LLC**
**P.O. Box 31411**
**CHARLESTON, SOUTH CAROLINA 29417**

**SUBMISSION DATE:**

**JANUARY 31, 2020**

**REVISED:**

**APRIL 17, 2020**

EXHIBIT C

Title Report

# COMMITMENT FOR TITLE INSURANCE
# ISSUED BY
# COMMONWEALTH LAND TITLE INSURANCE COMPANY

## NOTICE

**IMPORTANT—READ CAREFULLY:** THIS COMMITMENT IS AN OFFER TO ISSUE ONE OR MORE TITLE INSURANCE POLICIES. ALL CLAIMS OR REMEDIES SOUGHT AGAINST THE COMPANY INVOLVING THE CONTENT OF THIS COMMITMENT OR THE POLICY MUST BE BASED SOLELY IN CONTRACT.

THIS COMMITMENT IS NOT AN ABSTRACT OF TITLE, REPORT OF THE CONDITION OF TITLE, LEGAL OPINION, OPINION OF TITLE, OR OTHER REPRESENTATION OF THE STATUS OF TITLE. THE PROCEDURES USED BY THE COMPANY TO DETERMINE INSURABILITY OF THE TITLE, INCLUDING ANY SEARCH AND EXAMINATION, ARE PROPRIETARY TO THE COMPANY, WERE PERFORMED SOLELY FOR THE BENEFIT OF THE COMPANY, AND CREATE NO EXTRACONTRACTUAL LIABILITY TO ANY PERSON, INCLUDING A PROPOSED INSURED.

THE COMPANY'S OBLIGATION UNDER THIS COMMITMENT IS TO ISSUE A POLICY TO A PROPOSED INSURED IDENTIFIED IN SCHEDULE A IN ACCORDANCE WITH THE TERMS AND PROVISIONS OF THIS COMMITMENT. THE COMPANY HAS NO LIABILITY OR OBLIGATION INVOLVING THE CONTENT OF THIS COMMITMENT TO ANY OTHER PERSON.

## COMMITMENT TO ISSUE POLICY

Subject to the Notice; Schedule B, Part I—Requirements; Schedule B, Part II—Exceptions; and the Commitment Conditions, Commonwealth Land Title Insurance Company, a Florida Corporation (the "Company"), commits to issue the Policy according to the terms and provisions of this Commitment. This Commitment is effective as of the Commitment Date shown in Schedule A for each Policy described in Schedule A, only when the Company has entered in Schedule A both the specified dollar amount as the Proposed Policy Amount and the name of the Proposed Insured.

If all of the Schedule B, Part I—Requirements have not been met within 180 days after the Commitment Date, this Commitment terminates and the Company's liability and obligation end.

## COMMITMENT CONDITIONS

**1. DEFINITIONS**

(a) "Knowledge" or "Known": Actual or imputed knowledge, but not constructive notice imparted by the Public Records.

(b) "Land": The land described in Schedule A and affixed improvements that by law constitute real property. The term "Land" does not include any property beyond the lines of the area described in Schedule A, nor any right, title, interest, estate, or easement in abutting streets, roads, avenues, alleys, lanes, ways, or waterways, but this does not modify or limit the extent that a right of access to and from the Land is to be insured by the Policy.

(c) "Mortgage": A mortgage, deed of trust, or other security instrument, including one evidenced by electronic means authorized by law.

(d) "Policy": Each contract of title insurance, in a form adopted by the American Land Title Association, issued or to be issued by the Company pursuant to this Commitment.

(e) "Proposed Insured": Each person identified in Schedule A as the Proposed Insured of each Policy to be issued pursuant to this Commitment.



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(f) "Proposed Policy Amount": Each dollar amount specified in Schedule A as the Proposed Policy Amount of each Policy to be issued pursuant to this Commitment.
(g) "Public Records": Records established under state statutes at the Commitment Date for the purpose of imparting constructive notice of matters relating to real property to purchasers for value and without Knowledge.
(h) "Title": The estate or interest described in Schedule A.

**2.** If all of the Schedule B, Part I—Requirements have not been met within the time period specified in the Commitment to Issue Policy, this Commitment terminates and the Company's liability and obligation end.

**3.** The Company's liability and obligation is limited by and this Commitment is not valid without:
(a) the Notice;
(b) the Commitment to Issue Policy;
(c) the Commitment Conditions;
(d) Schedule A;
(e) Schedule B, Part I—Requirements; [and]
(f) Schedule B, Part II—Exceptions[; and
(g) a counter-signature by the Company or its issuing agent that may be in electronic form].

**4. COMPANY'S RIGHT TO AMEND**

The Company may amend this Commitment at any time. If the Company amends this Commitment to add a defect, lien, encumbrance, adverse claim, or other matter recorded in the Public Records prior to the Commitment Date, any liability of the Company is limited by Commitment Condition 5. The Company shall not be liable for any other amendment to this Commitment.

**5. LIMITATIONS OF LIABILITY**

(a) The Company's liability under Commitment Condition 4 is limited to the Proposed Insured's actual expense incurred in the interval between the Company's delivery to the Proposed Insured of the Commitment and the delivery of the amended Commitment, resulting from the Proposed Insured's good faith reliance to:
  (i) comply with the Schedule B, Part I—Requirements;
  (ii) eliminate, with the Company's written consent, any Schedule B, Part II—Exceptions; or
  (iii) acquire the Title or create the Mortgage covered by this Commitment.
(b) The Company shall not be liable under Commitment Condition 5(a) if the Proposed Insured requested the amendment or had Knowledge of the matter and did not notify the Company about it in writing.
(c) The Company will only have liability under Commitment Condition 4 if the Proposed Insured would not have incurred the expense had the Commitment included the added matter when the Commitment was first delivered to the Proposed Insured.
(d) The Company's liability shall not exceed the lesser of the Proposed Insured's actual expense incurred in good faith and described in Commitment Conditions 5(a)(i) through 5(a)(iii) or the Proposed Policy Amount.
(e) The Company shall not be liable for the content of the Transaction Identification Data, if any.
(f) In no event shall the Company be obligated to issue the Policy referred to in this Commitment unless all of the Schedule B, Part I—Requirements have been met to the satisfaction of the Company.
(g) In any event, the Company's liability is limited by the terms and provisions of the Policy.

**6. LIABILITY OF THE COMPANY MUST BE BASED ON THIS COMMITMENT**



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(a) Only a Proposed Insured identified in Schedule A, and no other person, may make a claim under this Commitment.
(b) Any claim must be based in contract and must be restricted solely to the terms and provisions of this Commitment.
(c) Until the Policy is issued, this Commitment, as last revised, is the exclusive and entire agreement between the parties with respect to the subject matter of this Commitment and supersedes all prior commitment negotiations, representations, and proposals of any kind, whether written or oral, express or implied, relating to the subject matter of this Commitment.
(d) The deletion or modification of any Schedule B, Part II—Exception does not constitute an agreement or obligation to provide coverage beyond the terms and provisions of this Commitment or the Policy.
(e) Any amendment or endorsement to this Commitment must be in writing and authenticated by a person authorized by the Company.
(f) When the Policy is issued, all liability and obligation under this Commitment will end and the Company's only liability will be under the Policy.

**7. IF THIS COMMITMENT HAS BEEN ISSUED BY AN ISSUING AGENT**

The issuing agent is the Company's agent only for the limited purpose of issuing title insurance commitments and policies. The issuing agent is not the Company's agent for the purpose of providing closing or settlement services.

**8. PRO-FORMA POLICY**

The Company may provide, at the request of a Proposed Insured, a pro-forma policy illustrating the coverage that the Company may provide. A pro-forma policy neither reflects the status of Title at the time that the pro-forma policy is delivered to a Proposed Insured, nor is it a commitment to insure.

**9. ARBITRATION**

The Policy contains an arbitration clause. All arbitrable matters when the Proposed Policy Amount is $2,000,000 or less shall be arbitrated at the option of either the Company or the Proposed Insured as the exclusive remedy of the parties. A Proposed Insured may review a copy of the arbitration rules at http://www.alta.org/arbitration.

Countersigned:

COMMONWEALTH LAND TITLE INSURANCE COMPANY

By: _____

ATTEST _____ President

_____ Secretary

Clear Title Agency, LLC
652 Coleman Boulevard
Suite 200
Mount Pleasant, SC 29464



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***Transaction Identification Data for reference only:***
Issuing Agent: Clear Title Agency, LLC
Issuing Office: 652 Coleman Boulevard, Suite 200, Mount Pleasant, SC 29464
Issuing Office's ALTA® Registry ID: 1037412
Loan ID Number:
Commitment Number: 2532.0011
Issuing Office File Number: 2532.0011
Property Address: 109.48 acres, more or less, off of Landsford Road, Chester, SC 29706
Revision Number:

## SCHEDULE A

1. Commitment Date: 03/26/2020 at 8:30 AM

2. Policy to be issued:

   a) ALTA Homeowner's Policy
   Proposed Insured: **Katawba Valley Land Trust, Inc.**
   Proposed Policy Amount: **$100,000.00**

3. The estate or interest in the Land described or referred to in this Commitment is: Conservation Easement

4. The Title is, at the Commitment Date vested in:
   Open Space Institute Land Trust, Inc., a New York Corporation

5. The Land is described as follows:
   SEE EXHIBIT 'A' ATTACHED HERETO.

Countersigned:

**By:** _____

**Authorized Officer or Agent**



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## SCHEDULE B, PART I
## Requirements

All of the following Requirements must be met:

1. The Proposed Insured must notify the Company in writing of the name of any party not referred to in this Commitment who will obtain an interest in the Land or who will make a loan on the Land. The Company may then make additional Requirements or Exceptions.

2. Pay the agreed amount for the estate or interest to be insured.

3. Pay the premiums, fees, and charges for the Policy to the Company.

4. Documents satisfactory to the Company that convey the Title or create the Mortgage to be insured, or both, must be properly authorized, executed, delivered, and recorded in the Public Records.

   Conservation Easement and Acceptance property executed by the president of Open Space Institute Land Trust, Inc., a New York corporation, or by such other person(s) as may be authorized to execute said instrument by a resolution of the board of directors or other governing body pursuant to the Charter and By-Laws of said Non-Profit, to Katawba Valley Land Trust, Inc., a _____ nonprofit corporation, to be executed and recorded at closing.

5. Payment of all taxes, charges, assessments, levied and assessed against the Land which are due and payable.

6. Satisfactory evidence should be had that improvement and/or repairs or alterations thereto are completed; that contractor, sub-contractors, labor and materialmen are all paid; and have released of record all liens or notice of intent to perfect a lien for labor of material.

7. Satisfaction and release of the insured Land from that certain Mortgage dated May 28, 2009 and recorded May 29, 2009 in Book 1444, at Page 276 in the Register of Deeds Office for Chester County, South Carolina OR Subordination Agreement in a form satisfactory to the Company subordinating the aforesaid Mortgage to the Conservation Easement and Acceptance described in Item 4 above.

8. Proof satisfactory to the Company that the conservation easement to be insured was properly created under and complies with South Carolina Code Sec. 27-8-10 et seq.

9. Proof satisfactory to the Company that the proposed insured qualifies as a "holder" under South Carolina Code Sec. 27-8-20.

10. We must be furnished with a copy of South Carolina Insurance Department 3601 executed pursuant to Section 38-75-960 of the South Carolina Code of Laws, 1976, as amended, and an executed Notice of Availability of Title Insurance pursuant to South Carolina Insurance Department Regulation R-69-18, Volume 25A of the South Carolina Code of Laws, 1976, as amended.

11. As to Open Space Institute Land Trust, Inc. and Katawba Valley Land Trust, Inc.: Obtain a Certificate of Existence from the Office of the Secretary of State for South Carolina or similar office in the state of organization.



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12. As to Open Space Institute Land Trust, Inc. and Katawba Valley Land Trust, Inc.: Present for examination and approval a copy of the Shareholder Agreement/Bylaws of the non-profit corporation, together with any amendments or modifications thereto.

13. Provide a satisfactory Owner's Affidavit of Possession and No Liens. Said affidavit when properly executed at closing by the seller(s), if any, and mortgagor(s) herein will serve to delete the standard lien and possession exceptions from the Loan Policy to be issued.

14. Execution and delivery of Seller's Affidavit concerning South Carolina Withholding Tax on Sales of Real and Associated Tangible Personal Property by Non-Residents, S. C. Code Section 12-8-580, et. seq.

15. Execution and delivery of Seller's Certification of Non-Foreign Status concerning the Foreign Investment in Real Property Tax Act (FIRPTA).

16. Evidence satisfactory to the Company that all taxes have been paid to the South Carolina Department of Revenue pursuant to SC Code Section 12-54-124 or said taxes are inapplicable. (Receipt of Transferor Affidavit form promulgated by the SC Dept. of Revenue may be used to satisfy this requirement.)

17. The structure of this transaction must be revealed to the Company, and the Company reserves the right to insert additional requirements or exceptions upon review of same.

18. An ALTA OwnerÍs Policy or HomeownerÍs Policy, insuring an estate or interest in Land, will not be issued for less than the full value of the estate or interest. The actual value of the estate or interest to be insured must be disclosed to the Company and subject to approval by the Company, entered as the Proposed Policy Amount to be issued on Schedule A of this Commitment. Until the Proposed Policy Amount to be issued shall be determined, and entered as aforesaid, it is agreed as between the Company, the Proposed Insured, and every person relying on this Commitment, the Company cannot be required to approve any such evaluation in excess of $100,000.00 and the total liability of the Company on account of this Commitment shall not exceed than amount. The Proposed Policy Amount(s) must be increased to full value of the estate or interest being insured and premium charged consistent therewith when the final amount(s) are approved.



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## SCHEDULE B, PART II
## Exceptions

THIS COMMITMENT DOES NOT REPUBLISH ANY COVENANT, CONDITION, RESTRICTION, OR LIMITATION CONTAINED IN ANY DOCUMENT REFERRED TO IN THIS COMMITMENT TO THE EXTENT THAT THE SPECIFIC COVENANT, CONDITION, RESTRICTION, OR LIMITATION VIOLATES STATE OR FEDERAL LAW BASED ON RACE, COLOR, RELIGION, SEX, SEXUAL ORIENTATION, GENDER IDENTITY, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN.

The Policy will not insure against loss or damage resulting from the terms and provisions of any lease or easement identified in Schedule A, and will include the following Exceptions unless cleared to the satisfaction of the Company:

1. Any defect, lien, encumbrance, adverse claim, or other matter that appears for the first time in the Public Records or is created, attached, or is disclosed between the Commitment Date and the date on which all of the Schedule B, Part I — Requirements are met.

2. Rights of parties in possession of the Land.

3. Any encroachment, encumbrance, violation, variation or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land.

4. Any lien, or right to a lien, for labor, services, or material heretofore or hereafter furnished.

5. Taxes for the year 2020 and subsequent years, a lien not yet due and payable.

6. All of the terms, provisions, conditions, restrictions, reservations, limitations on interest and obligations as described in and created by that certain Conservation Easement between Open Space Institute Land Trust, Inc., a New York corporation, and Katawba Valley Land Trust, Inc., a _____ nonprofit corporation, dated _____, 2020 and recorded _____2020, in Book _____, at Page_____, including but not limited to provisions relating to enforceability and compliance including the rights of third parties thereto.

7. This policy affords assurance as to the location of the boundary lines of subject property, but does not insure the engineering calculations in computing the exact amount of acreage contained therein.

8. Any right, interest or claim that may exist, arise or be asserted against the Title under or pursuant to the Perishable Agricultural Commodities Act of 1930, as amended, 7 USC 499a et seq., the Packers and Stockyard Act of 1921, as amended, 7 USC 181 et seq., or any similar state laws.

9. Covenants, conditions and restrictions contained in that certain Special Warranty Deed from Crescent Resources, LLC, a Georgia limited liability company, to The Landsford Group, LLC, a North Carolina limited liability company, dated May 27, 2009 and recorded May 29, 2009 in Book 991, at Page 117 in the Register of Deeds Office for Chester County, South Carolina, as further amended in that certain Amendment to General Deed Restrictions dated August 8, 2015 and recorded October 9, 2019 in Book 1289, at Page 141 in the Register of Deeds Office for Chester County, South Carolina.

10. Easements reserved to Crescent Resources LLC, a Georgia limited liability company, in that certain Special Warranty Deed from Crescent Resources, LLC to The Landsford Group, LLC, a North Carolina



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limited liability company, dated May 27, 2009 and recorded May 29, 2009 in Book 991, at Page 117 in the Register of Deeds Office for Chester County, South Carolina, as further amended in that certain Amendment to General Deed Restrictions dated August 8, 2015 and recorded October 9, 2019 in Book 1289, at Page 141 in the Register of Deeds Office for Chester County, South Carolina.

11. Transmission line and retail electric line right-of-way reserved or granted to Duke Energy Carolinas, LLC, f/k/a Duke Power Company and Duke Energy Corporation as contained in that certain Deed from Crescent Resource, LLC, a Georgia limited liability company, to the Landsford Group, LLC, a North Carolina limited liability company, dated May 27, 2009 and recorded May 29, 2009 in Book 991, at Page 117, in the Register of Deeds Office for Chester County, South Carolina.

12. Reservation of rights, privileges, and easement granted to Duke Power Company in that certain Deed from Duke Power Company to Crescent Land and Timber Corp. dated May 1, 1969 and recorded December 23, 1969 in Book 444, at Page 553 in the Register of Deeds Office for Chester County, South Carolina.

13. Easement granted to Duke Power Company dated April 2, 1973 and recorded April 11, 1973 in Book 461, at Page 523 in the Register of Deeds Office for Chester County, South Carolina.

14. Any taxes assessed under the roll-back provisions of Section 12-43-220-(D-4), South Carolina Code of Laws 1976, as amended.

15. Access to subject property is by way of private road(s) only.

16. Defects in title arising out of or in connection with errors, ambiguities, or other deficiencies in the description of the land in deed dated May 1, 1969, and recorded December 23, 1969, in Book 444, at Page 553, and in prior deeds, probate records or other documents pertaining to the land.

17. Rights of the public generally in and to the use of that portion of subject property used for a road and shown as "Existing Woods Road" and "PROPOSED ROAD" on that certain plat entitled “PROPERTY OWNED BY OPEN SPACE INSTITUTE LAND TRUST, INC. CONSERVATION EASEMENT BOUNDARY SURVEY FOR "LANDSFORD MITIGATION SITE" CHESTER COUNTY, SOUTH CAROLINA" dated January 16, 2020 and recorded _____, 2020 in the Register of Deeds Office for Chester County, South Carolina in Plat Book _____, at Page _____ .

18. Riparian rights incident to the premises.

19. Rights of upper and lower riparian owners in and to the waters of the Catawba River and the unnamed creek crossing or adjoining the property, and the natural flow thereof, free from diminution or pollution.

20. Title to any portion of the subject property lying below the mean high water mark of abutting Tidal Waters and any portion of the land which may be marshlands.

21. This policy does not insure title to any portion of the insured premises lying within the boundaries of Catawba River, the unnamed creek and stream shown on that certain plat entitled “PROPERTY OWNED BY OPEN SPACE INSTITUTE LAND TRUST, INC. CONSERVATION EASEMENT BOUNDARY SURVEY FOR "LANDSFORD MITIGATION SITE" CHESTER COUNTY, SOUTH CAROLINA" dated January 16, 2020 and recorded _____, 2020 in the Register of Deeds Office for Chester County, South Carolina in Plat Book _____, at Page _____.



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22. Jurisdiction of the U. S. Corps of Engineers with respect to any portion of the property which may constitute wetlands or marshlands or navigable waters.

23. Interests created by or limitations on the use imposed by the Federal Coastal Zone Management Act or other federal Law or Regulations or by South Carolina Code Section 48-39-10 through 48-39-360, as amended, or any regulations promulgated pursuant to said State or Federal Law.

24. This policy does not insure any portion of the subject property which consists of accreted lands.

25. Lack of record title prior to May 27, 2009 being the date of recordation of deed to Crescent Resources, LLC, a Georgia limited liability company, recorded in Book 991, page 117; also, defects, liens or encumbrances (including, among others, possible outstanding interests of former owners, or those claiming under them), created prior to recordation of said deed.

26. The following matters of survey as shown on that certain survey prepared by Michael R. Mills, S.C.P.L.S. No. 11606, of Glenn Associates Surveying, Inc., entitled “PROPERTY OWNED BY OPEN SPACE INSTITUTE LAND TRUST, INC. CONSERVATION EASEMENT BOUNDARY SURVEY FOR "LANDSFORD MITIGATION SITE" CHESTER COUNTY, SOUTH CAROLINA" dated January 16, 2020 and recorded _____, 2020 in the Register of Deeds Office for Chester County, South Carolina in Plat Book _____, at Page _____:

    a. STREAM
    b. WETLAND
    c. PROPOSED ROAD

The exception(s) in Schedule B omit(s) any covenants or restrictions, if any, based upon race, color, religion, sex, sexual orientation, familial status, marital status, disability, handicap, national origin, ancestry or source of income, as set forth in applicable state or federal laws, except to the extent that said covenant or restriction is permitted by applicable law.



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## LEGAL DESCRIPTION

## EXHIBIT "A"

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF CHESTER, STATE OF SOUTH CAROLINA AND IS DESCRIBED AS FOLLOWS:

ALL that certain piece, parcel or tract of land, situate, lying and being in the County of Chester, State of South Carolina, containing 109.48 acres, more or less, and shown and designated as "109.48 ACRES TMS# 162-00-00-001-000 (PORTION)" on a plat thereof prepared by Michael R. Mills, S.C.P.L.S. No. 11606, of Glenn Associates Surveying, Inc., entitled "PROPERTY OWNED BY OPEN SPACE INSTITUTE LAND TRUST, INC. CONSERVATION EASEMENT BOUNDARY SURVEY FOR "LANDSFORD MITIGATION SITE" CHESTER COUNTY, SOUTH CAROLINA" dated January 16, 2020 and recorded _____, 2020 in the Register of Deeds Office for Chester County, South Carolina in Plat Book _____, at Page _____ (the "Plat"). Said tract having such size, shape, location, buttings, boundings, courses and distances as by reference to said Plat will more fully appear.



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Commonwealth
LAND TITLE INSURANCE COMPANY

# Identified Risk Coverage Endorsement ALTA 34-06

**Policy Number:** **PROFORMA**
**File Number:** **2532.0011**
**Premium:** **$100.00**
**Name of Insured:** **Katawba Valley Land Trust, Inc.**

1. As used in this endorsement "Identified Risk" means: any right, title or interest in the Land held by those persons described in Exception 25 of Schedule B.

2. The Company insures against loss or damage sustained by the Insured by reason of:

   a. A final order or decree enforcing the Identified Risk in favor of an adverse party; or

   b. The release of a prospective purchaser or lessee of the Title or lender on the Title from the obligation to purchase, lease, or lend as a result of the Identified Risk, but only if

      i. there is a contractual condition requiring the delivery of marketable title, and

      ii. neither the Company nor any other title insurance company is willing to insure over the Identified Risk with the same conditions as in this endorsement.

3. The Company will also pay the costs, attorneys' fees, and expenses incurred in defense of the Title by reason of the Identified Risk insured against by Paragraph 2 of this endorsement, but only to the extent provided in the Conditions.

4. This endorsement does not obligate the Company to establish the Title free of the Identified Risk or to remove the Identified Risk, but if the Company does establish the Title free of the Identified Risk or removes it, Section 9(a) of the Conditions applies.

{01453977.DOC}This endorsement is issued as part of the policy. Except as it expressly states, it does not (i) modify any of the terms and provisions of the policy, (ii) modify any prior endorsements, (iii) extend the Date of Policy, or (iv) increase the Amount of Insurance. To the extent a provision of the policy or a previous endorsement is inconsistent with an express provision of this endorsement, this endorsement controls. Otherwise, this endorsement is subject to all of the terms and provisions of the policy and of any prior endorsements.

By: **PROFORMA**
Authorized Officer or Agent

Dated: April ___, 2020

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Commonwealth
LAND TITLE INSURANCE COMPANY

# Identified Risk Coverage Endorsement ALTA 34-06

**Policy Number:** **PROFORMA**
**File Number:** **2532.0011**
**Premium:** **$100.00**
**Name of Insured:** **Katawba Valley Land Trust, Inc.**

1. As used in this endorsement "Identified Risk" means: any right, title or interest in the Land held by an adverse party on the date of policy by reason of the vague legal description described in Exception 16 of Schedule B.

2. The Company insures against loss or damage sustained by the Insured by reason of:

   a. A final order or decree enforcing the Identified Risk in favor of an adverse party; or

   b. The release of a prospective purchaser or lessee of the Title or lender on the Title from the obligation to purchase, lease, or lend as a result of the Identified Risk, but only if

      i. there is a contractual condition requiring the delivery of marketable title, and

      ii. neither the Company nor any other title insurance company is willing to insure over the Identified Risk with the same conditions as in this endorsement.

3. The Company will also pay the costs, attorneys' fees, and expenses incurred in defense of the Title by reason of the Identified Risk insured against by Paragraph 2 of this endorsement, but only to the extent provided in the Conditions.

4. This endorsement does not obligate the Company to establish the Title free of the Identified Risk or to remove the Identified Risk, but if the Company does establish the Title free of the Identified Risk or removes it, Section 9(a) of the Conditions applies.

{01453974.DOC}This endorsement is issued as part of the policy. Except as it expressly states, it does not (i) modify any of the terms and provisions of the policy, (ii) modify any prior endorsements, (iii) extend the Date of Policy, or (iv) increase the Amount of Insurance. To the extent a provision of the policy or a previous endorsement is inconsistent with an express provision of this endorsement, this endorsement controls. Otherwise, this endorsement is subject to all of the terms and provisions of the policy and of any prior endorsements.

By: **PROFORMA**
Authorized Officer or Agent

Dated: April ___, 2020

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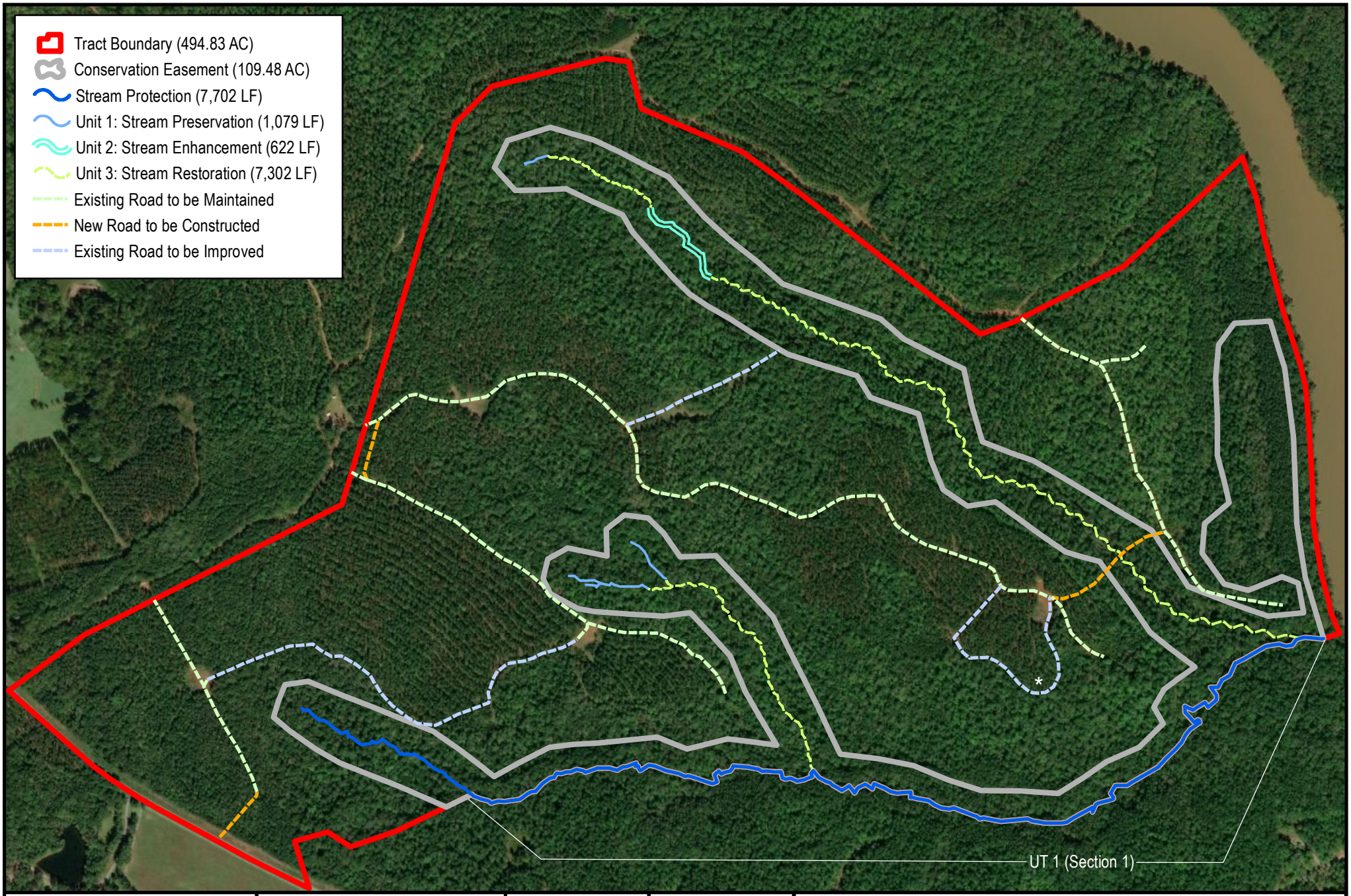
EXHIBIT D

Access Roads




# Landsford Tract

**Chester County**
**South Carolina**

1 inch = 750 feet

0 187.5 375 750 Feet

**Exhibit D: Access Roads**

Project Inspector
Sources: ESRI
Date: April 2020

Palustrine Group

N
W E
S

Notes:

1) Exact locations and configurations of proposed access roads to be determined at a later date and coordinated with SCDNR prior to construction.

2) Trail and pedestrian bridge to be installed over UT 1 (Section 1). Exact location and configuration to be determined at a later date.

*Road to be improved as needed during construction to facilitate site access.

Exhibit E

Signage to be Erected on the Boundary of the Protected Property

# Landsford Mitigation Protected Natural Area

**THIS AREA IS MANAGED JOINTLY BY THE SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND KATAWBA VALLEY LAND TRUST TO PROTECT AQUATIC AND OTHER NATURAL RESOURCES.**

**SC Department of Natural Resources**
**PO Box 167**
**Columbia, SC 29202**

EXHIBIT F

Long-Term Management Plan

and surface and sub-surface water levels. Post-construction water quality data will be collected at the same locations as baseline monitoring at a frequency of four times per year (one sample per season). Post-construction benthic macroinvertebrate sampling will be performed annually using the same locations and methods as outlined in the Baseline Data Collection Plan (Section 4.9.2).

Vegetation quadrats will remain in the same locations as pre-construction. All stems or trees planted within the vegetation quadrats, along with preferred volunteer species, will be tagged, numbered, and species noted. Vegetative monitoring will occur annually between July 1st and leaf drop/end of the growing season. Data collected will include count, height, root collar diameter and lateral growth. The tag number and species will be noted. Presence and location of invasive species will be reported.

## 4.10 Long-Term Management Plan

The primary goal of the Mitigation Site is to create a self-sustaining natural aquatic system that achieves the intended level of aquatic ecosystem functionality with minimal human intervention, including long-term maintenance. Natural changes to the vegetative community that occur after all Mitigation Site performance standards have been met, other than changes caused by non-native/invasive weeds, are not expected to require remediation. The Long-Term Management Plan (hereinafter "Management Plan") establishes objectives, priorities and tasks to manage, monitor, maintain and report on the status of streams and wetlands and their associated buffers after all performance standards and mitigation requirements have been met.

### 4.10.1 Transfer of Ownership

The 494.83-acre parcel on which the 109.48-acre Mitigation Site is contained (refer to Figure 4) is owned by Owner. All property rights, including water, timber, mineral and hunting rights, are held by Owner. After approval of the PRM Plan, Owner will subdivide the 494.83-acre parcel; said subdivision will include the 109.48-acre Mitigation Site. Owner will retain ownership of the subdivided land (including the Mitigation Site) during the implementation phase of the mitigation plan. After all performance standards and mitigation requirements have been met, Owner will then donate the subdivided land (including the Mitigation Site) to SCDNR for incorporation into the WMA program. SCDNR, who has reviewed and agreed to the contents of the PRM Plan, will then become the Long-Term Steward (hereinafter "Steward") of the Mitigation Site. The remaining acreage is planned for a conservation buyer; the SCDNR has expressed interest in pursuing.

SCDNR owned and managed WMAs are protected areas that play a critical role in conserving fish, wildlife and other natural resources, and as such serve a different purpose than state park lands. Appropriate and compatible uses of SCDNR managed lands are hunting, fishing, wildlife or other natural resource observation, wildlife or other natural resource photography, environmental education, and environmental interpretation.

### 4.10.2 Long-Term Steward Responsibilities

The Steward is solely responsible for managing the Mitigation Site in perpetuity after all performance standards and mitigation requirements have been met in accordance with the terms of the site protection instrument. The Steward shall preserve the Mitigation Site's habitat and conservation values in perpetuity in accordance with the terms of the site protection instrument. The Steward will be responsible, at its sole cost and expense, for all long-term management tasks and funding required to maintain the aquatic resources on the Mitigation Site in perpetuity.

SCDNR is the principal advocate for the stewardship of the natural resources of South Carolina. Further, SCDNR holds ownership in tracts of land throughout the State. Each land acquisition has been based upon some intended purpose of the occurrence of some significant plant, animal, ecosystem, physical feature and/or cultural resource or to provide recreational hunting and fishing opportunities for the public. Resource protection and management are the primary purpose for these landholdings. As the human population of South Carolina continues to grow at a rapid rate, outdoor space will diminish and large outdoor areas suitable for recreation are not likely to be well distributed or readily available. Publicly available land for traditional activities like hunting, fishing, bird watching, and others are important. Public agencies that own land must exercise care in providing recreational activities that are compatible with the resources for which the lands are valued; therefore, SCDNR has a policy established that provides an evaluation process by which all recreational activities and uses of SCDNR lands are determined first to be “appropriate” and second the be “compatible.”

### 4.10.3 Identification of Long-Term Management Activities

As the Steward, SCDNR will ensure that signs demarcating the Mitigation Site remain intact. Further, SCDNR will manage the Mitigation Site for trespass and litter, monitor boundary encroachments, maintain access roads, maintain gates, maintain signage and manage the Mitigation Site in accordance with a typical SCDNR-WMA plan.

Typical SCDNR management involves the protection of natural resources in addition to management. Harvesting and management of timber within the Mitigation Site will be limited to the extent necessary to protect the natural environment in areas where the forest is damaged by natural forces such as fire, flood, storm, insects or infectious organisms. Such timber harvesting and management shall be carried out in accordance with a Forest Management Plan and Best Management Practices approved by the South Carolina Forestry Commission or successor agency.

The use of prescribed fire may also be implemented within the Mitigation Site to restore and maintain fire-dependent ecosystems, promoting both species and habitat diversity. Prescribed fire, in addition to other appropriate control measures, such as the use of herbicides or mechanical means (i.e. mowing or Gyro trac), may be implemented within the Mitigation Site to control exotic and invasive species. Other management activities within the Mitigation Site may include research studies or the maintenance of roads for public and management access. Long-term management may also include additional restoration and enhancement activities on waters on the site if future site and environmental conditions need it.

### 4.10.4 Funding Mechanism

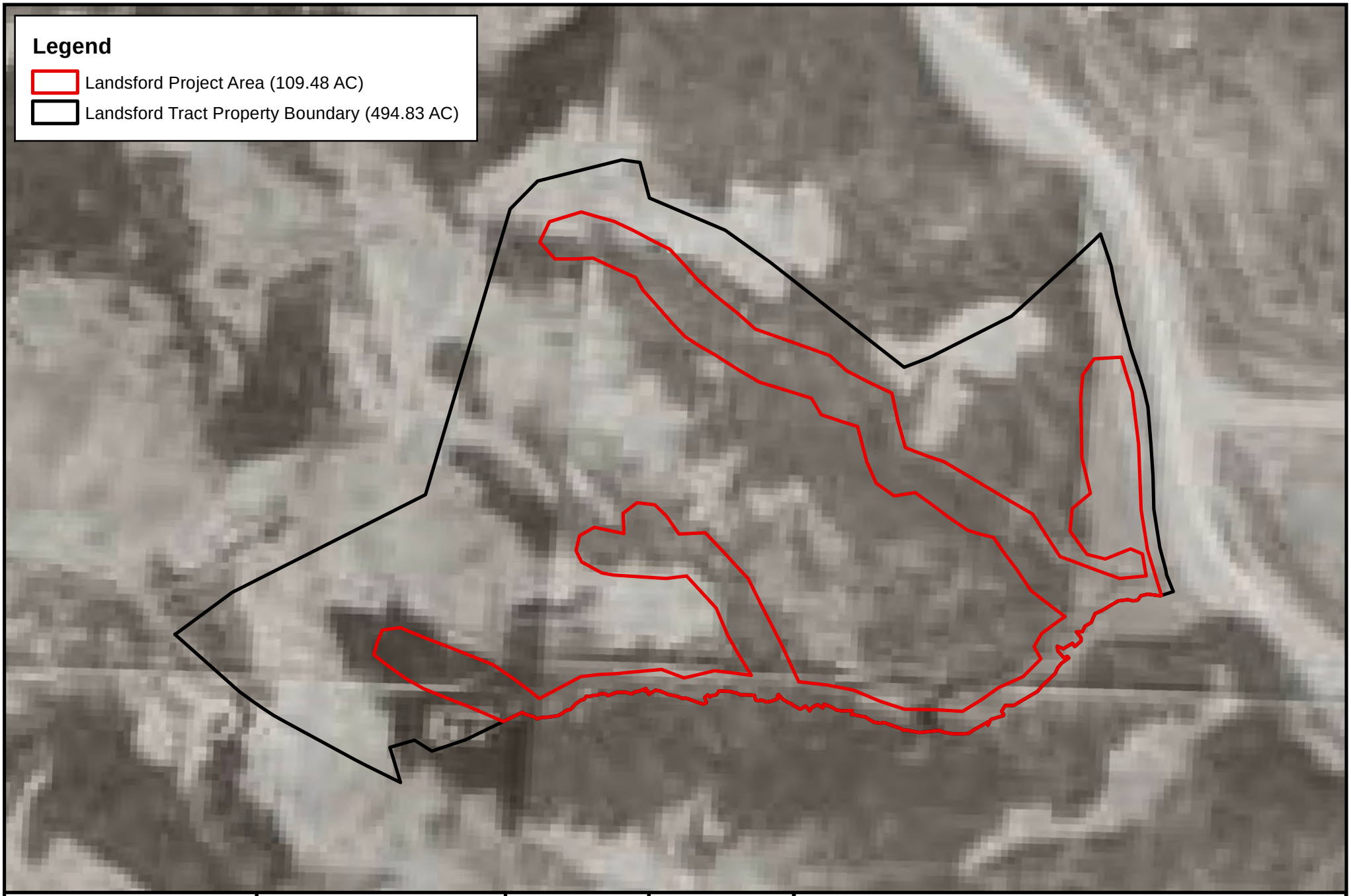
Any management activities following completion of the monitoring period and achievement of all performance standards and mitigation requirements as specified in this PRM Plan will be funded through monetary appropriations by SCDNR.

### 4.10.5 Justification for Level of Funding

The level of funding will be determined by the Steward on an annual basis. The amount of funding will be sufficient to manage the Mitigation Site in a manner that is consistent with the Management Plan.

# APPENDIX C

# HISTORIC AERIAL PHOTOGRAPHS




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1941**

Sources: U.S. Agriculture Adjustment Administration
Date: January 2020

Palustrine Group

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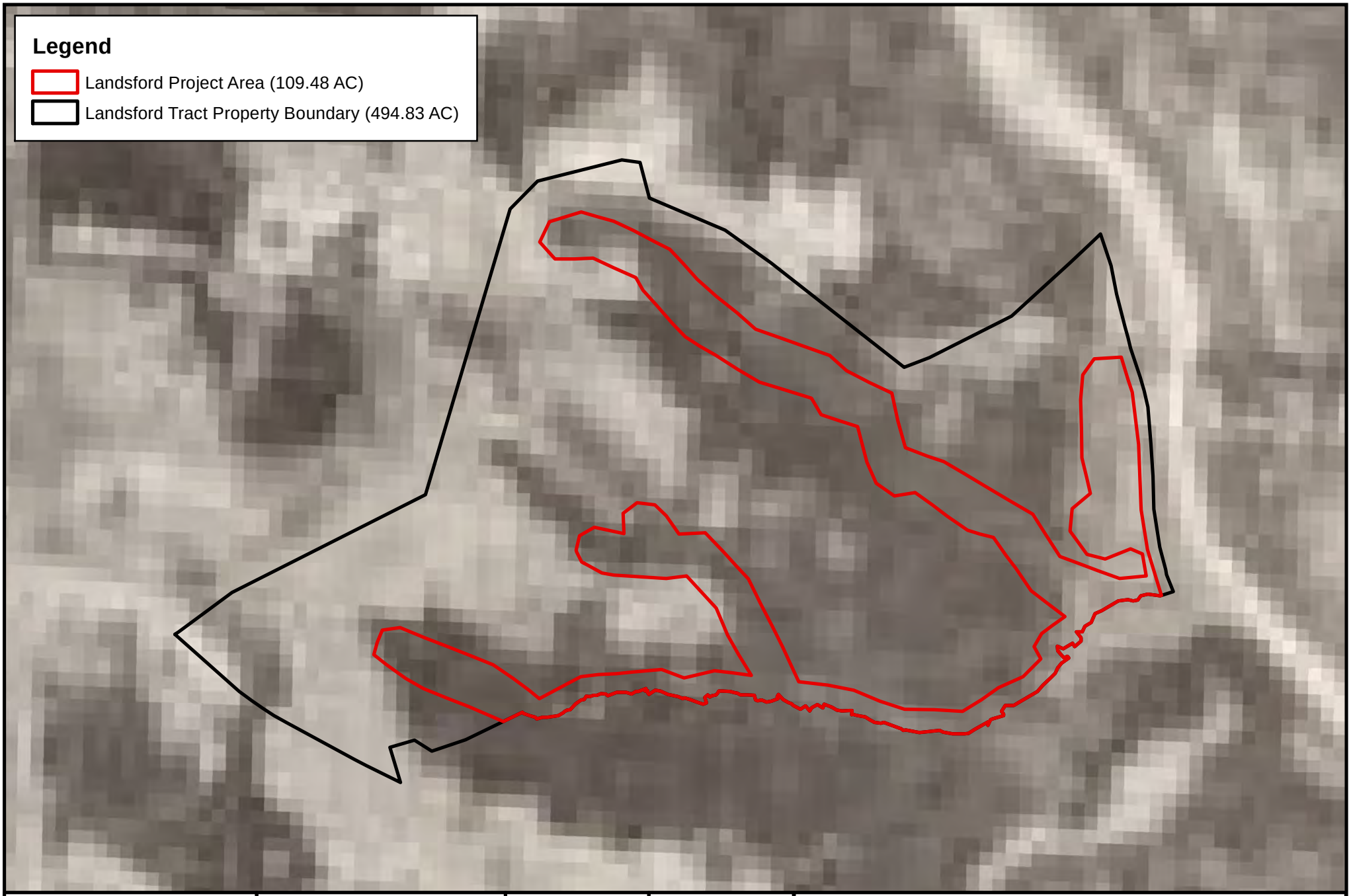


**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1949**

Sources: U.S. Department of Agriculture
Date: January 2020

Palustrine Group

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# Landsford Tract

**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1954**

Sources: U.S. Department of Agriculture
Date: January 2020

Palustrine Group

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**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1959**

Sources: U.S. Department of Agriculture
Date: January 2020

Palustrine Group

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Notes:

**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1964**

Sources: U.S. Agricultural Stabilization and Conservation Service
Date: January 2020

Palustrine Group

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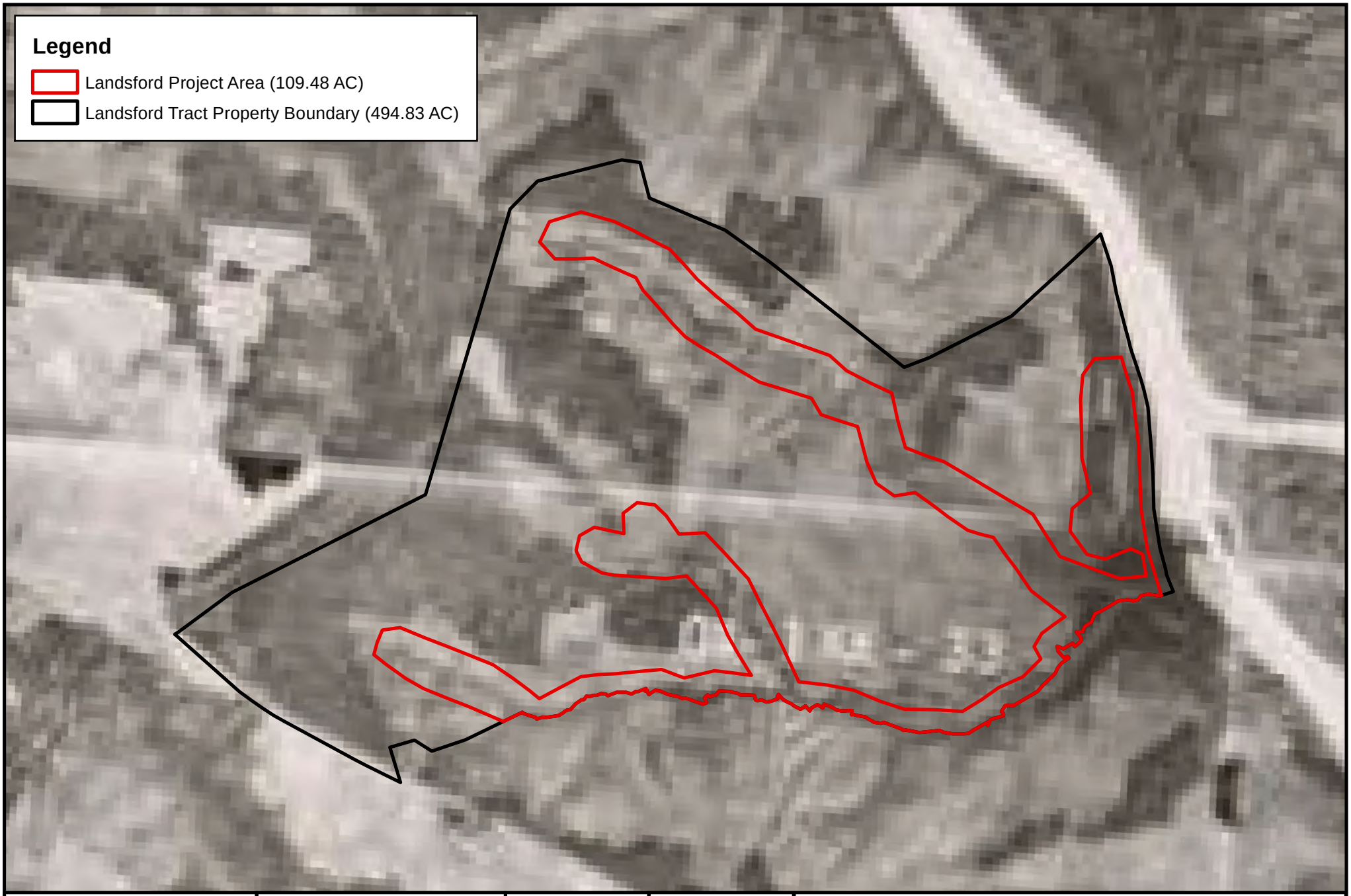


**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1969**

Sources: U.S. Agricultural Stabilization and Conservation Service
Date: January 2020

Palustrine Group

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Notes:

**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1981**

Sources: U.S. Agricultural Stabilization and Conservation Service
Date: January 2020

Palustrine Group

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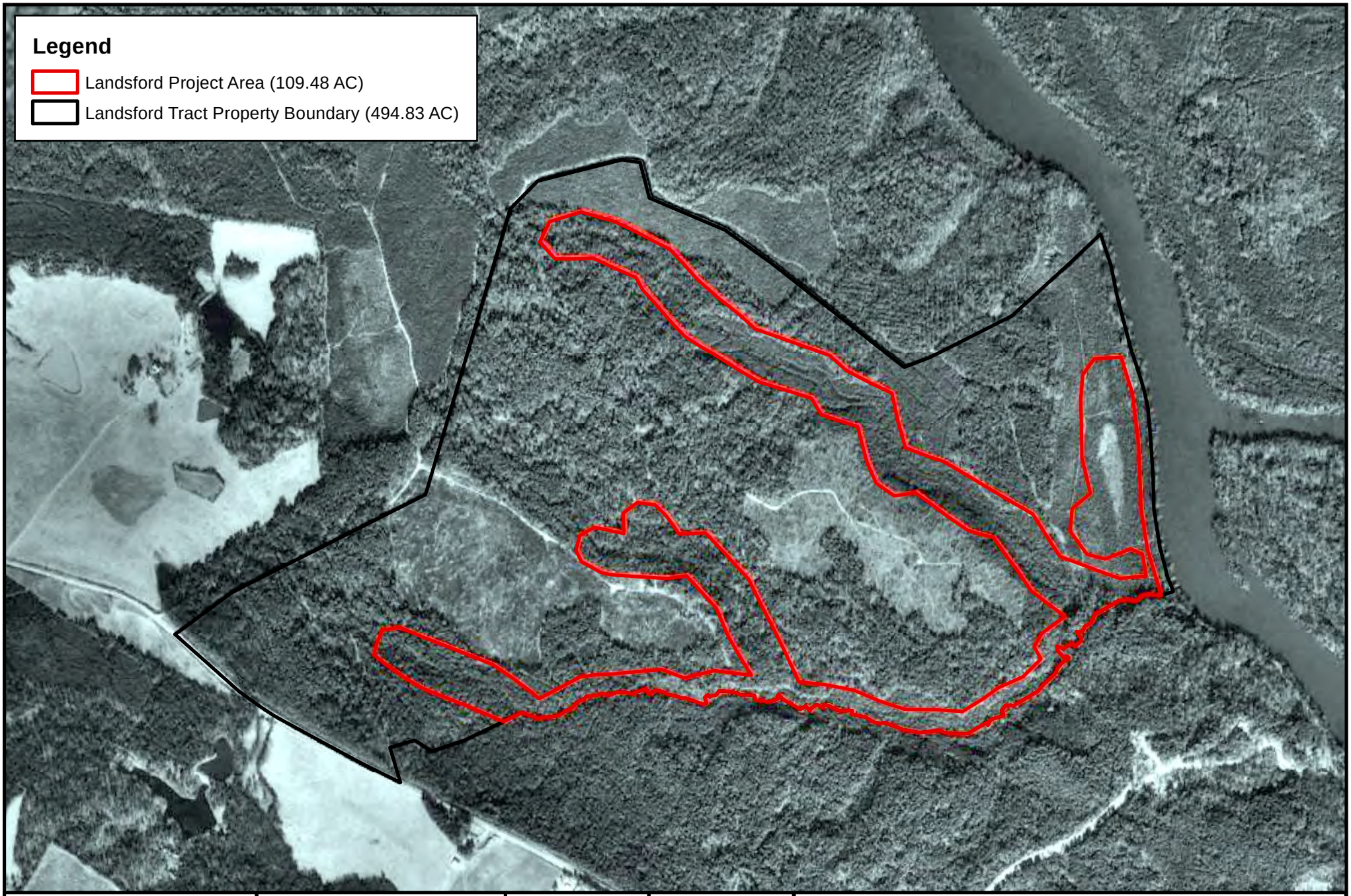


**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 1994**

Sources: USGS
Date: January 2020

Palustrine Group

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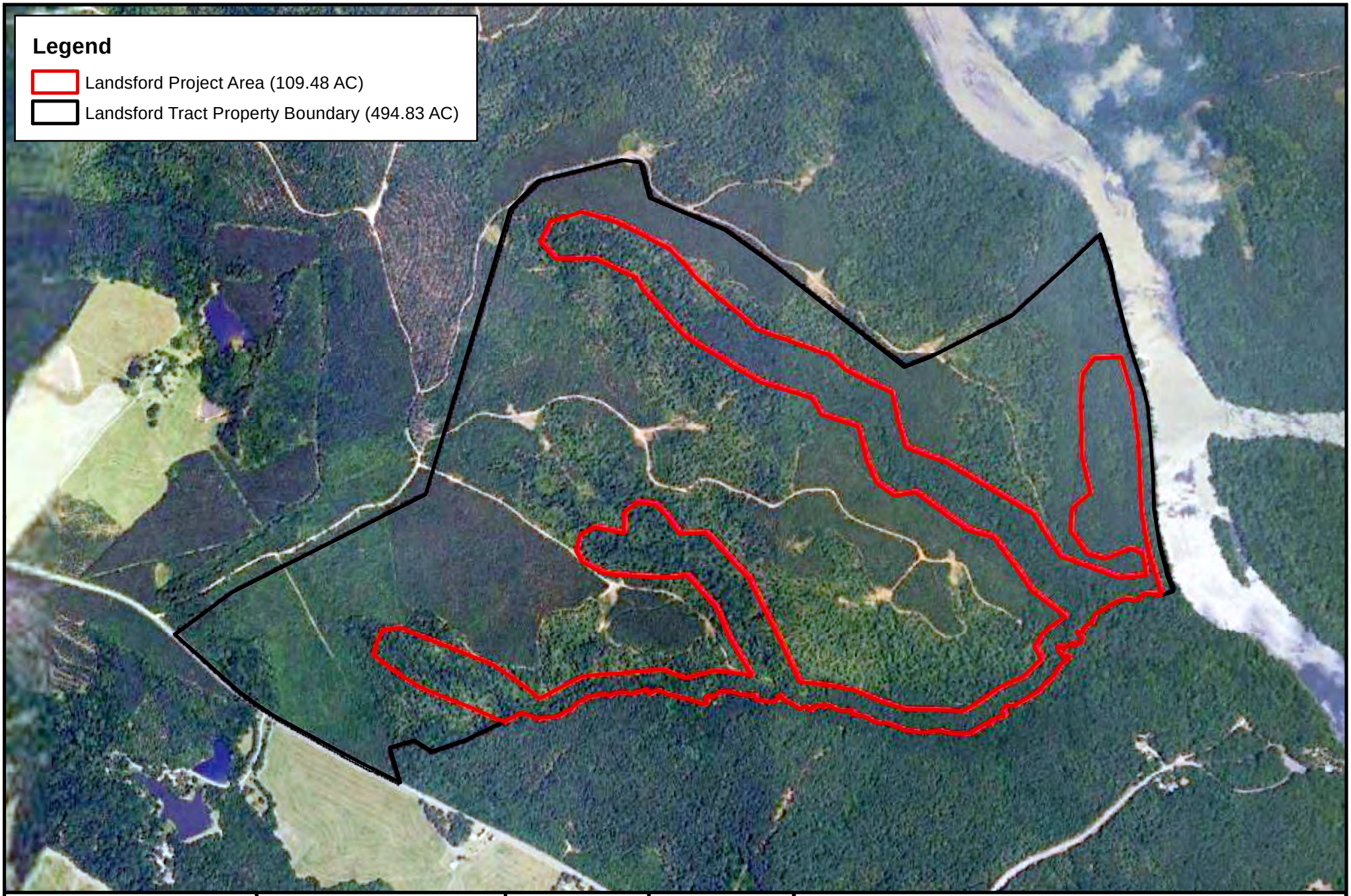


**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 2005**

Sources: USDA
Farm Service Agency
Date: January 2020

Palustrine Group

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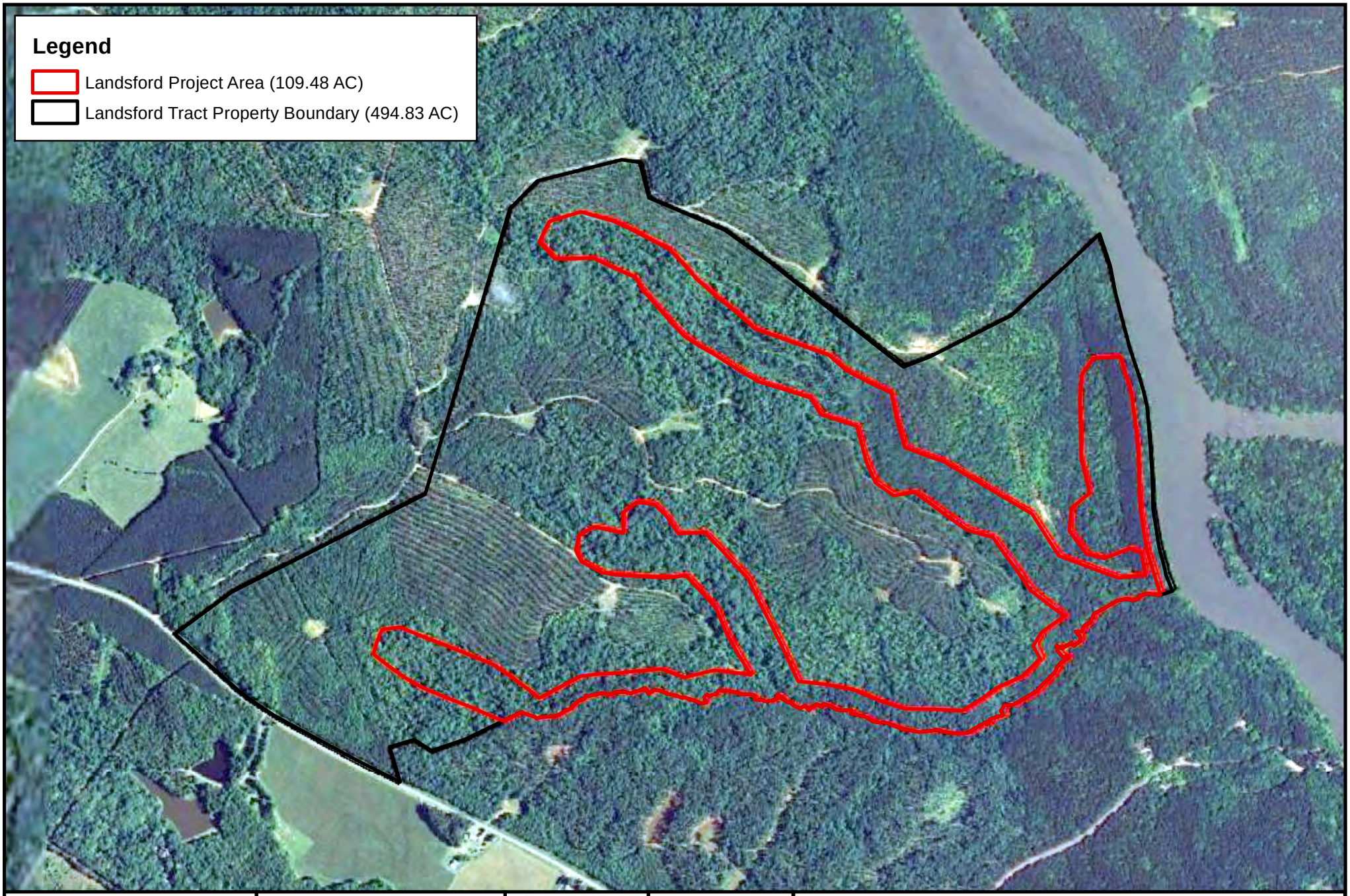
Notes:




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 2011**

Sources: USDA
Farm Service Agency
Date: January 2020

Palustrine Group

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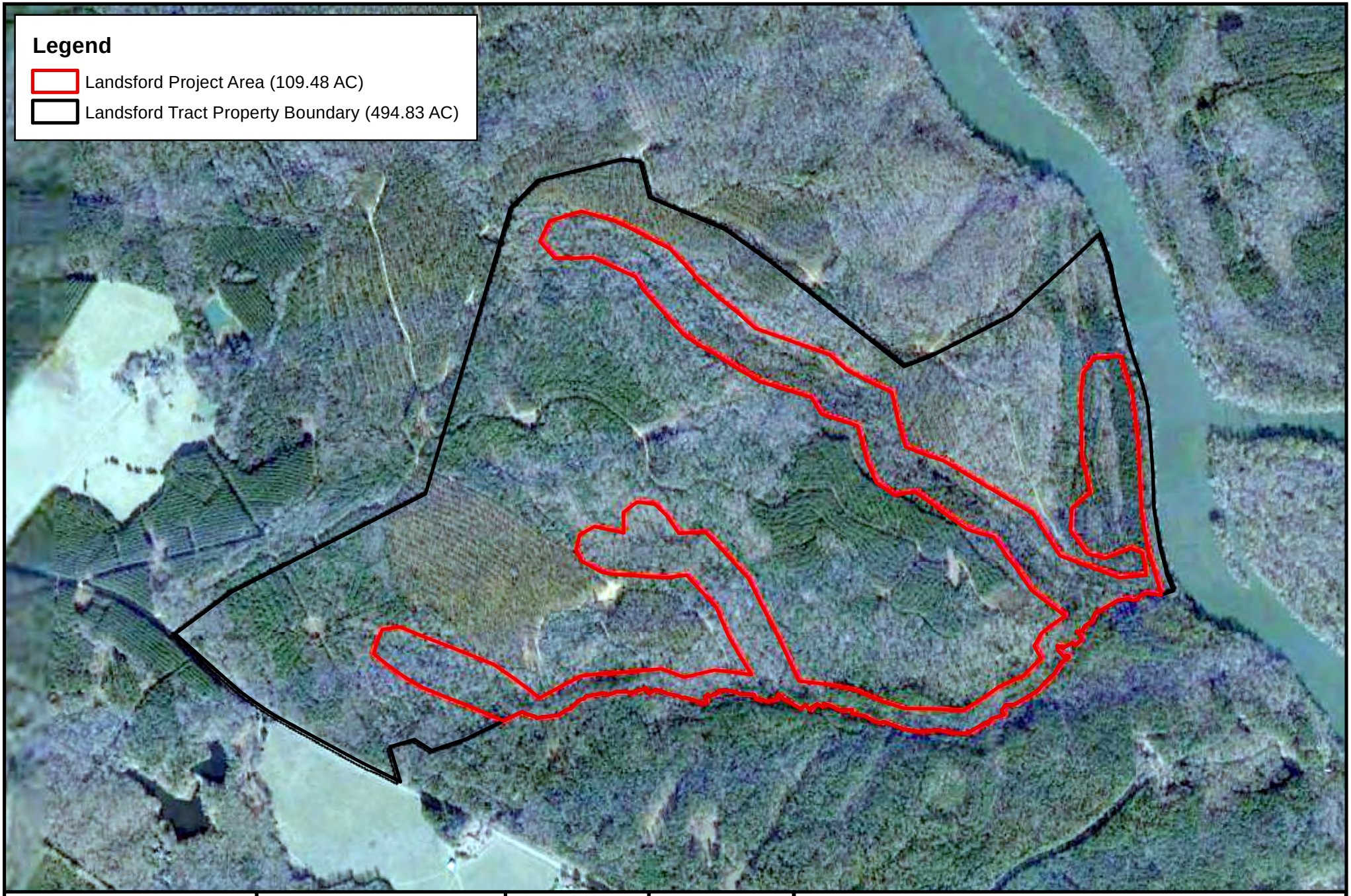
Notes:




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Historic Aerial - 2013**

Sources: Google Earth
Date: January 2020

Palustrine Group

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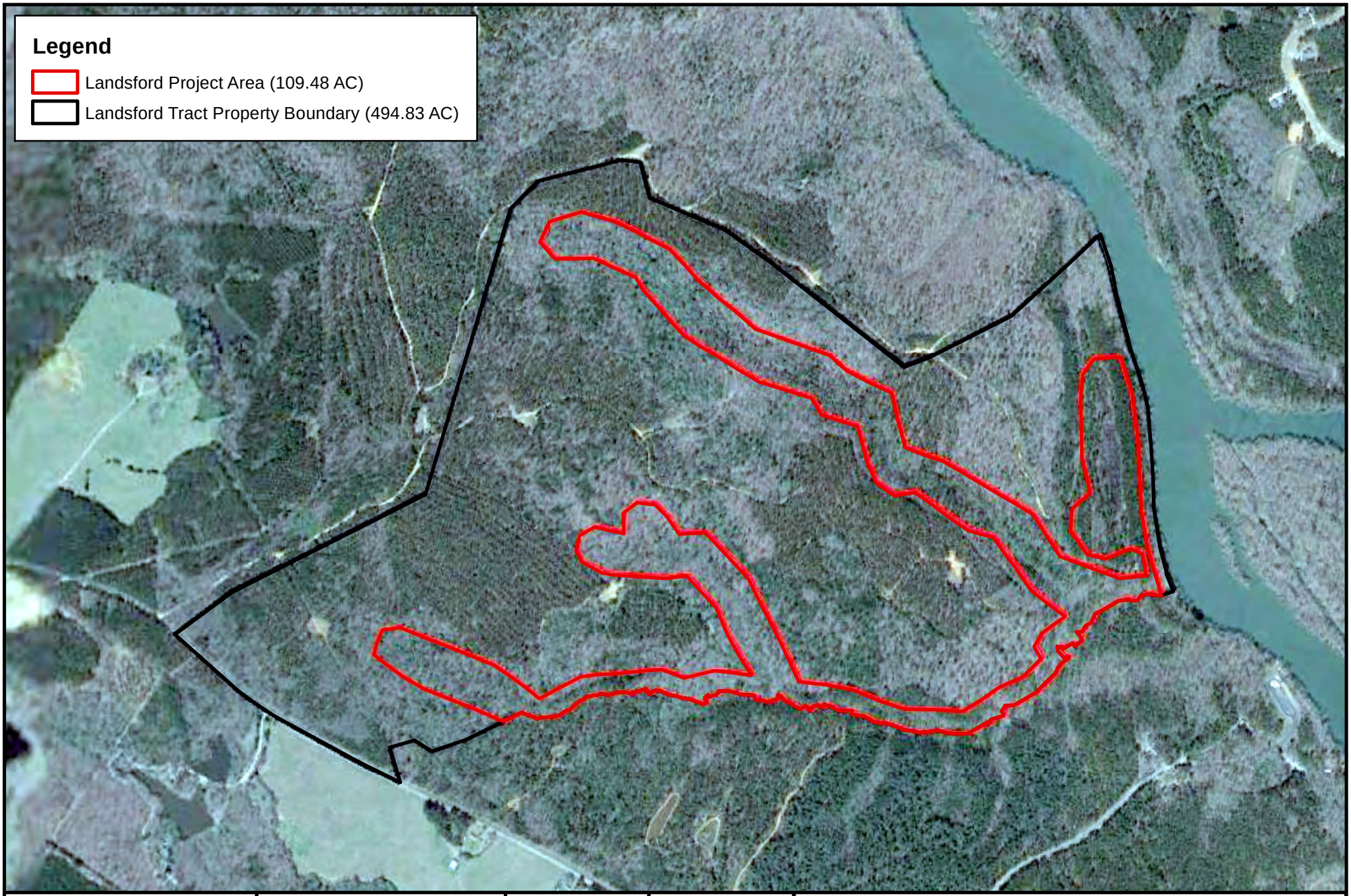
Notes:




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 1,000 feet

0 250 500 1,000 Feet

**Current Aerial - 2019**

Sources: Google Earth
Date: January 2020

Palustrine Group

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Notes:

# APPENDIX D

# ISSUED JURISDICTIONAL DETERMINATION

**DEPARTMENT OF THE ARMY**
**CHARLESTON DISTRICT, CORPS OF ENGINEERS**
**69A HAGOOD AVENUE**
**CHARLESTON, SC 29403**

28 January 2020

Regulatory Division

Mr. Tory Grayson
Palustrine Group, LLC
216 Red Knot Lane
Charleston, South Carolina 29464
tgrayson@palustrinegroup.com

Dear Mr. Grayson:

This is in response to your request for a revised Preliminary Jurisdictional Determination (PJD) (SAC-2019-02031) based on changes in project boundary received in our office on January 25, 2020, for a 109.48-acre site located off U.S. Highway 21 between Landsford Road and the Catawba River, Chester County, South Carolina (Latitude: 34.797°, Longitude: -80.897°). A PJD is used to indicate the approximate location(s) and boundaries of wetlands and/or other aquatic resources presumed to be waters of the United States on a site pursuant to Section 404 of the Clean Water Act (CWA) (33 U.S.C. § 1344) and/or navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA) (33 U.S.C. § 403).

The site is shown on the attached depiction entitled "Figure 6: Delineated Aquatic Features Map" and dated January, 2020, prepared by Palustrine Group. Based upon on-site inspection, a review of aerial photography, topographic maps, National Wetlands Inventory maps, soil survey information, and Wetland Determination Data Form(s), we conclude the boundaries shown on the referenced depiction are a reasonable approximation of the aquatic resources found within the site that are presumed to be subject to regulatory jurisdiction of the Corps of Engineers. The site contains a total of approximately 3.25 acres and 16,958 linear feet of federally defined wetlands and other aquatic resources that are presumed to be waters of the United States subject to Corps' jurisdiction under Section 404 of the CWA.

You are cautioned the boundaries of the delineated wetlands and/or other aquatic resources presumed to be subject to regulatory jurisdiction of the Corps of Engineers shown on the attached depiction are approximate and subject to change.

By providing this PJD, the Corps of Engineers is making no legally binding determination of any type regarding whether jurisdiction exists over the particular aquatic resource(s) in question. This PJD is not a definitive determination of the presence or absence of areas within the Corps of Engineers' jurisdiction, and, therefore, it does not have an expiration date. Also note this PJD is not an appealable action under the Corps of Engineers' administrative appeal procedures defined at 33 CFR 331 as it is not a final action. A PJD is "preliminary" in the sense that a recipient of a PJD can later request and obtain an Approved Jurisdictional Determination (AJD) for a definitive, official determination of the presence or absence of jurisdictional aquatic resources on a site, including the identification of the geographic limits of the jurisdictional aquatic resources. To receive a definitive determination of jurisdiction, you must submit an AJD request.

Be aware a permit from this office may be required for certain activities in the areas identified as wetlands and/or other aquatic resources that are presumed to be subject to regulatory jurisdiction of the Corps of Engineers. These areas may further be subject to restrictions or requirements of other state or local government agencies. A PJD may be used as the basis of a permit decision however, when computing impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a PJD will treat all aquatic resources affected in any way by the permitted activity as jurisdictional. If you intend to request an AJD in the future, you are advised not to commence work in these wetlands and/or other aquatic resources presumed to be jurisdictional prior to receiving the AJD. Attached is a Preliminary Jurisdictional Determination Form describing the areas in question and clarifying the option to request an AJD.

If you submit a permit application as a result of this PJD, include a copy of this letter and the depiction as part of the application. Not submitting the letter and depiction will cause a delay while we confirm a PJD was performed for the proposed permit project area. Note that some or all of these areas may be regulated by other state or local government entities, and you should contact the South Carolina Department of Health and Environmental Control, Bureau of Water, or Department of Ocean and Coastal Resource Management, to determine the limits of their jurisdiction.

This PJD was conducted to identify approximate location(s) of aquatic resources presumed to be subject to regulatory jurisdiction of the Corps of Engineers on the particular site identified in this request. This PJD may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

Attached is a copy of the Preliminary Jurisdictional Determination Form signed by our office. Please sign, retain a copy for your records, and return a signed copy to this office within 30 days of receipt of this letter. Note that this PJD supersedes and replaces the PJD issued under this project number on January 2, 2020.

In all future correspondence, please refer to file number SAC-2019-02031. A copy of this letter is being forwarded to State and/or Federal agencies for their information. If you have any questions, please contact me at (843) 329-8403, or by email at Richard.L.Darden@usace.army.mil.

Sincerely,

Richard L. Darden, Ph.D.
Project Manager

Attachments:
Preliminary Jurisdictional Determination Form
Notification of Appeal Options
Figure 6: Delineated Aquatic Features Map

Copies Furnished:

Mr. Daniel Young
South Carolina Department of Commerce
1201 Main Street, Suite 1600
Columbia, South Carolina 29201-2300
dyoung@sccommerce.com

SCDHEC - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201
WQCWetlands@dhec.sc.gov

SCDHEC - OCRM
1362 McMillan Avenue, Suite 400
North Charleston, South Carolina 29405
OCRMPermitting@dhec.sc.gov

**Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM**

**BACKGROUND INFORMATION**

**A. REPORT COMPLETION DATE FOR PJD: January 27, 2019**

**B. NAME AND ADDRESS OF PERSON REQUESTING PJD:**

**Applicant:**
Mr. Daniel Young
SC Dept. of Commerce
1201 Main Street, Suite 1600
Columbia, South Carolina 29201-3200
dyoung@sccommerce.com
(803) 413-6776

**Consultant:**
Mr. Tory Grayson
Palustrine Group, LLC
216 Red Knot Lane
Charleston, South Carolina 29464
tgrayson@palustrinegroup.com

**C. DISTRICT OFFICE, FILE NAME, AND NUMBER:** SAC-2019-02031 Project Inspector Mitigation Site

**D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:** The project is located of U.S. Highway 21 between Landsford Road and the Catawba River.

**(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)**

State: South Carolina County/parish/borough: Chester County City:

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

Lat.: 34.7968354136088 ° Long.: -80.8974154277194 °

Universal Transverse Mercator:

Name of nearest waterbody: Catawba River

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

☒ Office (Desk) Determination. Date: December 31, 2019

☒ Field Determination. Date(s): December 11, 2019

**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) |
|---|---|---|---|---|---|
| Wetland A | 34.79759 | -80.88668 | 2.99 acres | Wetland | Section 404 |
| Wetland B | 34.79599 | -80.88760 | 0.26 acre | Wetland | Section 404 |
| Unnamed Tributary 1 | 34.79369 | -80.89613 | 7,702 linear feet | Non-wetland | Section 404 |
| Unnamed Tributary 2 | 34.79853 | -80.89451 | 6,494 linear feet | Non-wetland | Section 404 |
| Unnamed Tributary 3 | 34.79478 | -80.89924 | 2,284 linear feet | Non-wetland | Section 404 |
| Unnamed Tributary 4 | 34.79654 | -80.90164 | 111 linear feet | Non-wetland | Section 404 |
| Unnamed Tributary 5 | 34.79728 | -80.90079 | 367 linear feet | Non-wetland | Section 404 |

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: The site depiction, overlaid on an aerial photograph, was prepared by Palustrine Group, and is titled "Figure 6: Delineated Aquatic Features Map"

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
- ☒ Office concurs with data sheets/delineation report. Office concurs with report conclusions.
- ☐ 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: 1" = 800'; ESRI, SCDNR

☒ Natural Resources Conservation Service Soil Survey. Citation: ESRI soils layer

☒ National wetlands inventory map(s). Cite name: ESRI, SCDNR
NWI layer

☐ State/local wetland inventory map(s):

☐ FEMA/FIRM maps:

☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): ESRI, prepared December 10, 2019
- ☒ Other (Name & Date): site photographs

☐ 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 | 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.

## NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

| Applicant: Palustrine Group | File Number: SAC-2019-02031 | Date: 28 Jan 2020 |
|---|---|---|
| Attached is: | | See Section below |
| | INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission) | A |
| | PROFFERED PERMIT (Standard Permit or Letter of permission) | B |
| | PERMIT DENIAL | C |
| | APPROVED JURISDICTIONAL DETERMINATION | D |
| X | PRELIMINARY JURISDICTIONAL DETERMINATION | E |

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the Division Engineer, South Atlantic Division, 60 Forsyth St, SW, Atlanta, GA 30308-8801. This form must be received by the Division Engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD **is not appealable**. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

## SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

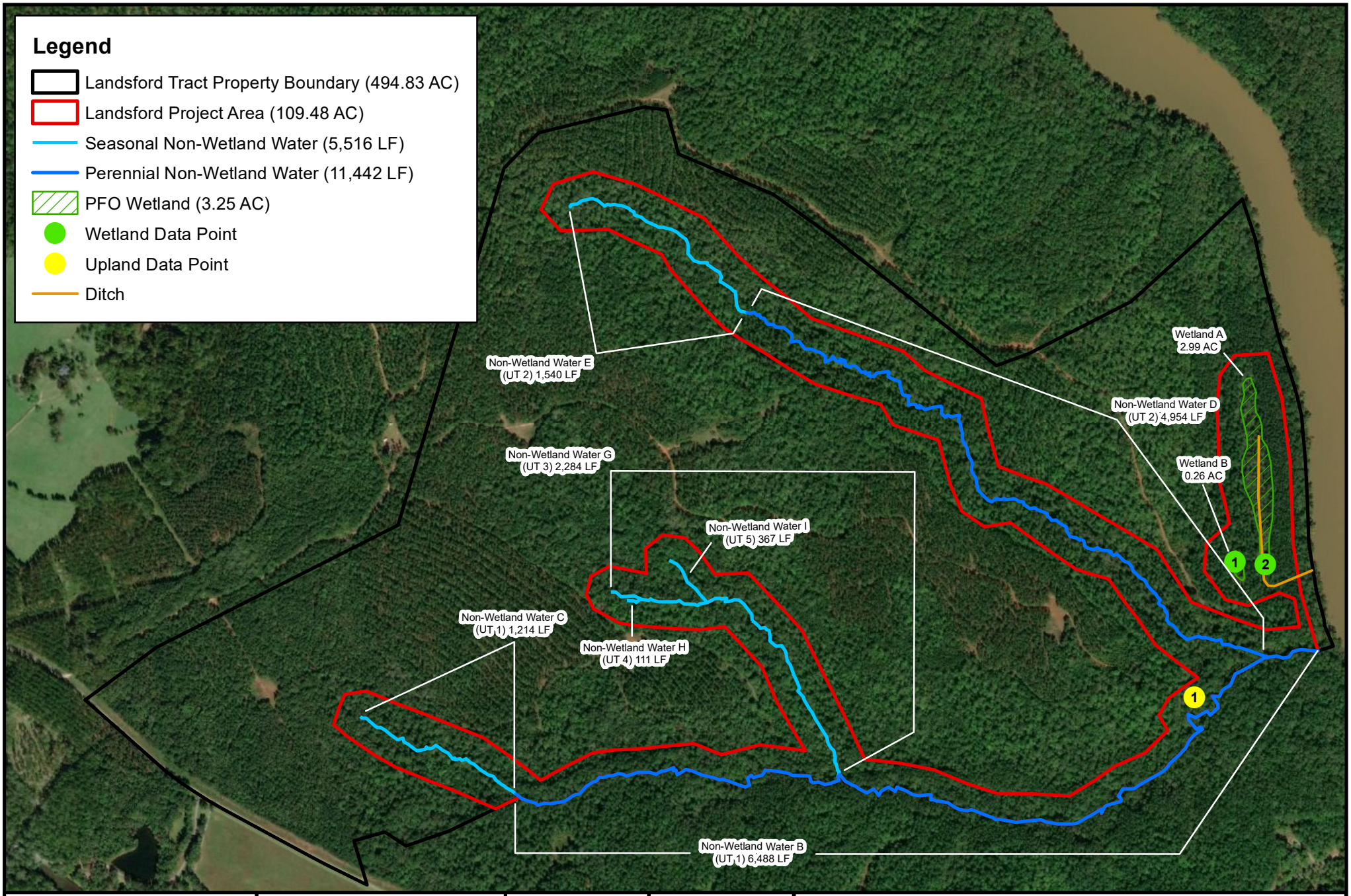
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

## POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

| | |
|---|---|
| If you have questions regarding this decision and/or the appeal process you may contact the Corps biologist who signed the letter to which this notification is attached. The name and telephone number of this person is given at the end of the letter. | If you only have questions regarding the appeal process you may also contact: Jason W. Steele<br>Administrative Appeals Review Officer<br>USACE South Atlantic Division<br>60 Forsyth St, SW<br>Atlanta, GA 30308-8801<br>(404) 562-5137 |

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

| | | |
|---|---|---|
| _____<br>Signature of appellant or agent. | Date: | Telephone number: |




**Landsford Tract**
**Chester County**
**South Carolina**

1 inch = 800 feet

0 195 390 780 Feet

**Figure 6: Delineated Aquatic Features Map**

Sources: ESRI
Date: January, 2020

Palustrine Group

N
W E
S

Notes: Non-Wetland Water B (UT 1) centerline is the assumed property boundary.

# APPENDIX E

# REPRESENTATIVE PHOTOGRAPHS

**Photo Page 1**

UT 1 (Section 1) looking upstream from UT 2 confluence

Middle Extent of UT 1 (Section 1)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 2**

Middle Extent of UT 1 (Section 1)

UT 1 (Section 2)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 3**

UT 1 (Section 2)

UT 2 (Section 1)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 4**

UT 2 (Section 2)

UT 2 (Section 3)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 5**

UT 2 (Section 4)

UT 3 (Section 1)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 6**

UT 3 (Section 2) – Functional Reference

UT 4 (Section 1)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 7**

UT 4 (Section 2)

UT 5

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

**Photo Page 8**

Wetland (Preservation)

Wetland (Enhancement)

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

Drainage Ditch

Catawba River

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

# APPENDIX F

# LOW GRADIENT STREAM ASSESSMENT DATA SHEETS

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 1 (Section 1) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34.797064 | Longitude: -80.897325 | County: Chester |
| Date: October 14, 2019 | Time: 11:45 AM | Investigator: CC |
| Stream width: ~ 9' | Stream Depth: ~ 6 - 8' | Length of Stream Reach: 6,488' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc):Predominantly Silviculture | |

| **Habitat** | **Condition Category** | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 14 NOTES/COMMENTS:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 1 (Section 2) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34.797064 | Longitude: -80.897325 | County: Chester |
| Date: October 14, 2019 | Time: 4:30 PM | Investigator: CC |
| Stream width: ~ 4 - 5' | Stream Depth: ~ 6 - 8' | Length of Stream Reach: 1,214' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Mixed Upland Forest | |

| Habitat | Condition Category | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 11.5 NOTES/COMMENTS:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 2 (Section 1) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34°47'45.805"N | Longitude: 80°53'20.65"W | County: Chester |
| Date: October 14, 2019 | Time: 11:55 AM | Investigator: TC |
| Stream width: 8' | Stream Depth: 4' | Length of Stream Reach: 4,713' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Silviculture | |

| Habitat | Condition Category | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 7.5 NOTES/COMMENTS:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 2 (Section 2) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34°47'58.949"N | Longitude: 80°53'44.829"W | County: Chester |
| Date: October 14, 2019 | Time: 1:59 PM | Investigator: TC |
| Stream width: 10' | Stream Depth: 3.5' | Length of Stream Reach: 622' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Silviculture | |

| Habitat | Condition Category | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 11.5 NOTES/COMMENTS:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT2 (Section 3) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34.802406 | Longitude: -80.900551 | County: Chester |
| Date: October 14, 2019 | Time: 10:30 AM | Investigator: CC |
| Stream width: 3.75 FT | Stream Depth: 0.75 FT | Length of Stream Reach: 746 FT |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Predominantly Mixed Upland Forest | |

| Habitat | Condition Category | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 11 NOTES/COMMENTS:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT2 Section 4 | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude:34.802406 | Longitude: -80.900551 | County: Chester |
| Date: October 14, 2019 | Time: 10:30 AM | Investigator: CC |
| Stream width:3.25 FT | Stream Depth: 0.75 FT | Length of Stream Reach: 158 FT |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Predominantly Mixed Upland Forest | |

| Habitat | Condition Category | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 14.5 NOTES/COMMENTS:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 3 (Section 1) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34.797064 | Longitude: -80.897325 | County: Chester |
| Date: October 14, 2019 | Time: 1:30 PM | Investigator: CC |
| Stream width: ~ 4 - 5' | Stream Depth: ~ 4' | Length of Stream Reach: 1,782' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Mixed Upland Forest | |

| **Habitat** | **Condition Category** | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 8.5 NOTES/COMMENTS:

# LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 3 (Section 2) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34°47'43.831"N | Longitude: 80°53'57.177"W | County: Chester |
| Date: October 14, 2019 | Time: 3:20 PM | Investigator: TC |
| Stream width: 3' | Stream Depth: 0.5' | Length of Stream Reach: 504' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Mixed Upland Forest | |

| **Habitat** | **Condition Category** | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 18.5 NOTES:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 4 (Section 1) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34.797064 | Longitude: -80.897325 | County: Chester |
| Date: October 14, 2019 | Time: 1:30 PM | Investigator: CC |
| Stream width: ~ 4 - 5' | Stream Depth: ~ 4' | Length of Stream Reach: 61' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Mixed Upland Forest | |

| **Habitat** | **Condition Category** | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 8.5 NOTES/COMMENTS:

# LOW GRADIENT STREAM ASSESSMENT DATA SHEET

| | | |
|---|---|---|
| Stream Name: UT 4 (Section 2) | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34°47'43.761"N | Longitude: 80°53'59.306"W | County: Chester |
| Date: October 14, 2019 | Time: 3:46 PM | Investigator: TC |
| Stream width: 3' | Stream Depth: 0.5' | Length of Stream Reach: 306' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Mixed Upland Forest | |

| Habitat | Condition Category | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 16 NOTES:

## LOW GRADIENT STREAM ASSESSMENT DATA SHEET

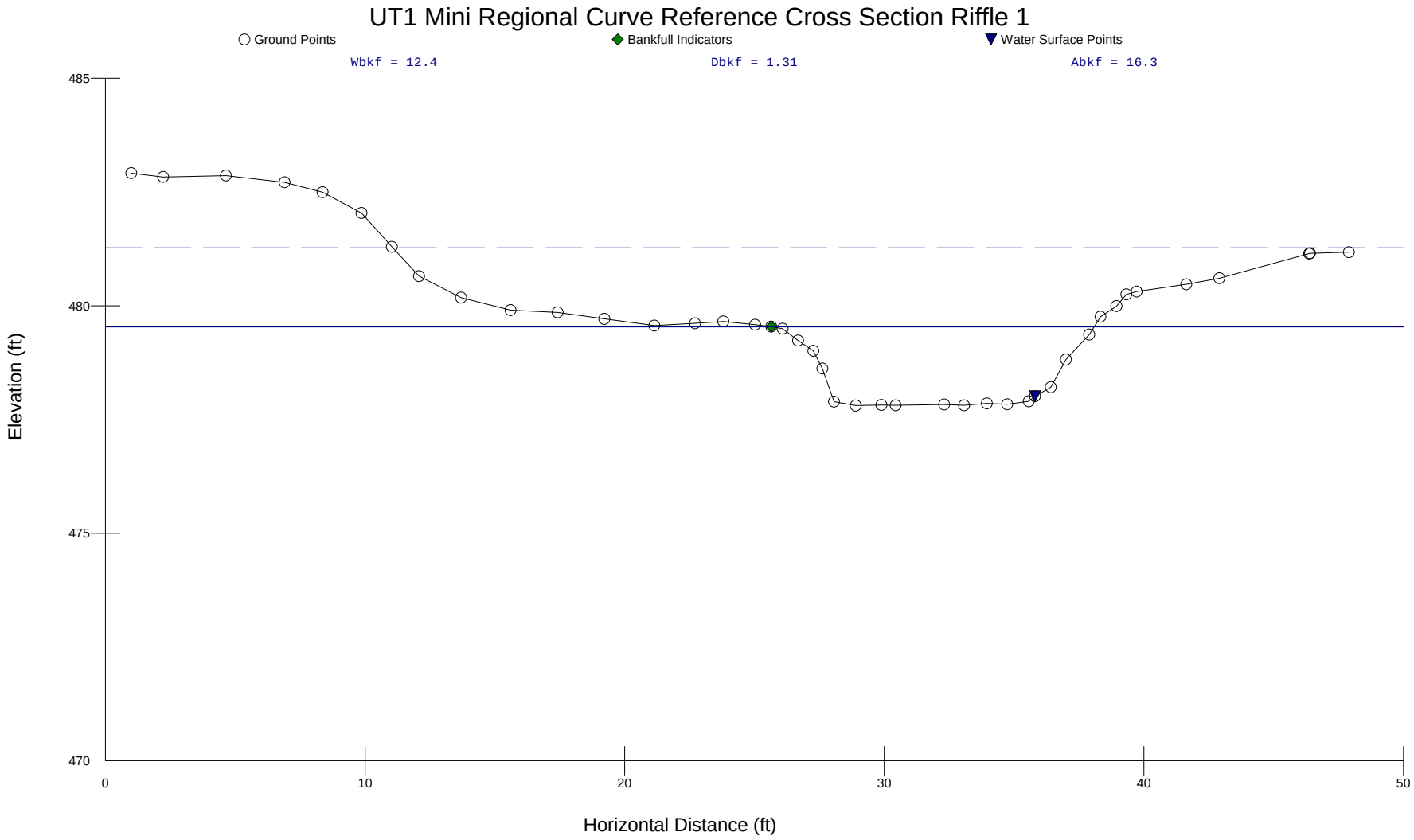
| | | |
|---|---|---|
| Stream Name: UT 5 | Basin/Watershed: Lower Catawba River | USGS Quad: Catawba |
| Latitude: 34.797064 | Longitude: -80.897325 | County: Chester |
| Date: October 14, 2019 | Time: 2:30 PM | Investigator: CC |
| Stream width: 3' | Stream Depth: 0.5' | Length of Stream Reach: 111' |
| Has it rained within the past 48 hours? No | Adjacent land use? (Industrial, agriculture, etc): Mixed Upland Forest | |

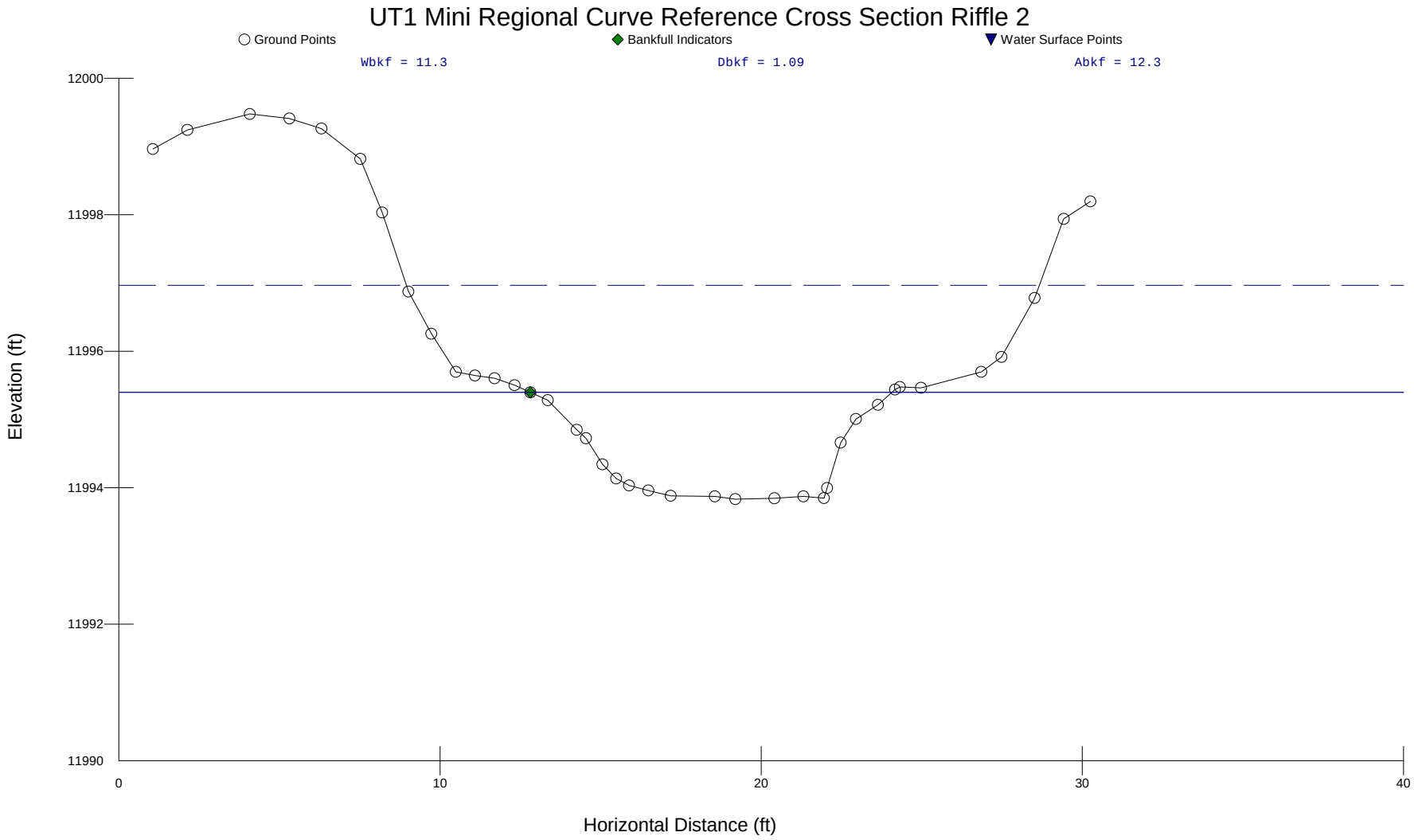
| **Habitat** | **Condition Category** | | | |
|---|---|---|---|---|
| Parameter | Fully Functional | Partially Impaired | Impaired | Very Impaired |
| **1.Epifaunal Substrate or Available Cover** | **Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).** | **30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization** | **10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.** | **Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **2.Pool Substrate Characterization** | **Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.** | **Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.** | **All mud or clay or sand bottom; little or no root mat; no submerged vegetation.** | **Hard-pan, clay, or bedrock; no root mat or vegetation.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **3.Pool variability** | **Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.** | **Majority of pools large-deep; very few shallow.** | **Shallow pools much more prevalent than deep pools.** | **Majority of pools small-shallow or pools absent.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **4.Sediment Deposition** | **Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.** | **Some new increase in bar formation, mostly from gravel, sand or fine sediment. 20-50% of the bottom affected; slight deposition in pools.** | **Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.** | **Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.** |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **5.Channel Flow Status** | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel or < 25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **6.Channel Alteration** | Channelization or dredging absent or minimal; stream with normal pattern | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **7.Channel Sinuosity** | The bends in the stream increase the stream length 3-4X longer than if it was in a straight line (If braided channel, this parameter is difficult to rate.) | The bends in the stream increase the stream length 2-3X longer than if it was in a straight line. | The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. | Channel straight; waterway has been channelized for a long distance. |
| **SCORE** | 2.0 | 1.5 | 1.0 | 0.5 |
| **8.Bank Stability** | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **9.Vegetative Protection** | >90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally | 70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining | 50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining. | <50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **10.Riparian Veg Zone Width** | Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities. |
| **SCORE** | Left Bank 1.0 | 0.75 | 0.50 | 0.25 |
| **SCORE** | Right Bank 1.0 | 0.75 | 0.50 | 0.25 |

Total Score: 16 NOTES:

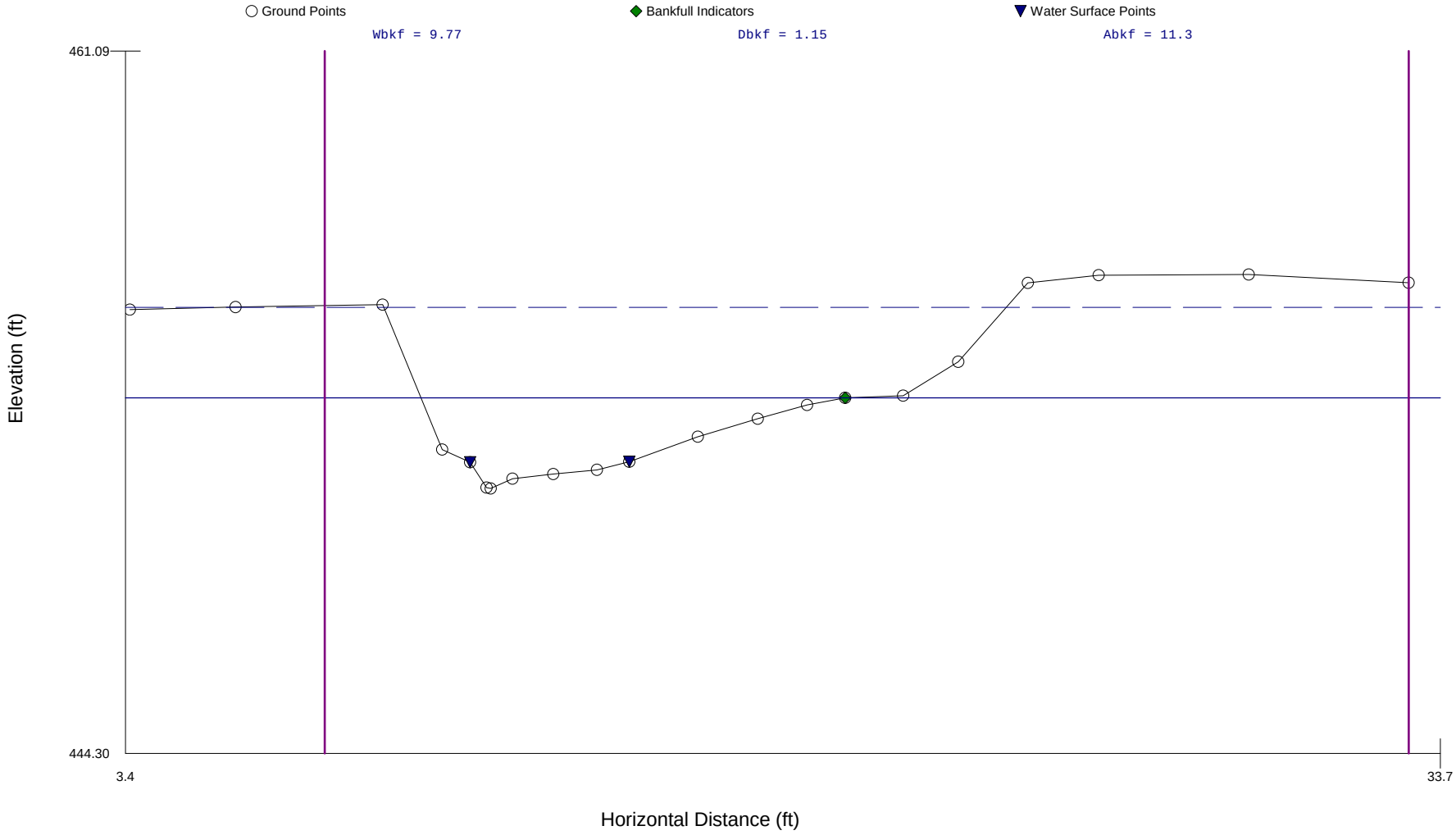
# APPENDIX G

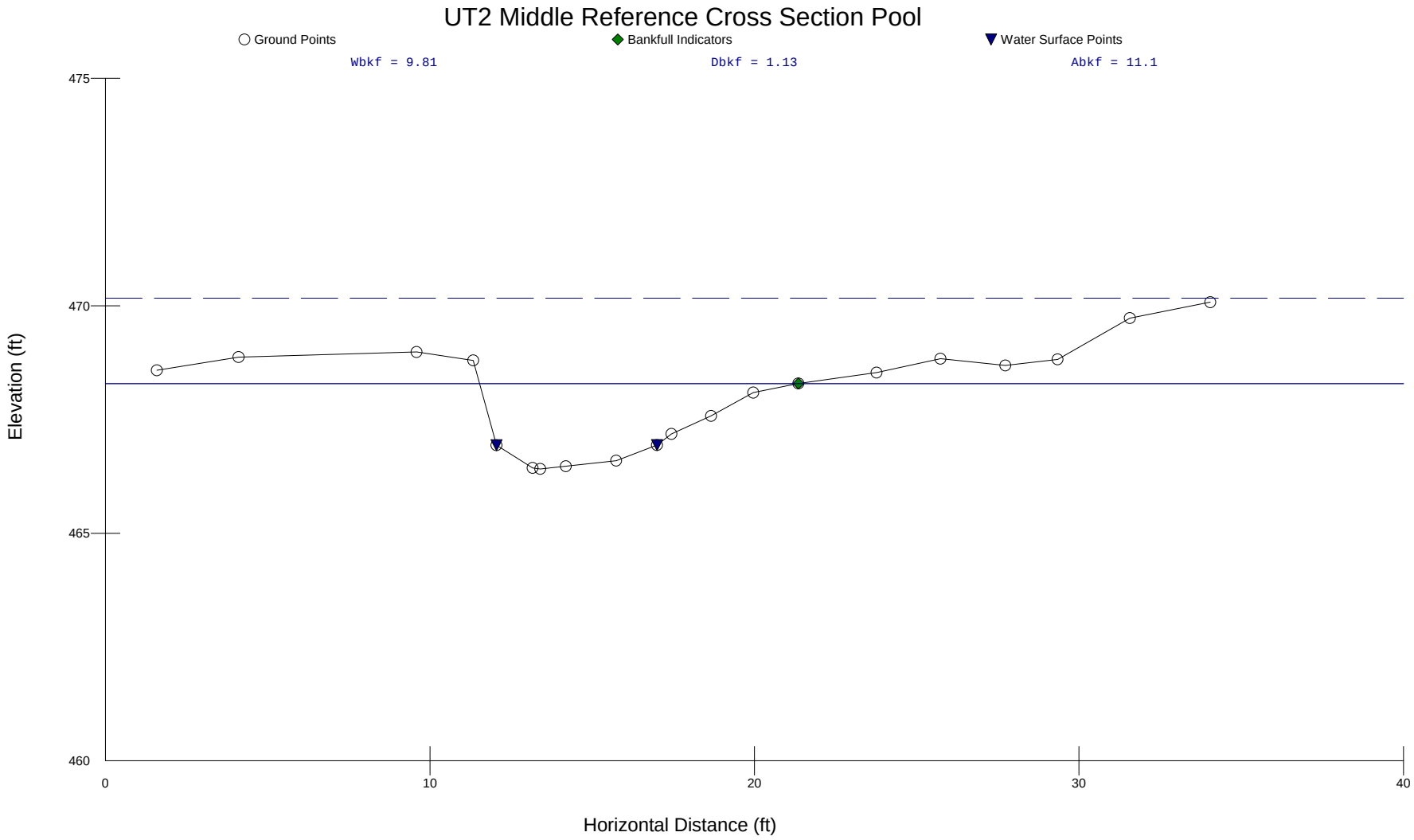
# STREAM CROSS-SECTIONS

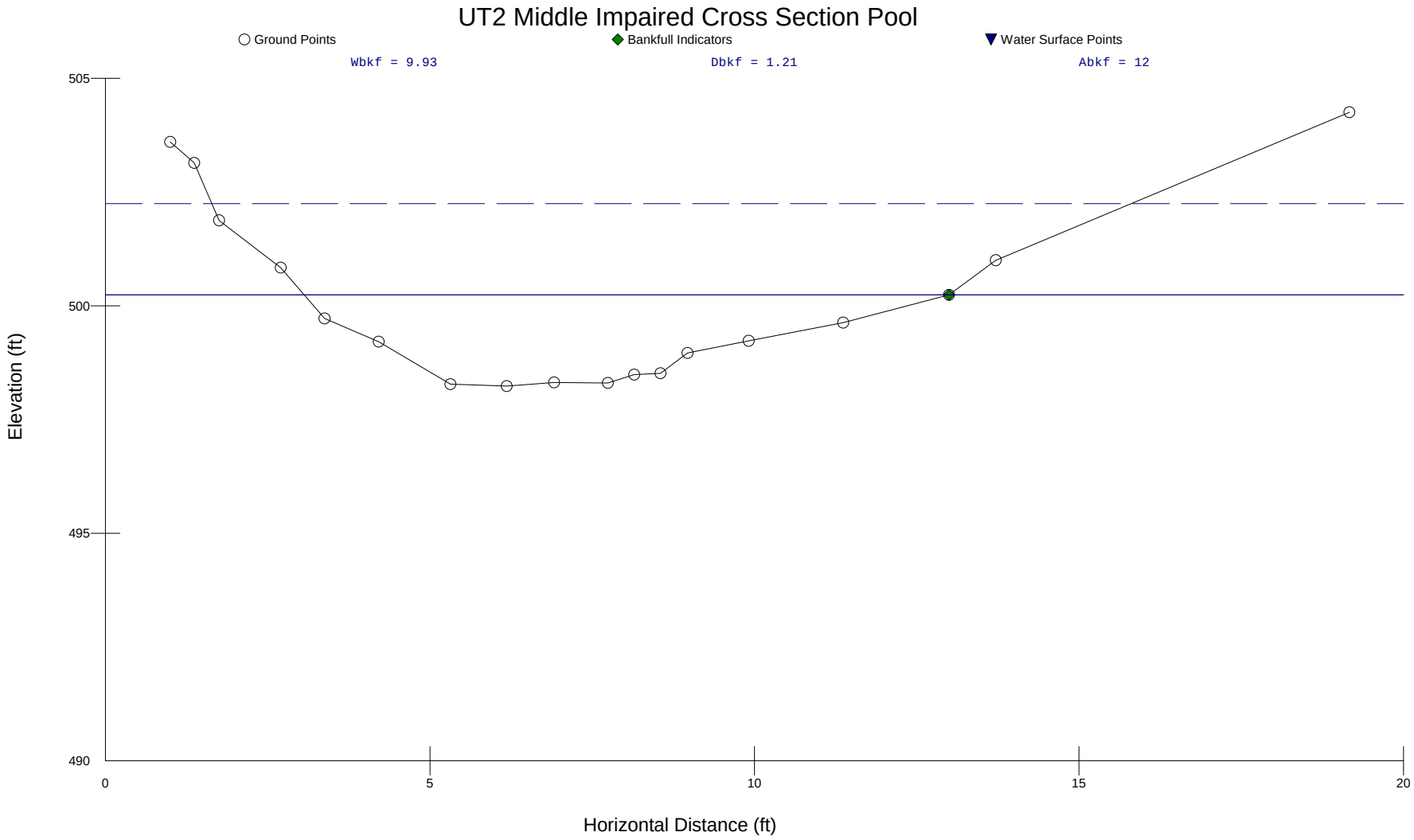

UT1 Mini Regional Curve Reference Cross Section Riffle 1
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 12.4
Dbkf = 1.31
Abkf = 16.3
485
480
475
470
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

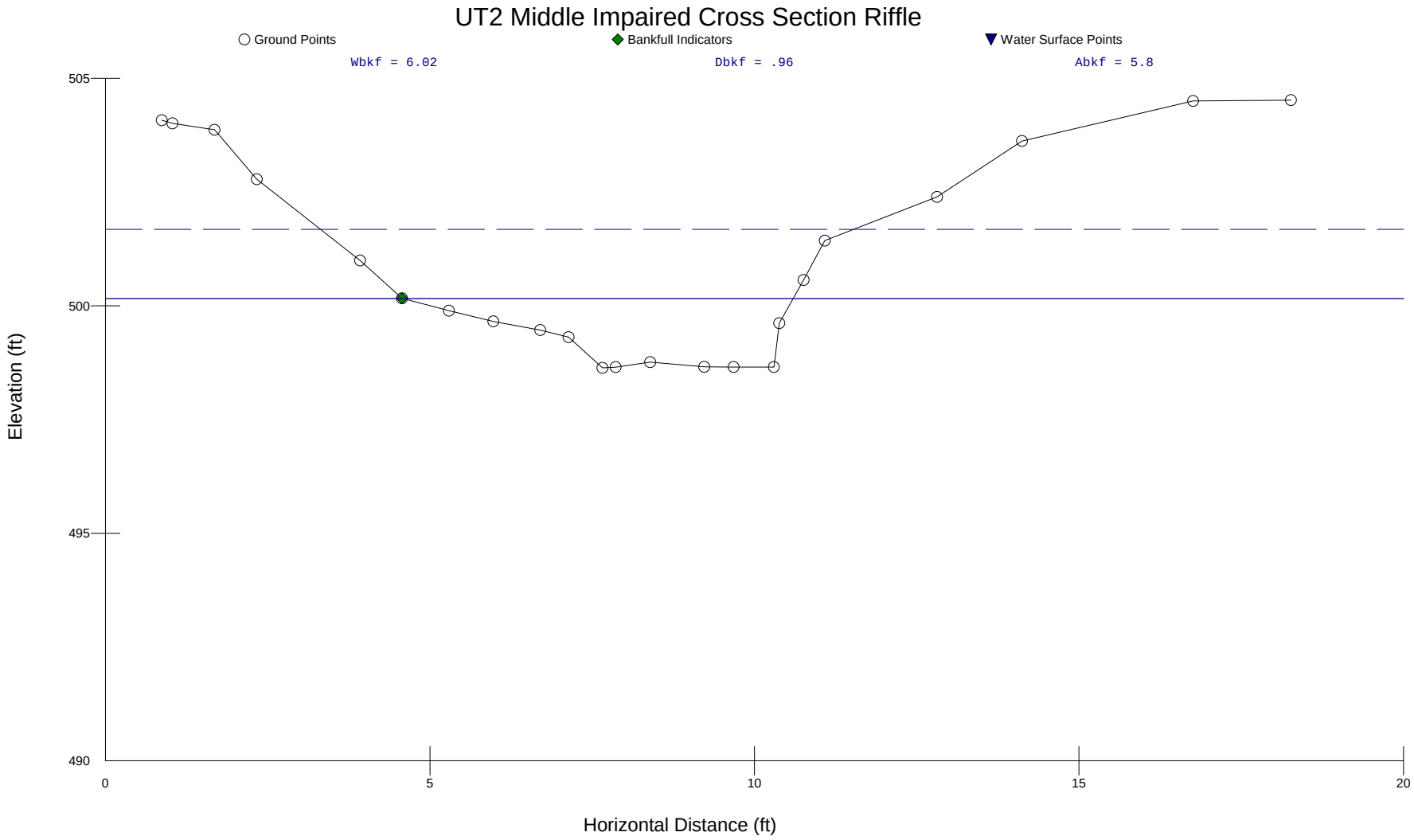

UT1 Mini Regional Curve Reference Cross Section Riffle 2
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 11.3
Dbkf = 1.09
Abkf = 12.3
12000
11998
11996
11994
11992
11990
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

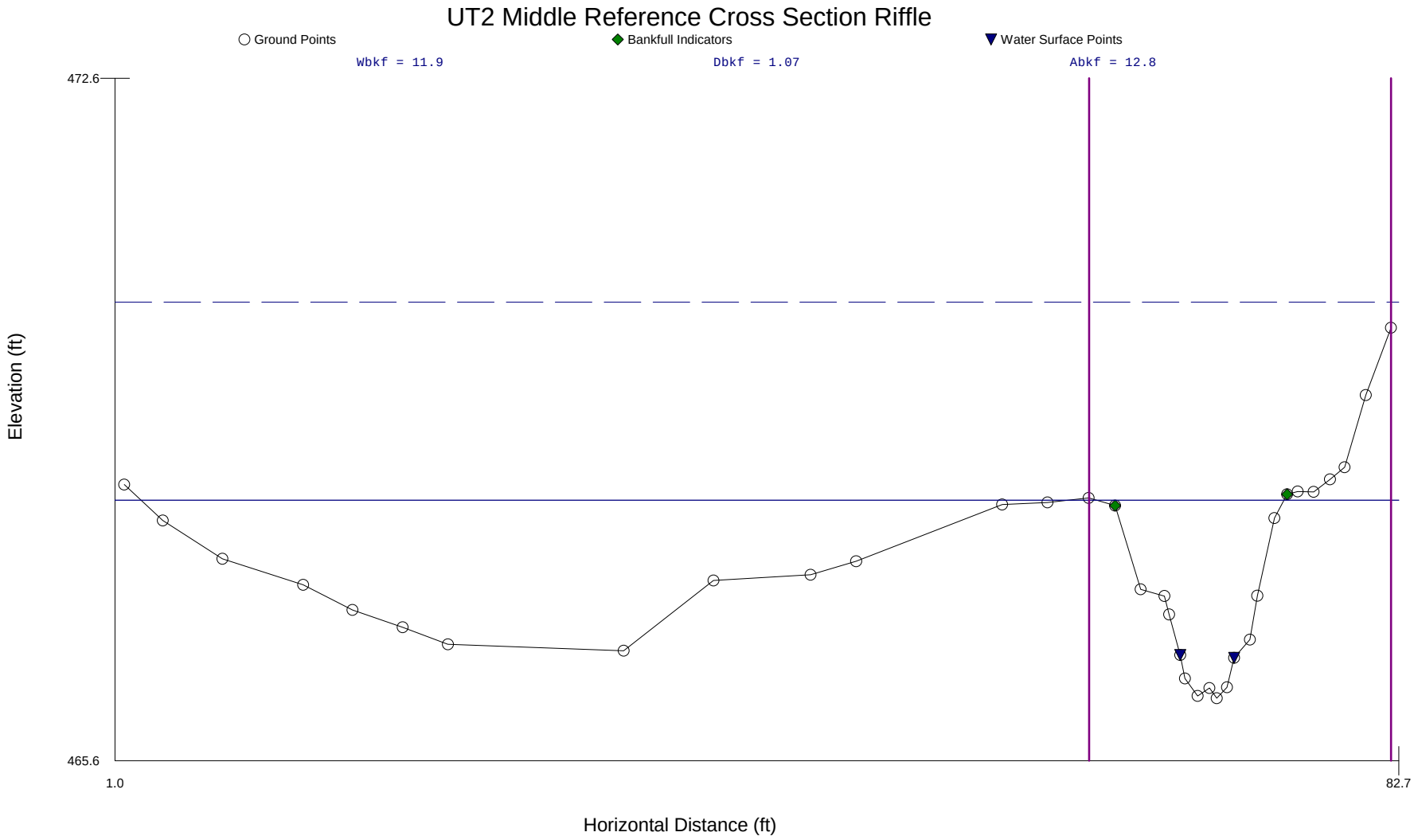
# UT2 Downstream Impaired Cross Section Pool

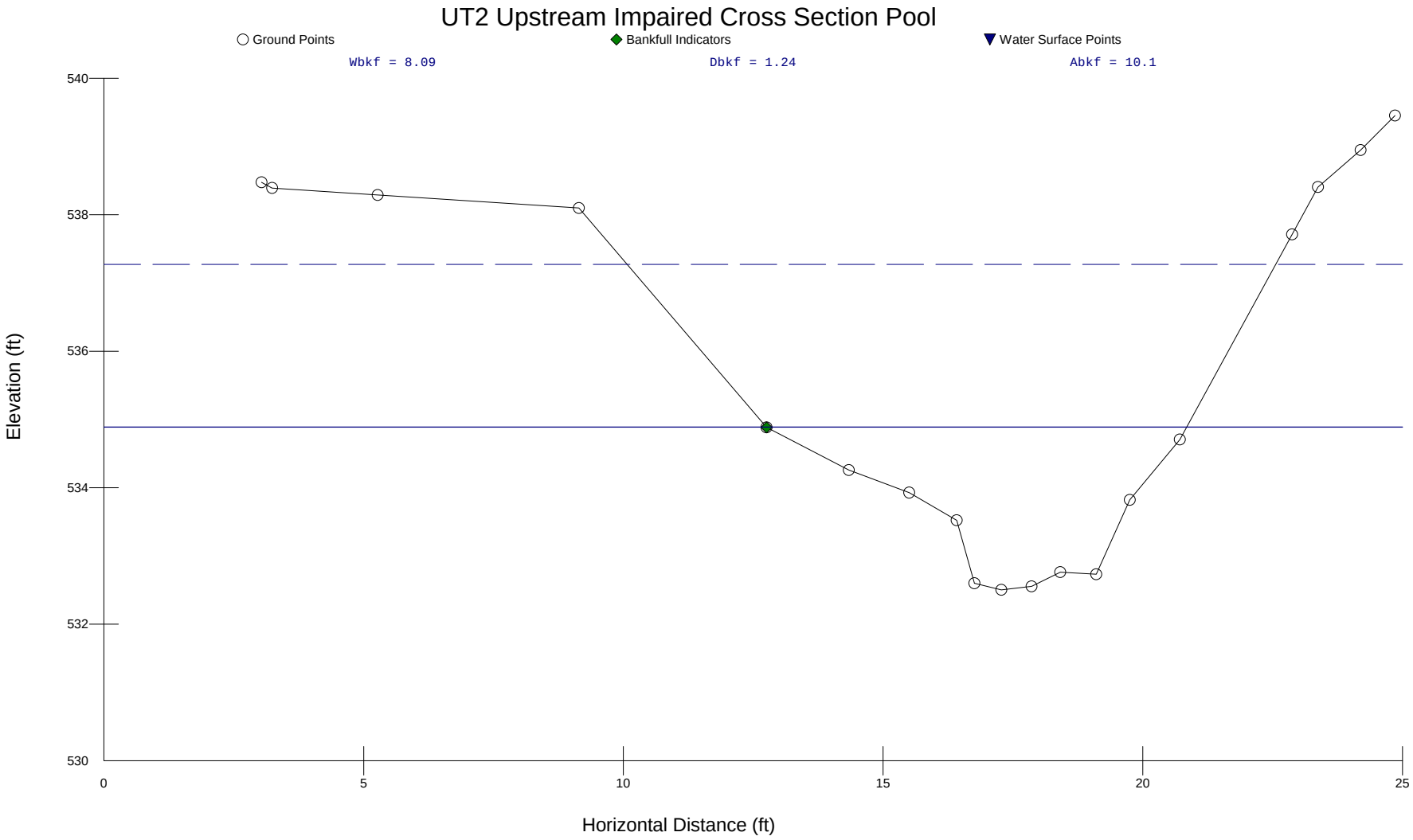



UT2 Middle Reference Cross Section Pool
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 9.81
Dbkf = 1.13
Abkf = 11.1
475
470
465
460
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

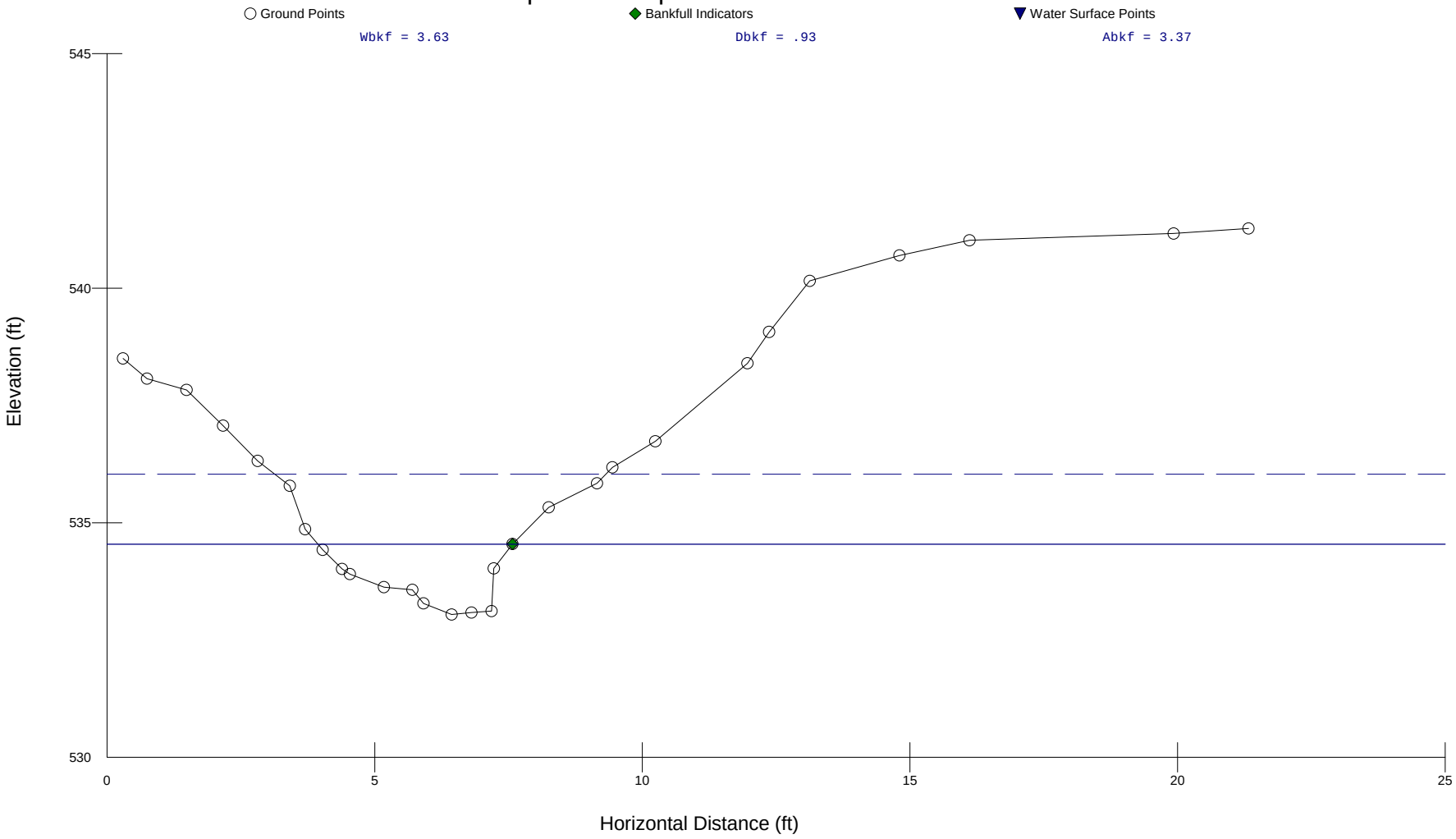

UT2 Middle Impaired Cross Section Pool
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 9.93
Dbkf = 1.21
Abkf = 12
505
500
495
490
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

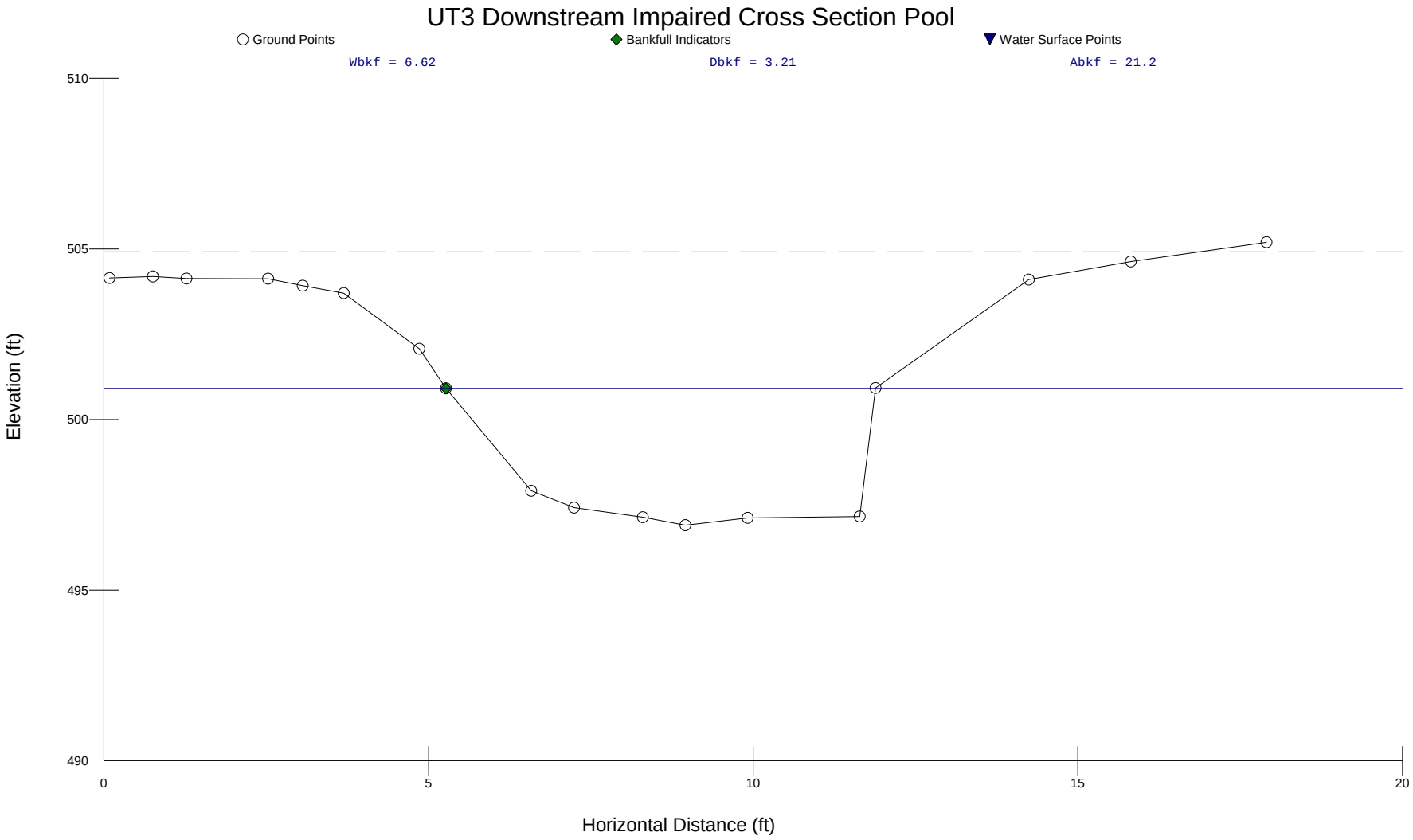

UT2 Middle Impaired Cross Section Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.02
Dbkf = .96
Abkf = 5.8
505
500
495
490
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

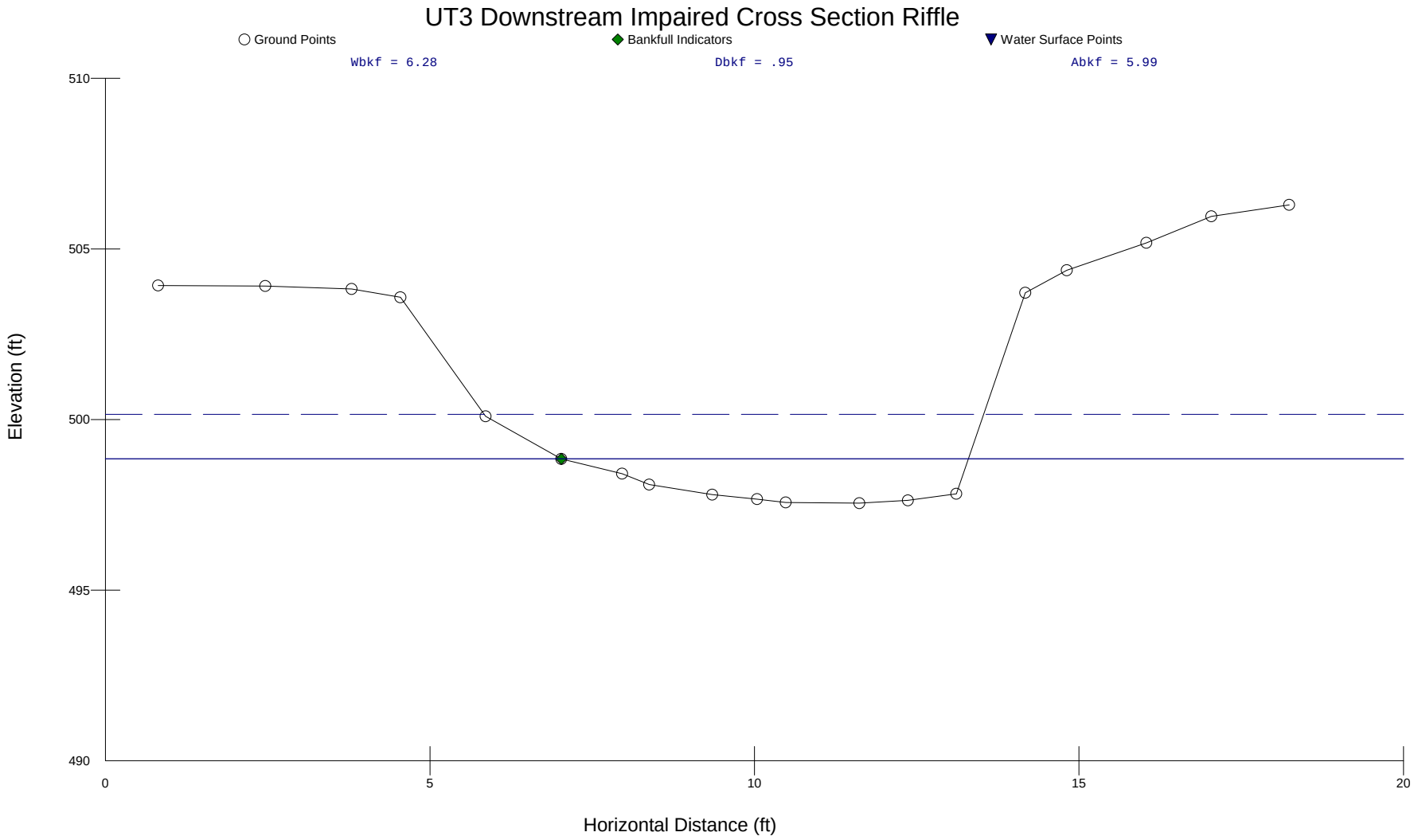

UT2 Middle Reference Cross Section Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 11.9
Dbkf = 1.07
Abkf = 12.8
472.6
465.6
1.0
82.7
Elevation (ft)
Horizontal Distance (ft)


UT2 Upstream Impaired Cross Section Pool
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 8.09
Dbkf = 1.24
Abkf = 10.1
Elevation (ft)
540
538
536
534
532
530
0
5
10
15
20
25
Horizontal Distance (ft)

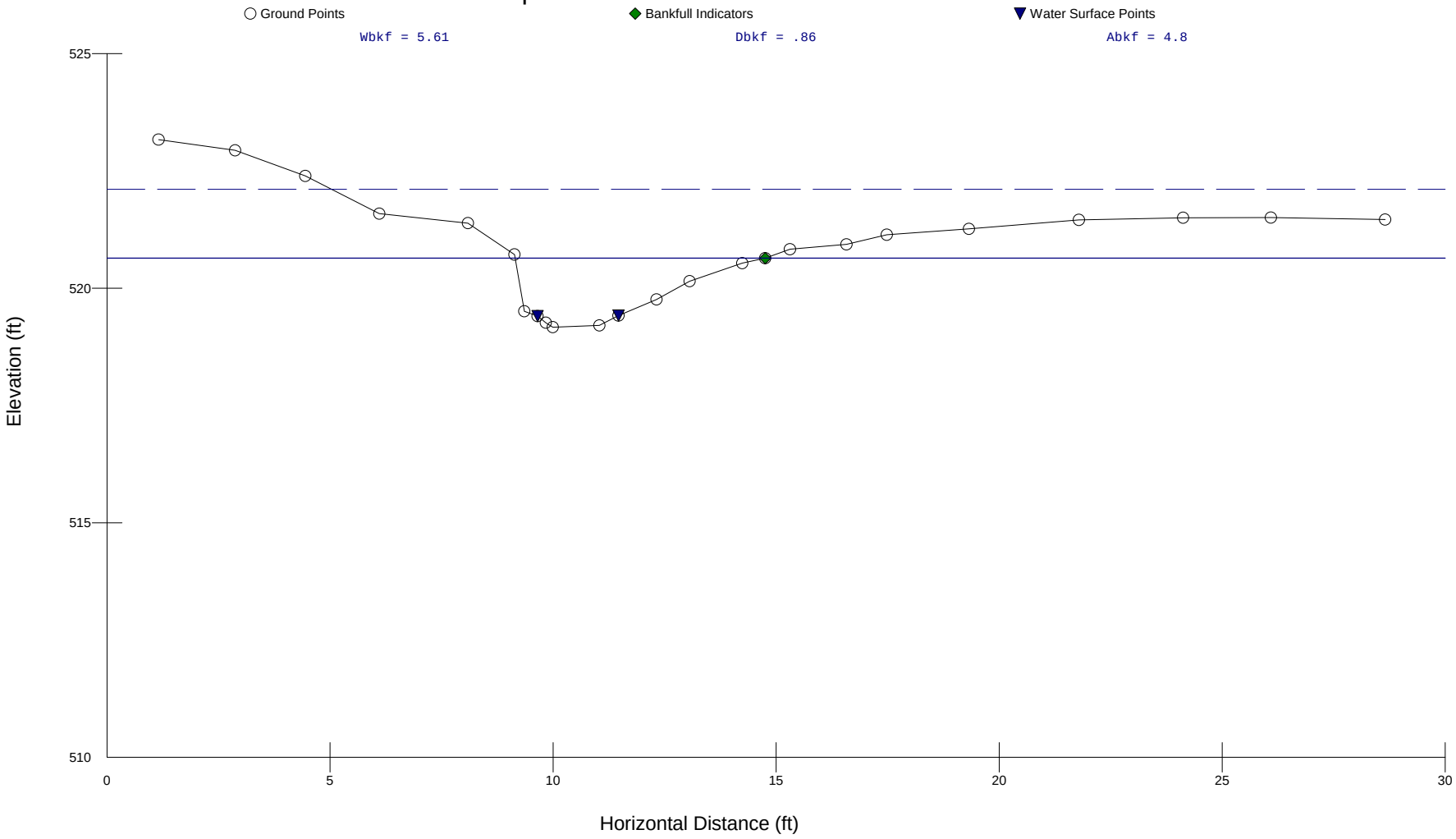
# UT2 Upstream Impaired Cross Section Riffle

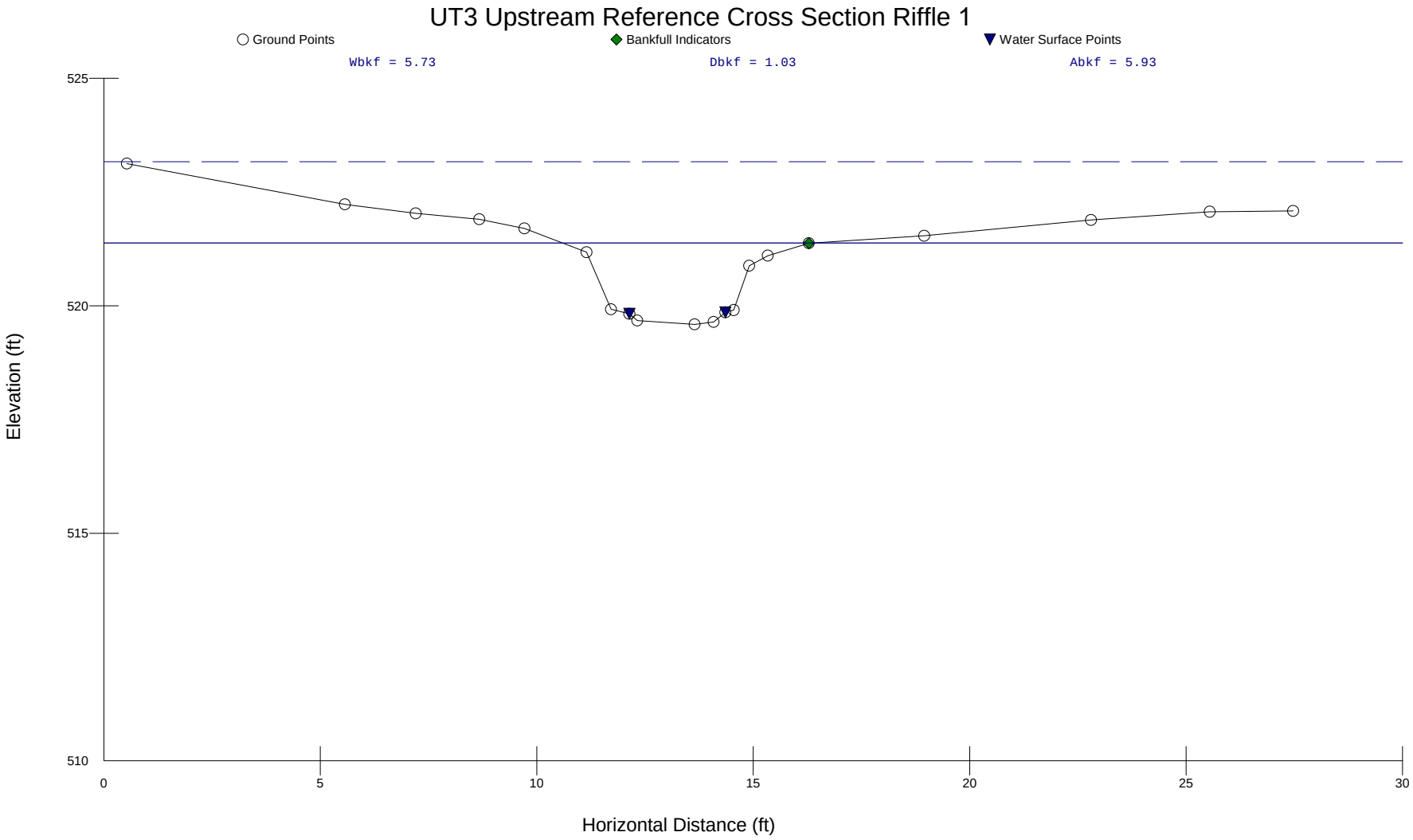



UT3 Downstream Impaired Cross Section Pool
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.62
Dbkf = 3.21
Abkf = 21.2
510
505
500
495
490
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

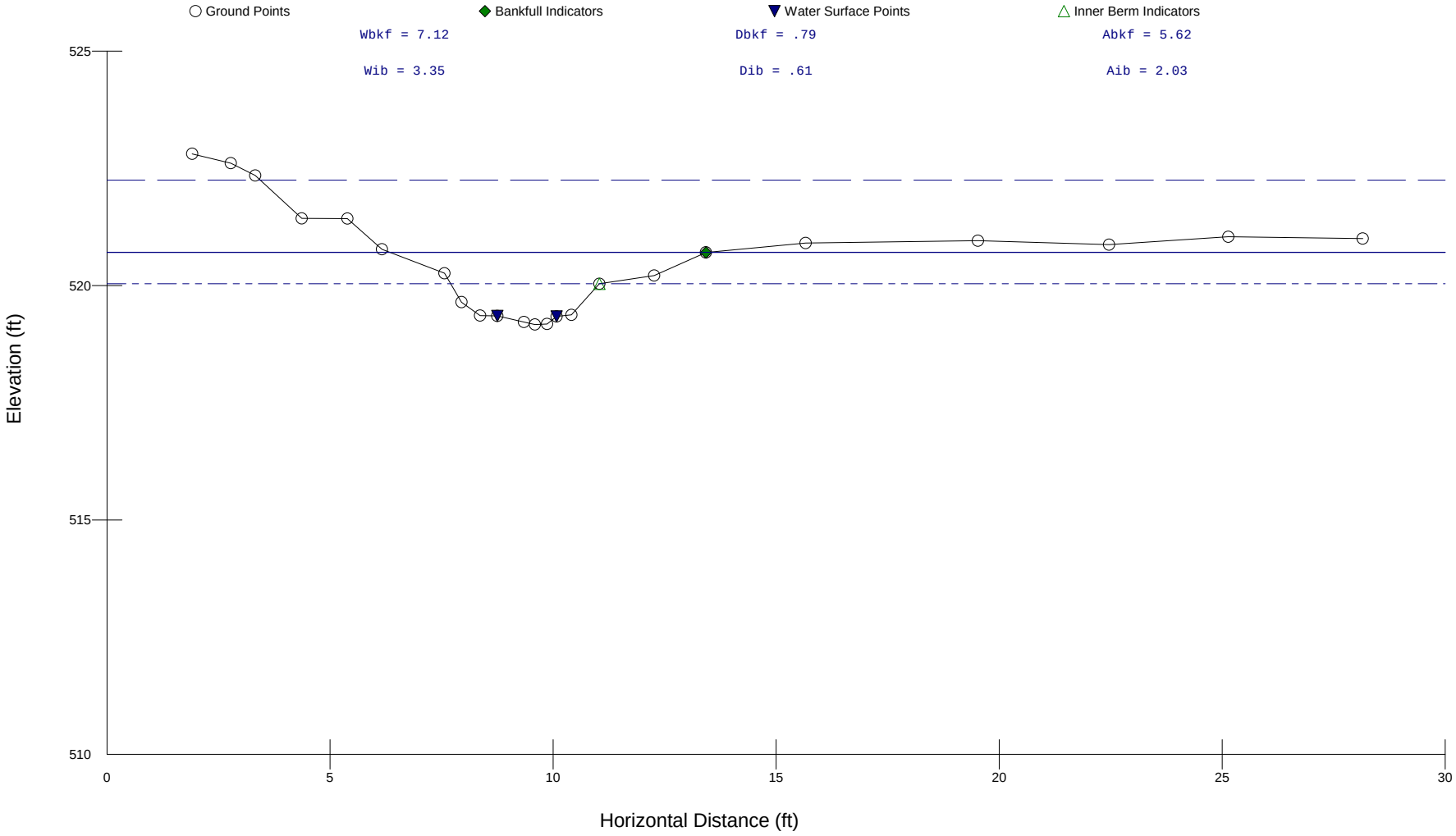

UT3 Downstream Impaired Cross Section Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.28
Dbkf = .95
Abkf = 5.99
510
505
500
495
490
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

# UT3 Upstream Reference Cross Section Pool

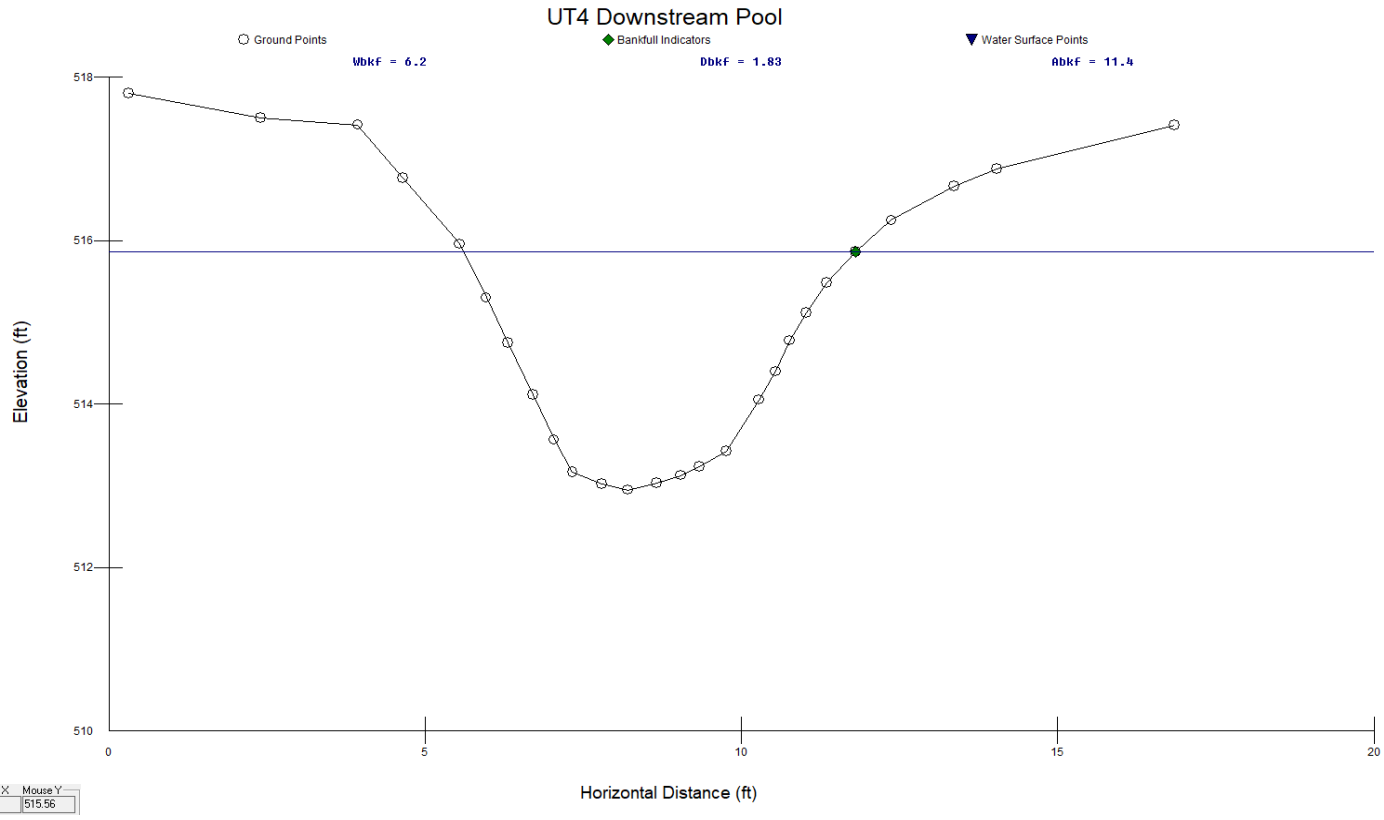



UT3 Upstream Reference Cross Section Riffle 1
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 5.73
Dbkf = 1.03
Abkf = 5.93
525
520
515
510
Elevation (ft)
0
5
10
15
20
25
30
Horizontal Distance (ft)

# UT3 Upstream Reference Cross Section Riffle 2

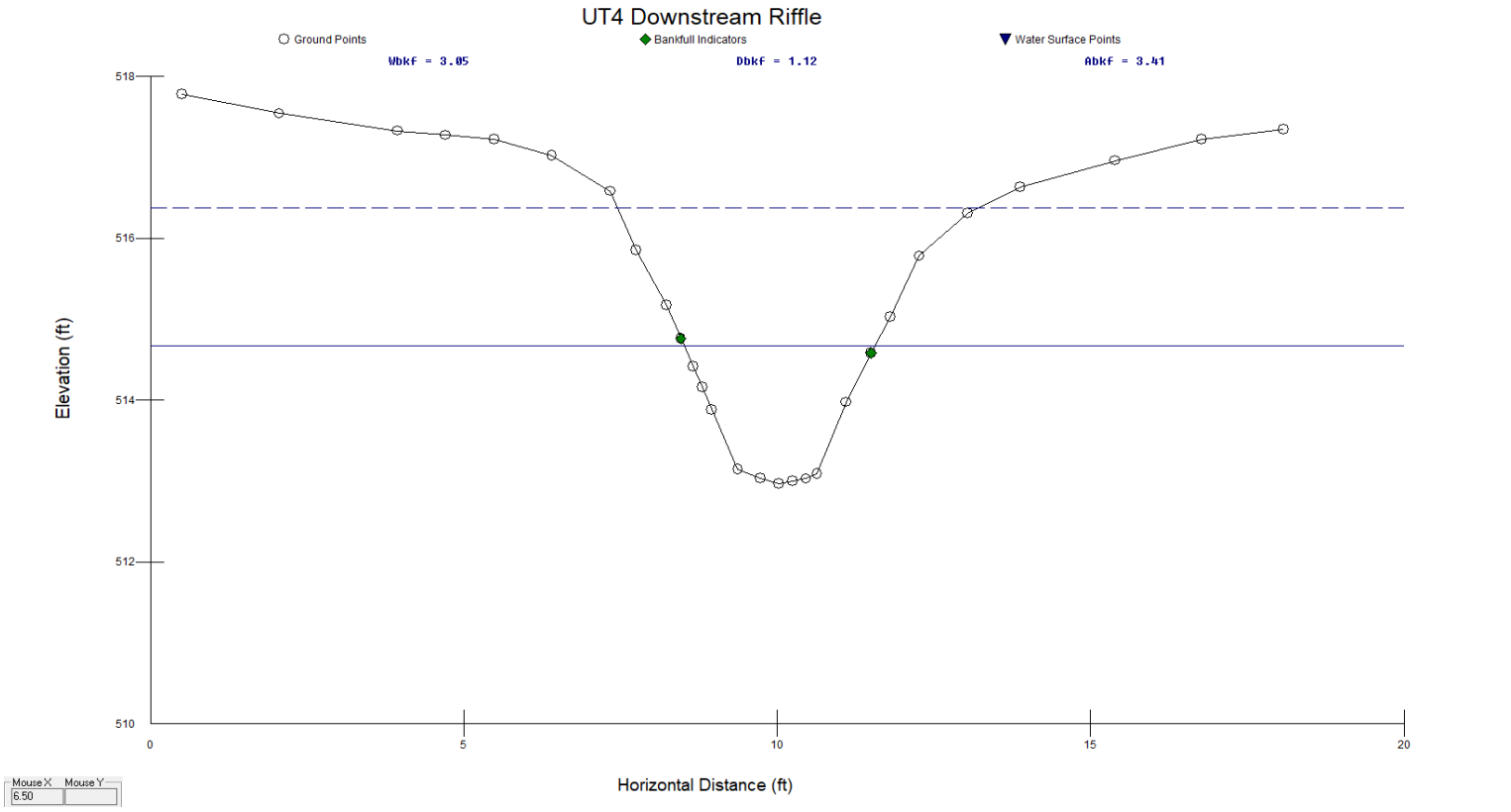


Graph Tools Drawing | Bankfull Elev 515.86



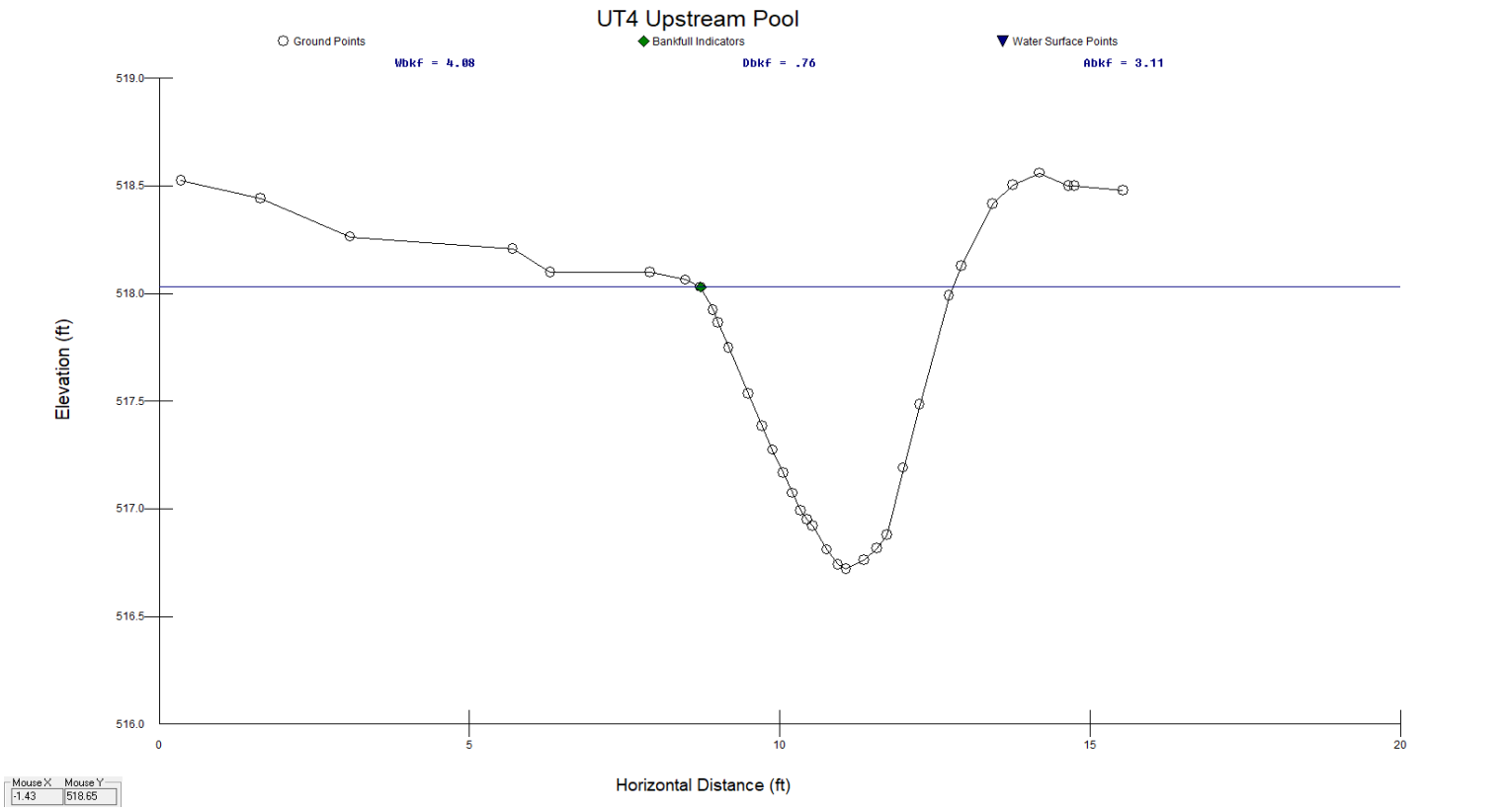

Mouse X 9.07 Mouse Y 515.56

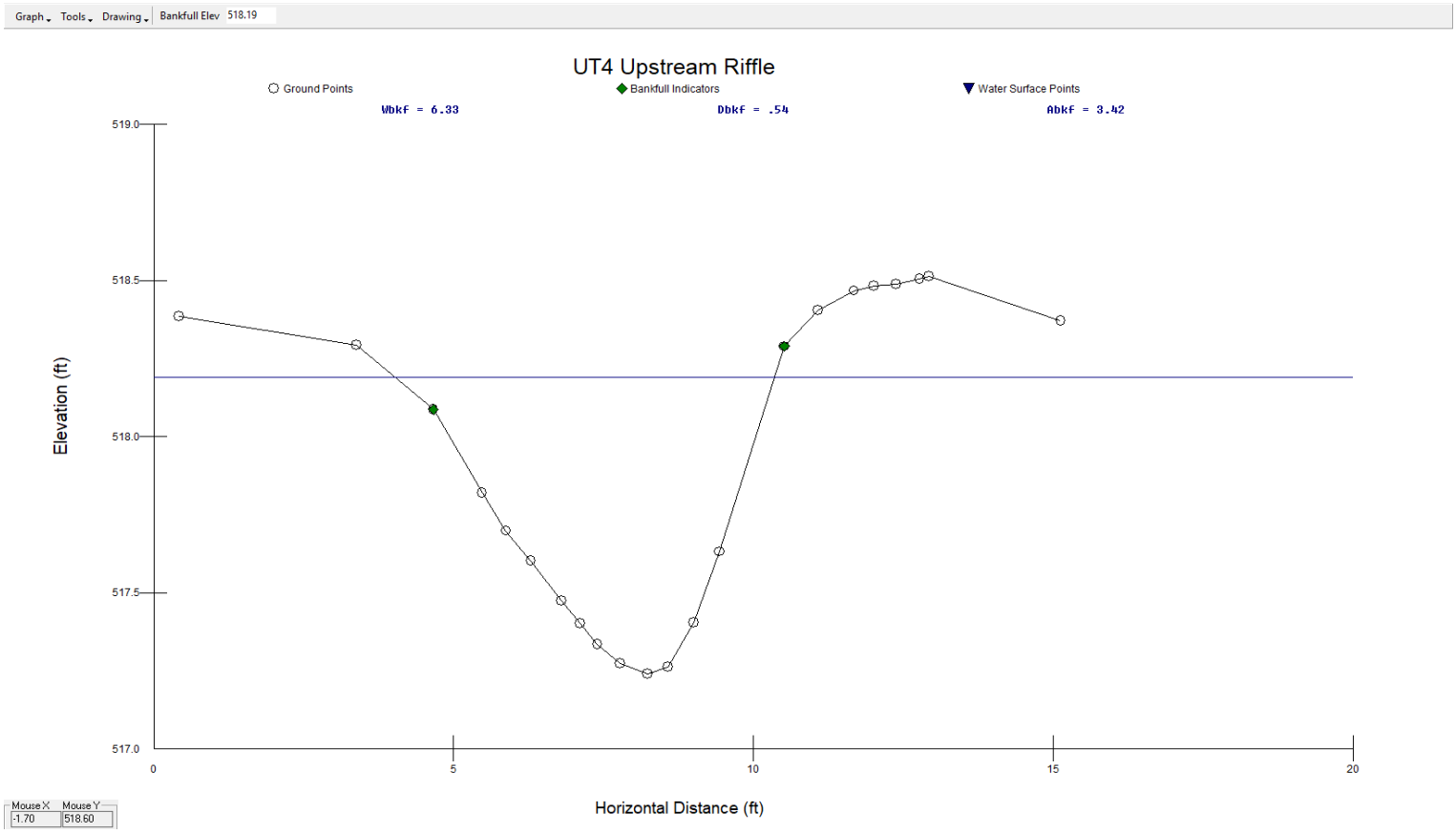
Graph Tools Drawing | Bankfull Elev 514.67




Mouse X 6.50 Mouse Y

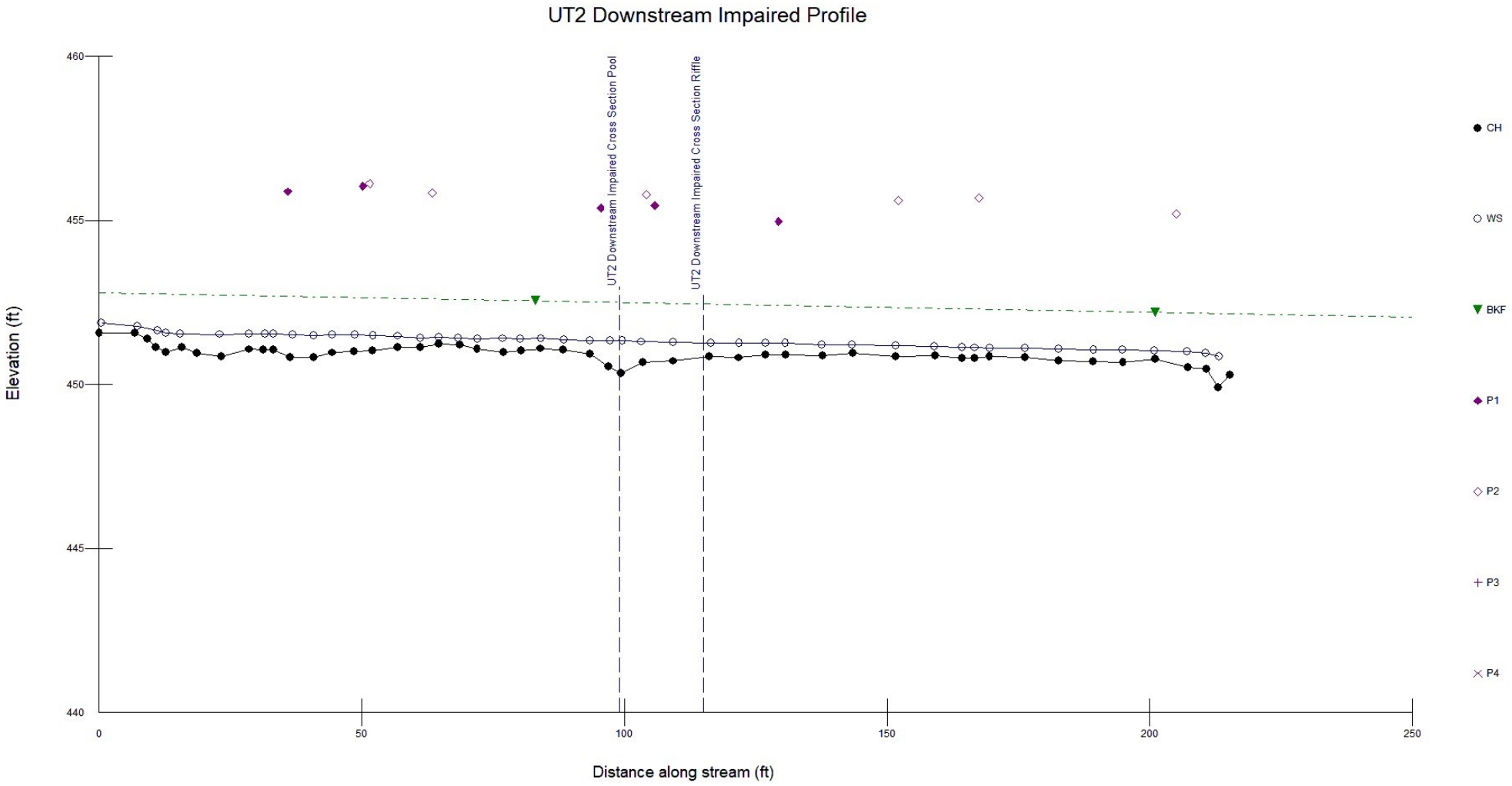
Graph Tools Drawing Bankfull Elev 518.03



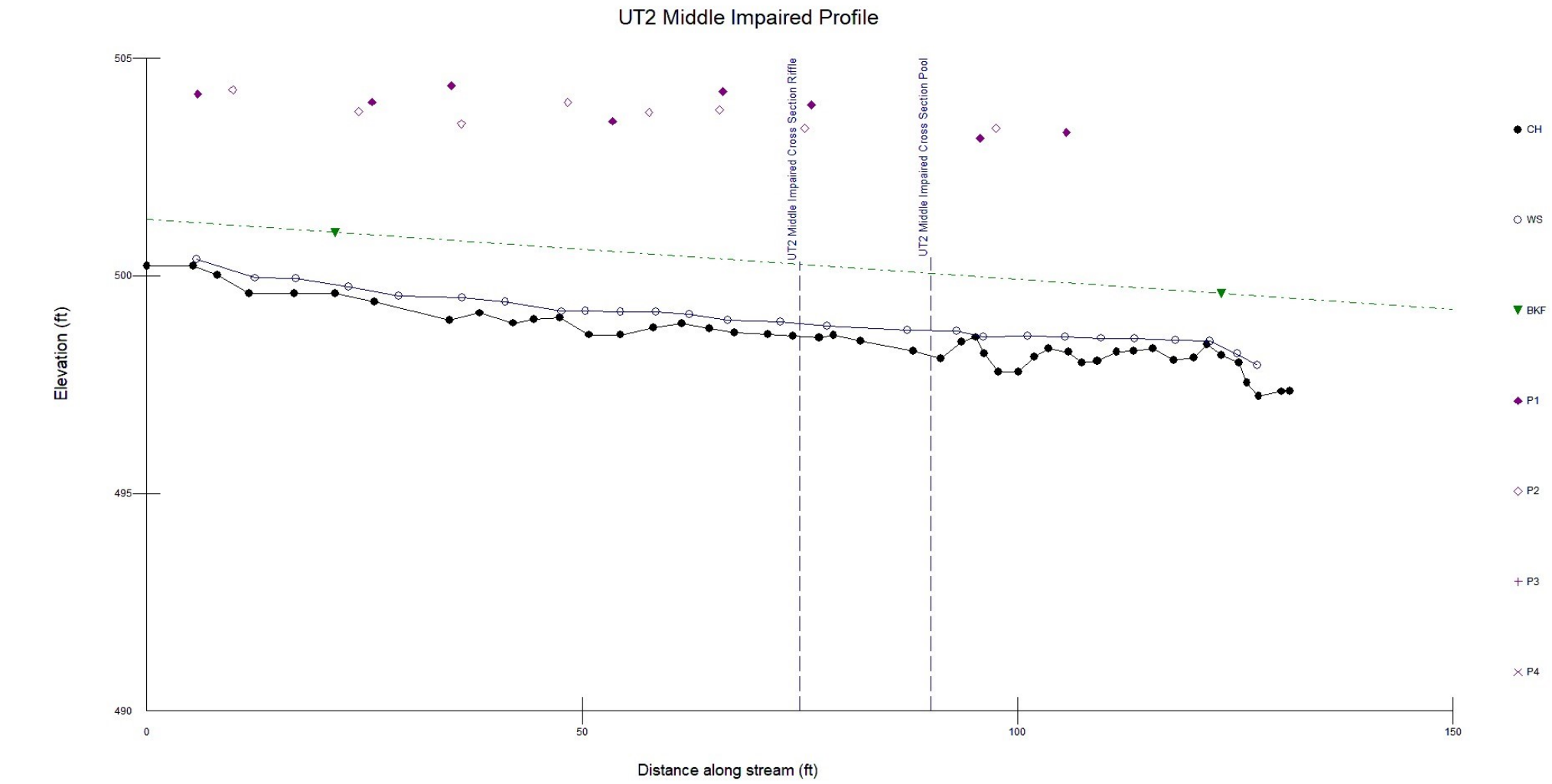

Graph
Tools
Drawing
Bankfull Elev 518.19
UT4 Upstream Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.33
Dbkf = .54
Abkf = 3.42
519.0
518.5
518.0
517.5
517.0
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)
Mouse X
Mouse Y
-1.70
518.60

# APPENDIX H

# STREAM PROFILES

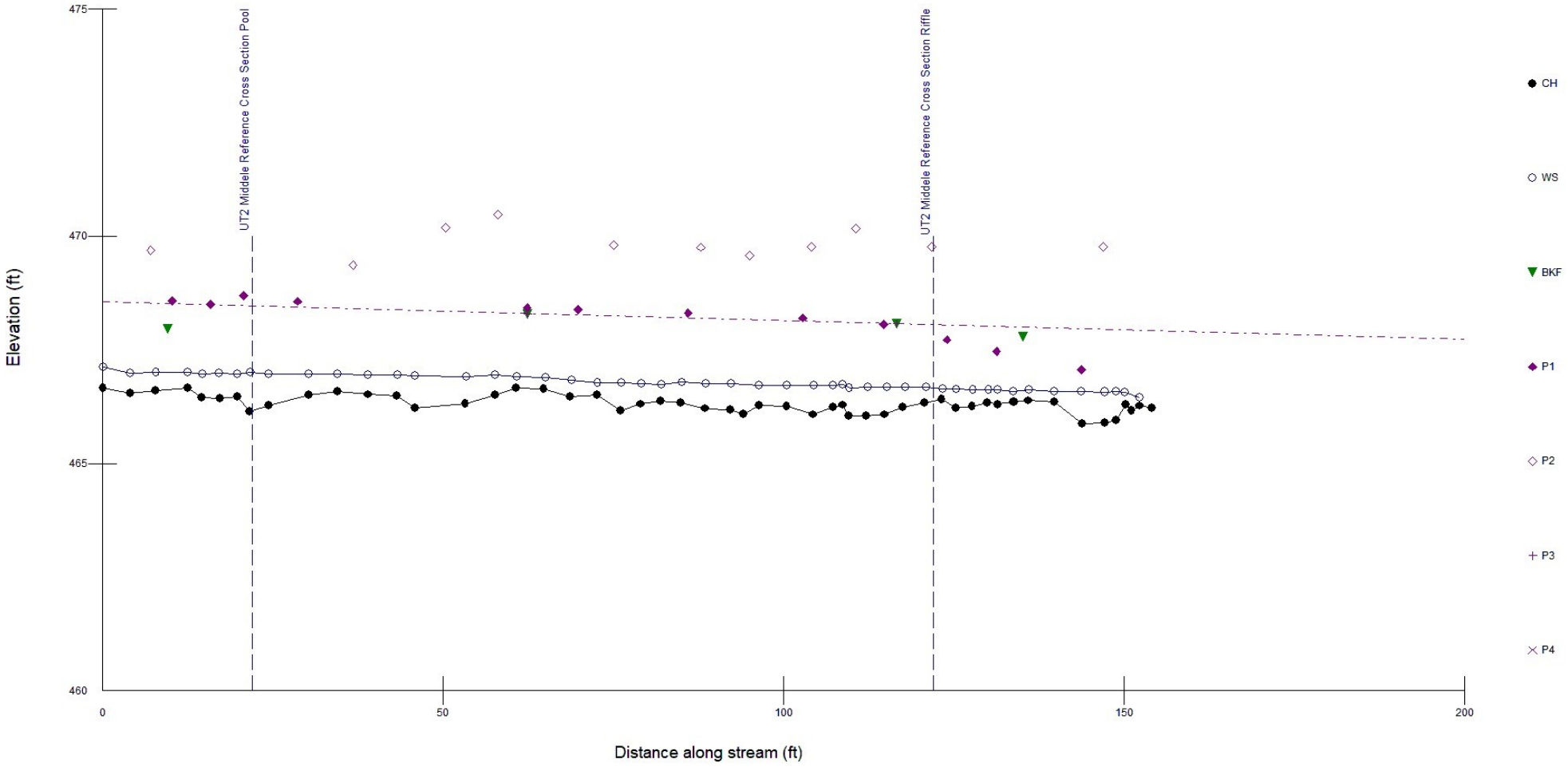



BKF Best Fit Slope = 0.00301

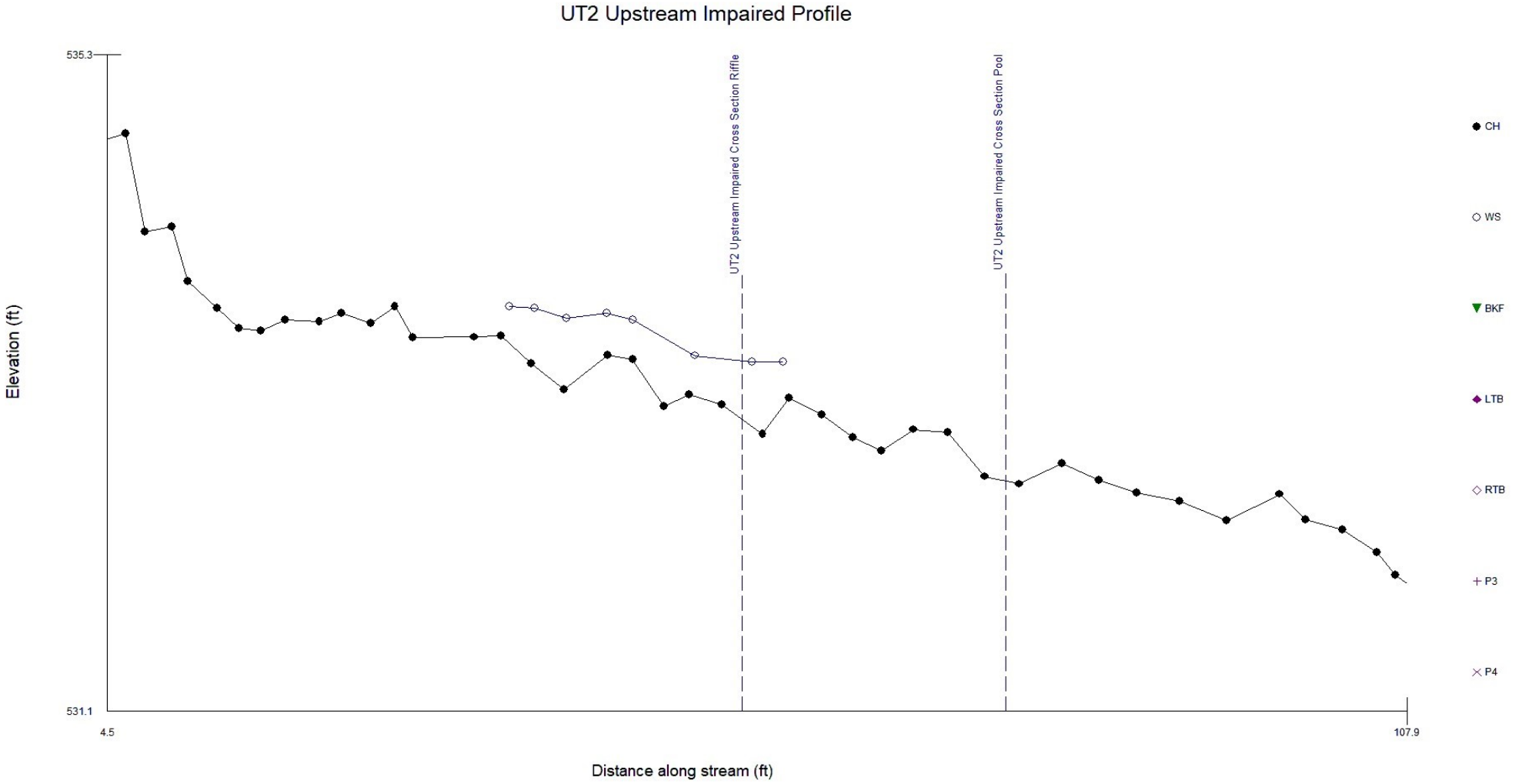


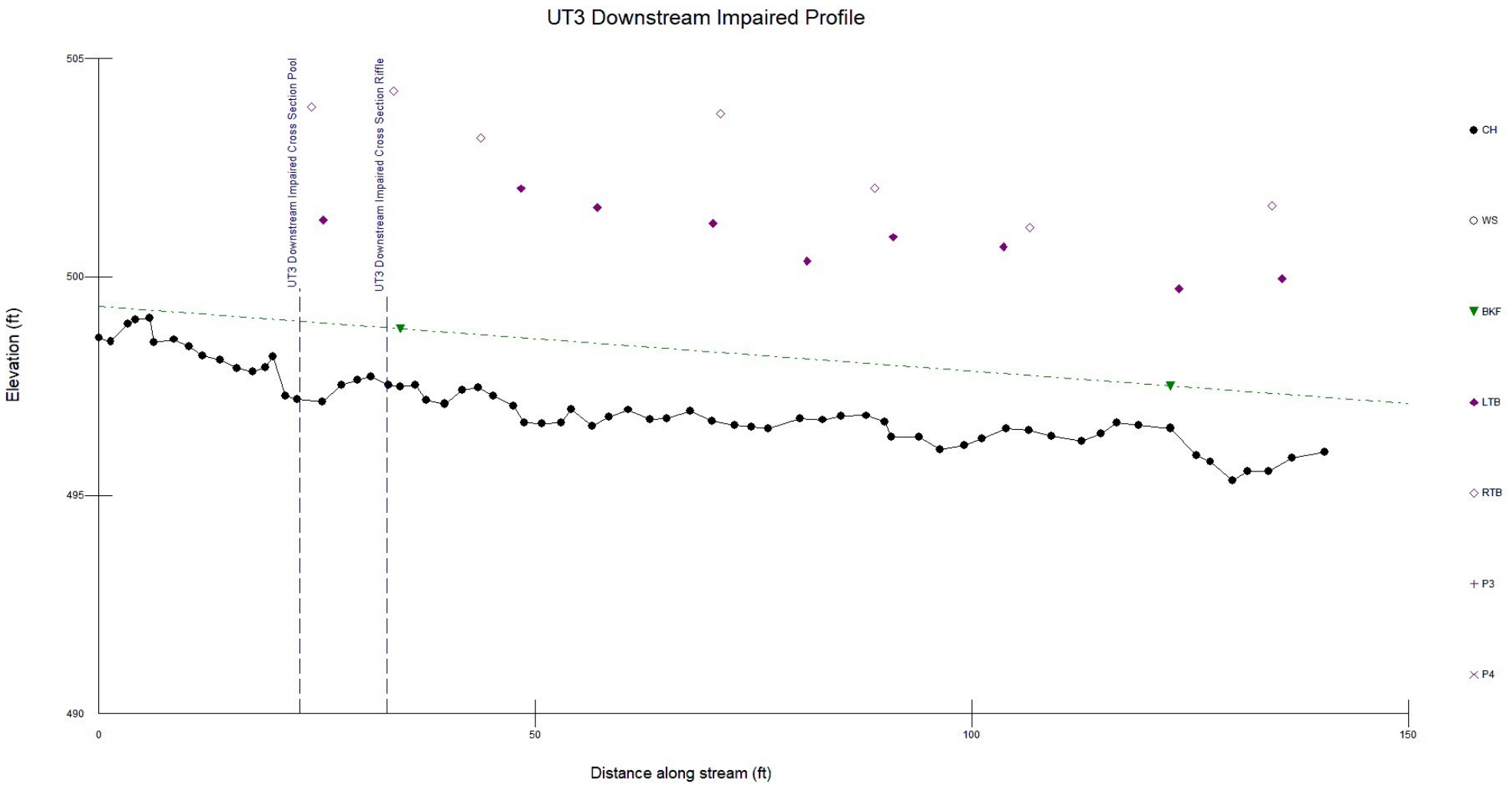

BKF Best Fit Slope = 0.01376

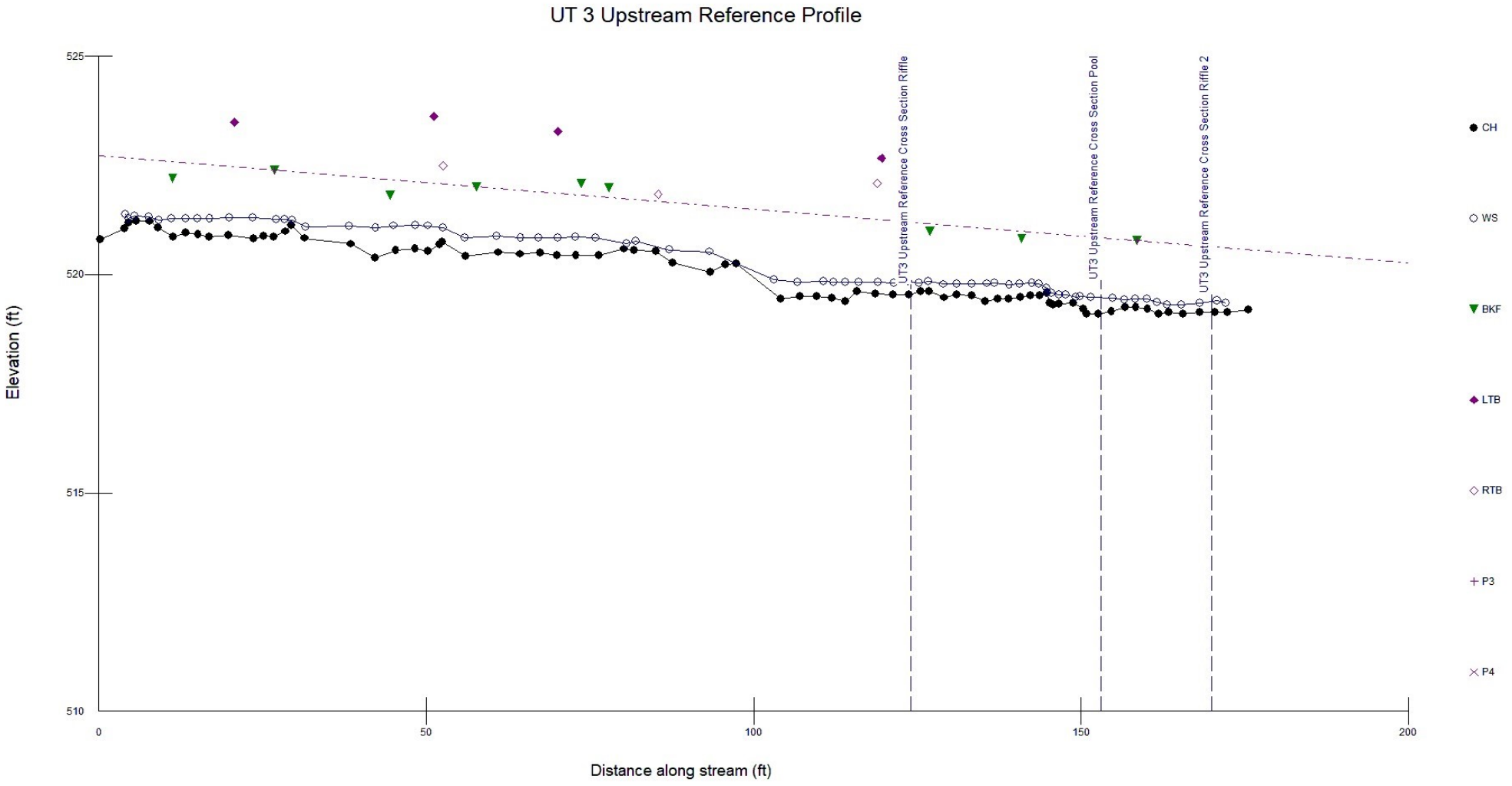
# UT2 Middle Reference Profile



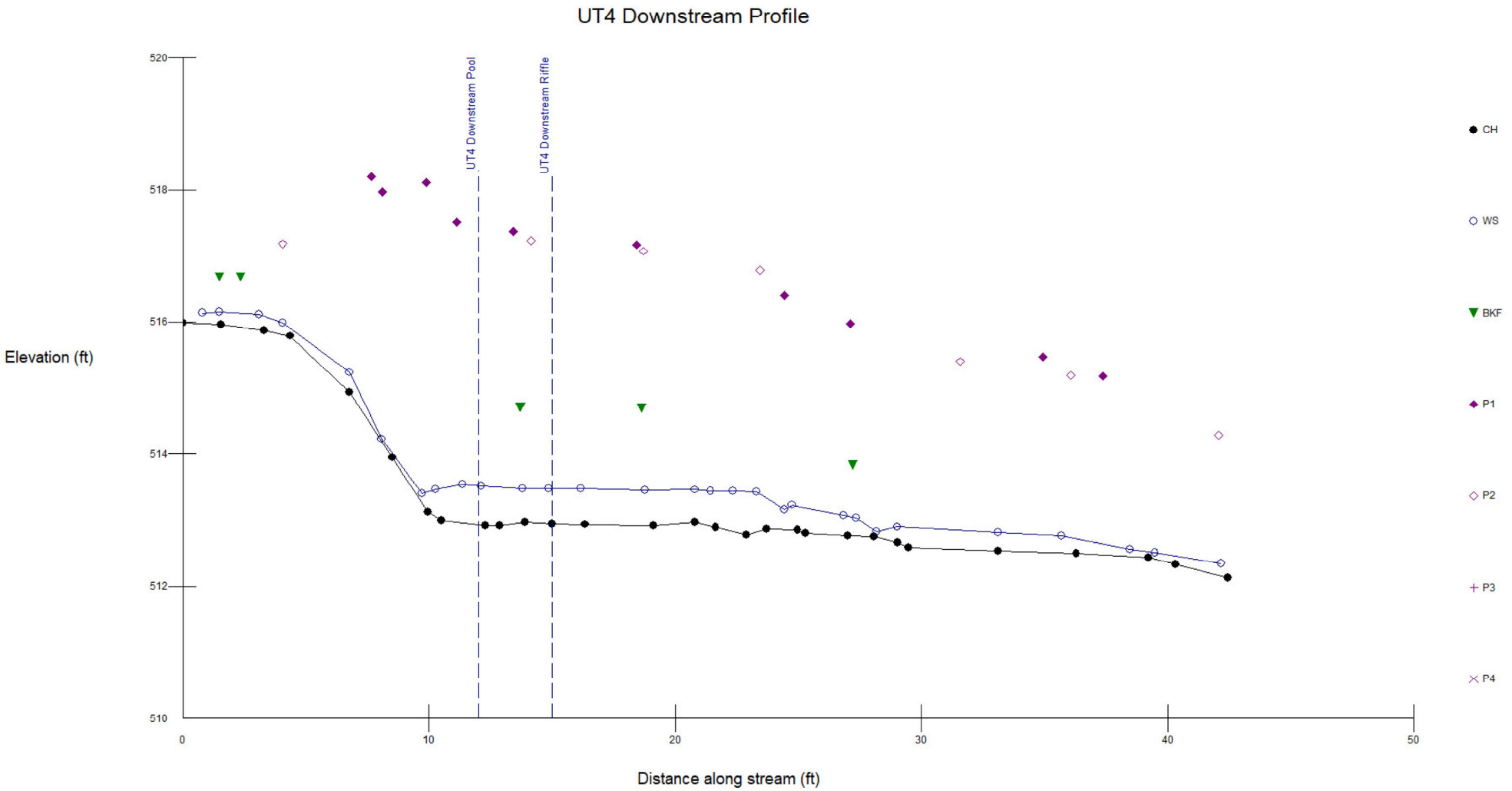

P3 Best Fit Slope = 0.00409

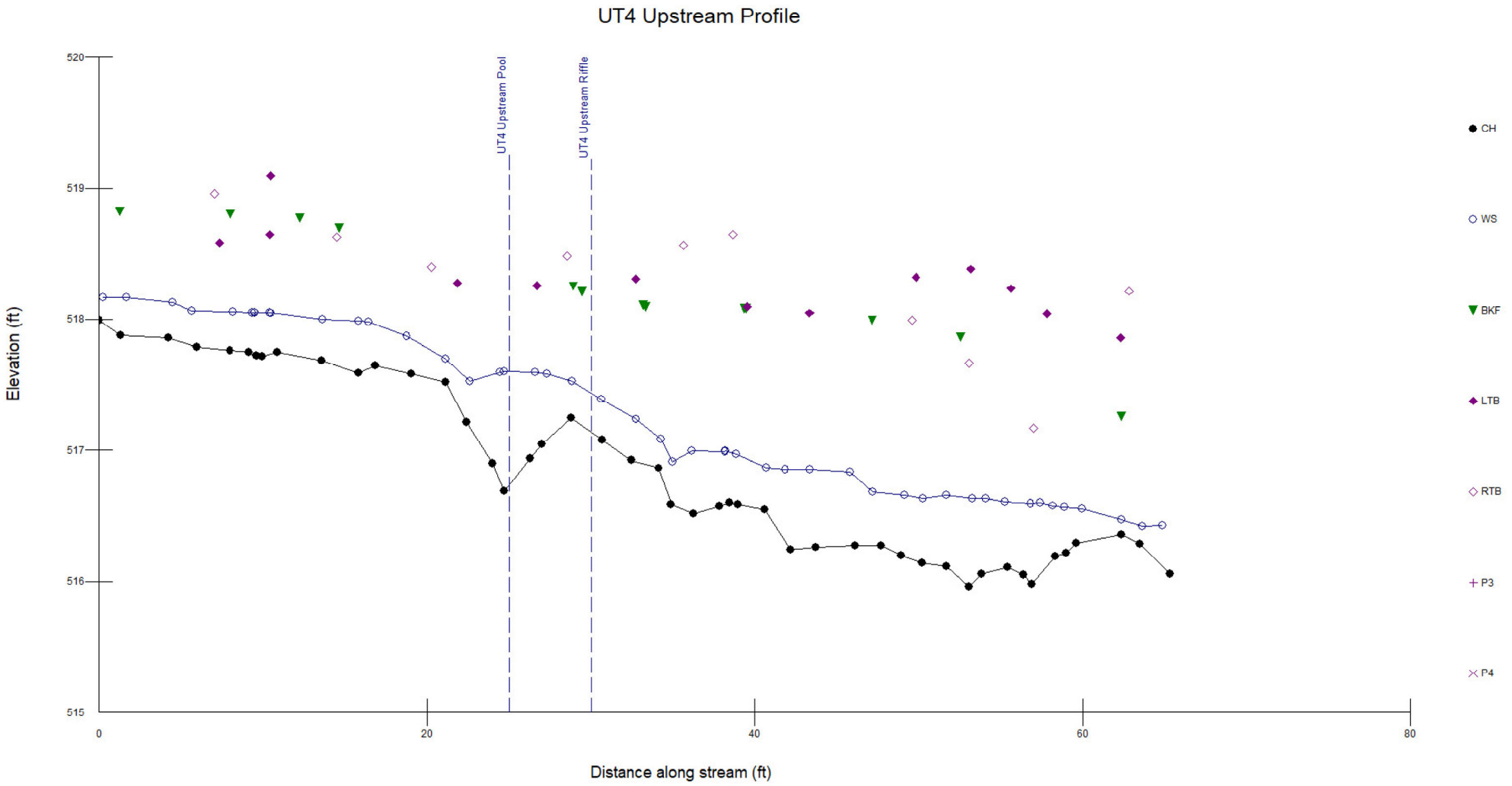

UT2 Upstream Impaired Profile
535.3
531.1
4.5
107.9
Elevation (ft)
Distance along stream (ft)
UT2 Upstream Impaired Cross Section Riffle
UT2 Upstream Impaired Cross Section Pool
CH
WS
BKF
LTB
RTB
P3
P4


UT3 Downstream Impaired Profile
505
500
495
490
Elevation (ft)
UT3 Downstream Impaired Cross Section Pool
UT3 Downstream Impaired Cross Section Riffle
0
50
100
150
Distance along stream (ft)
CH
WS
BKF
LTB
RTB
P3
P4



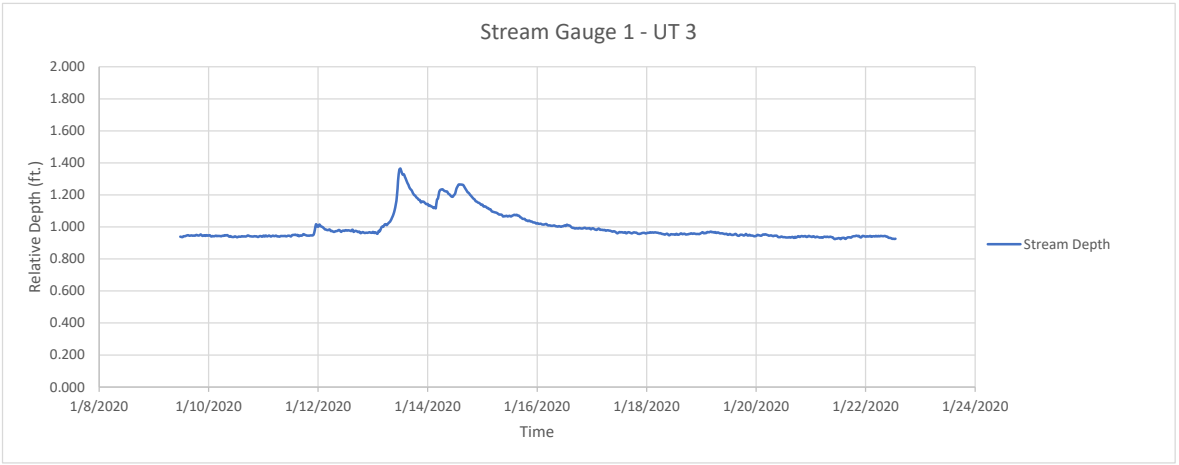

P3 Best Fit Slope = 0.01222

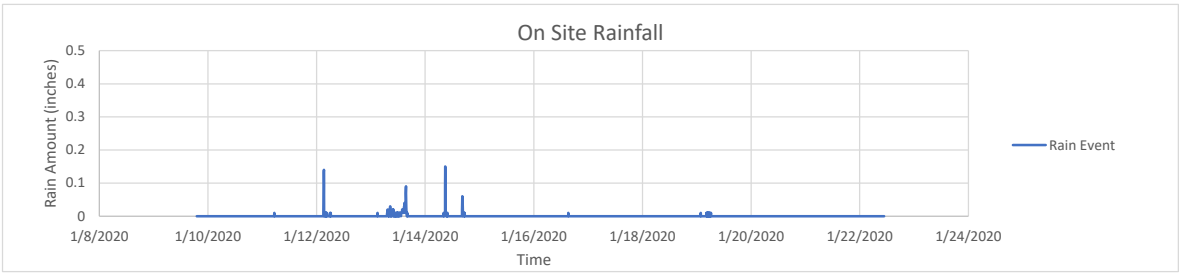

UT4 Downstream Profile
UT4 Downstream Pool
UT4 Downstream Riffle
Elevation (ft)
520
518
516
514
512
510
0
10
20
30
40
50
Distance along stream (ft)
CH
WS
BKF
P1
P2
P3
P4

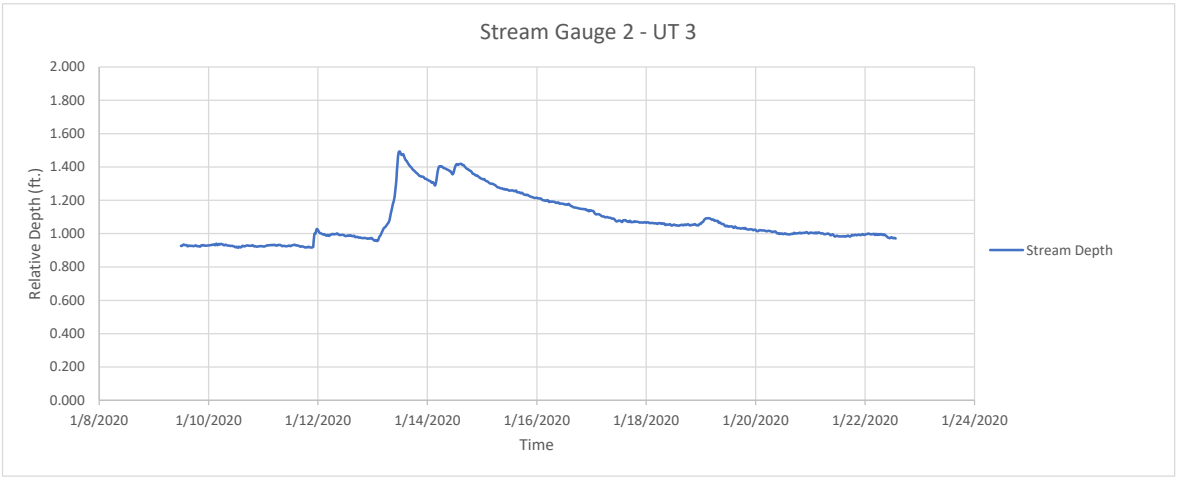

UT4 Upstream Profile
520
519
518
517
516
515
Elevation (ft)
UT4 Upstream Pool
UT4 Upstream Riffle
0
20
40
60
80
Distance along stream (ft)
CH
WS
BKF
LTB
RTB
P3
P4

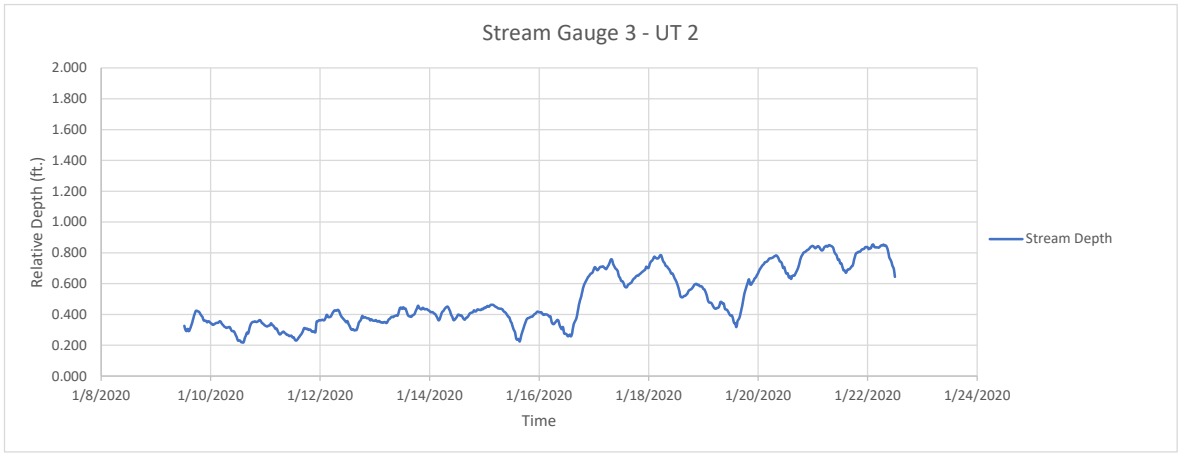
# APPENDIX I

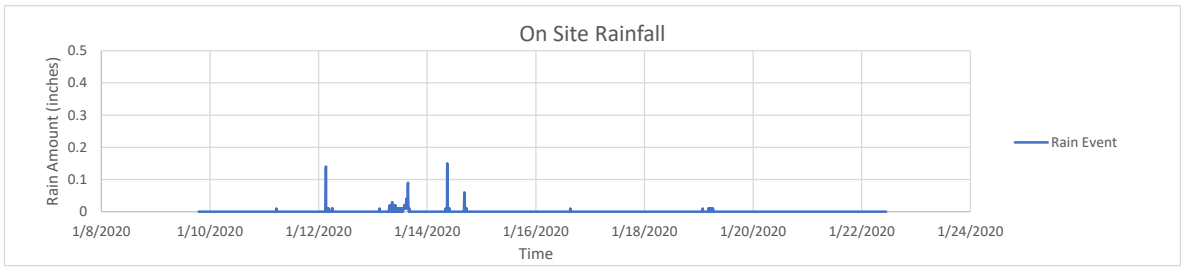
# STREAM GAUGE AND GROUNDWATER WELL HYDROGRAPHS

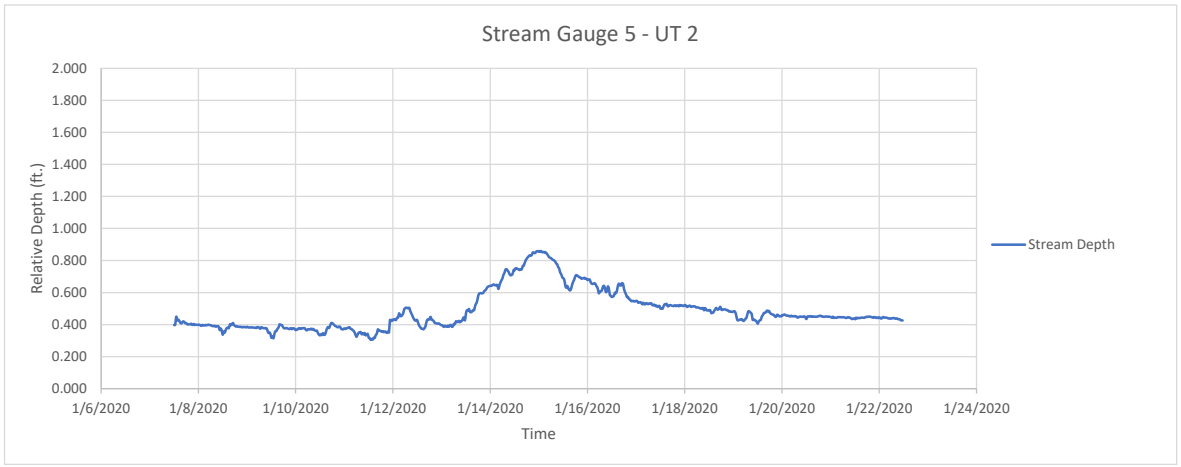

Stream Gauge 1 - UT 3
Relative Depth (ft.)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Stream Depth

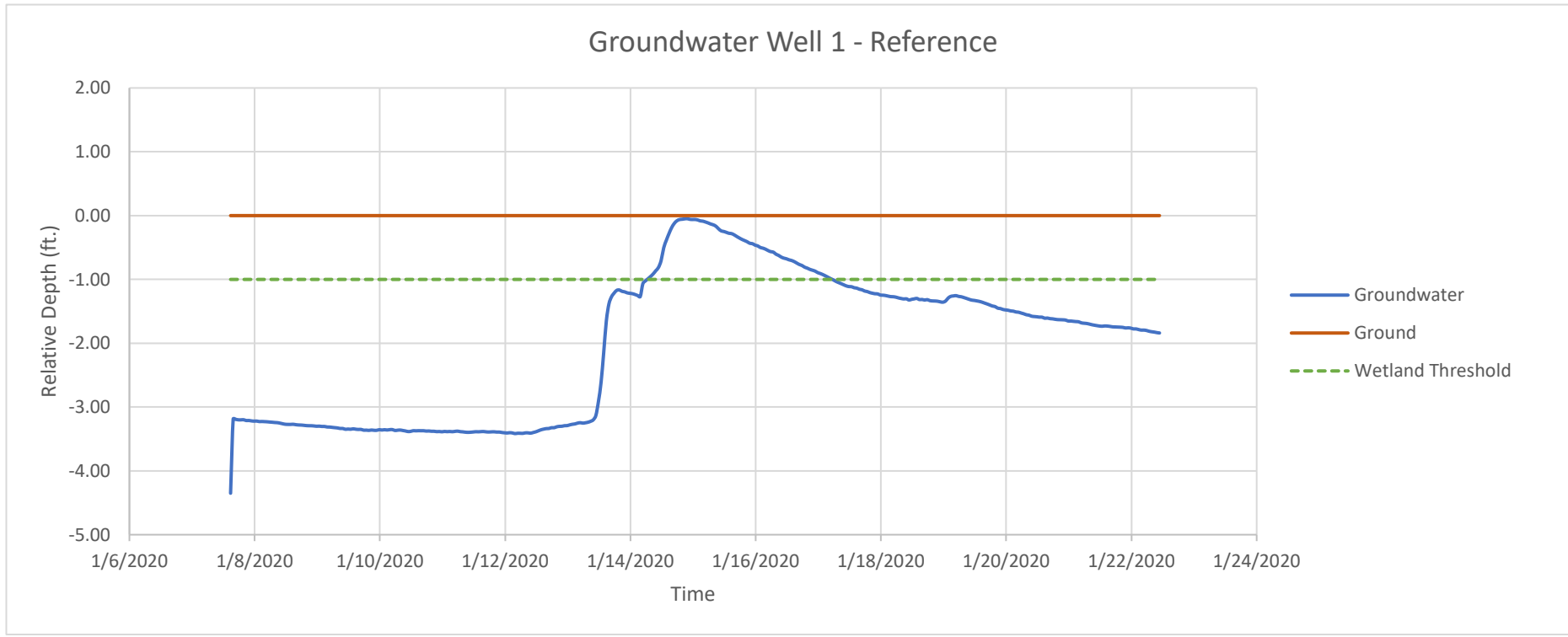

On Site Rainfall
Rain Amount (inches)
0.5
0.4
0.3
0.2
0.1
0
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Rain Event

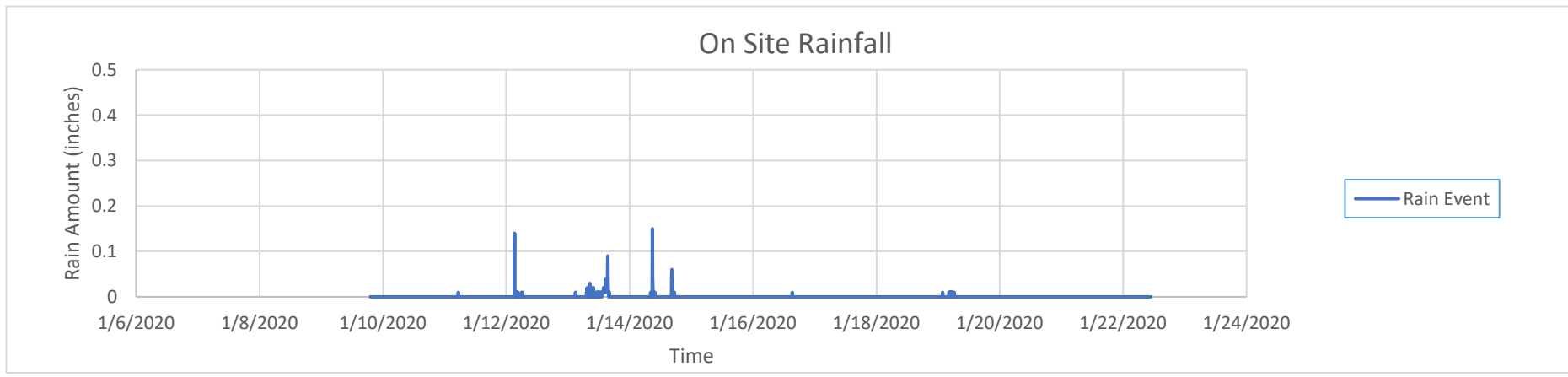

Stream Gauge 2 - UT 3
Relative Depth (ft.)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Stream Depth

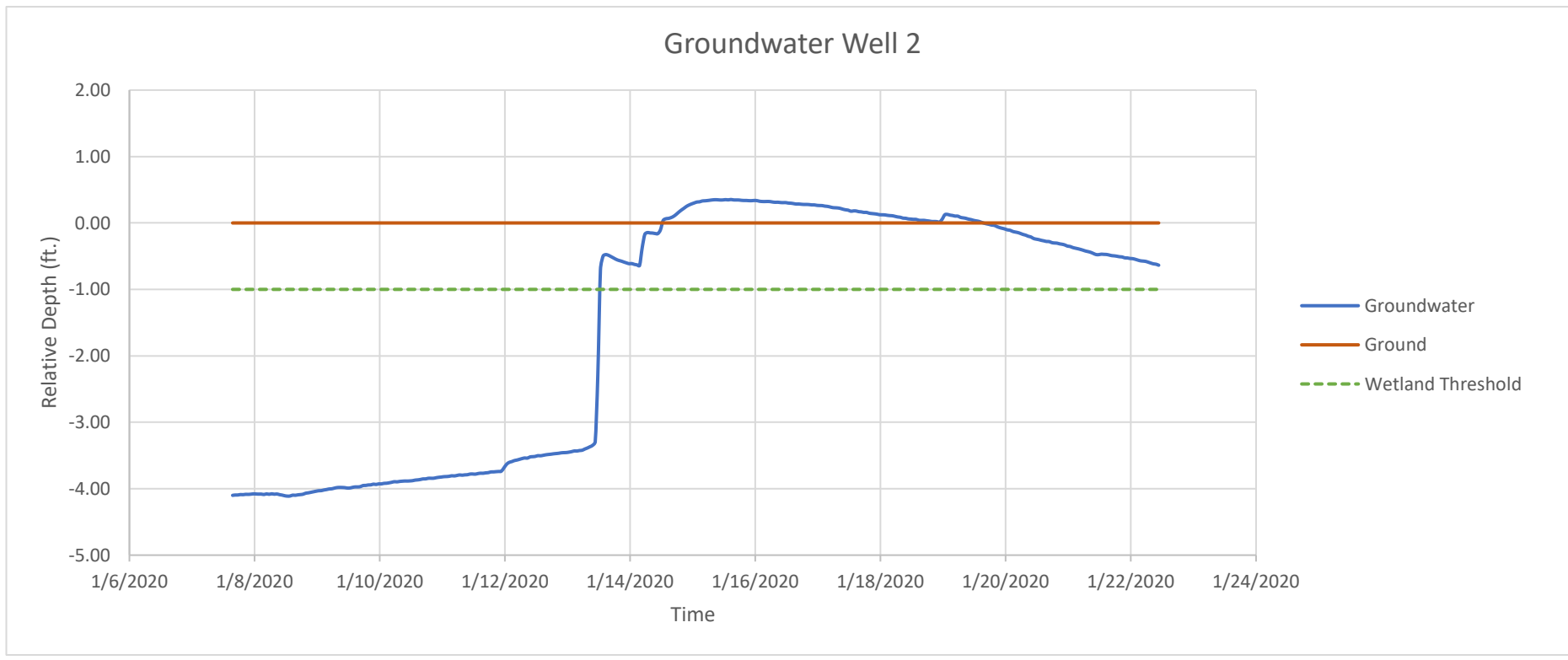

Stream Gauge 3 - UT 2
Relative Depth (ft.)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Stream Depth


On Site Rainfall
Rain Amount (inches)
0.5
0.4
0.3
0.2
0.1
0
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Rain Event


Stream Gauge 5 - UT 2
Relative Depth (ft.)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1/6/2020
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Stream Depth


Groundwater Well 1 - Reference
Relative Depth (ft.)
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
1/6/2020
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Groundwater
Ground
Wetland Threshold


On Site Rainfall
Rain Amount (inches)
0.5
0.4
0.3
0.2
0.1
0
1/6/2020
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Rain Event


Groundwater Well 2
Relative Depth (ft.)
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
1/6/2020
1/8/2020
1/10/2020
1/12/2020
1/14/2020
1/16/2020
1/18/2020
1/20/2020
1/22/2020
1/24/2020
Time
Groundwater
Ground
Wetland Threshold

# APPENDIX J

# GROUNDWATER WELL INSTALLATION DATA SHEETS

# Installation Data Sheet

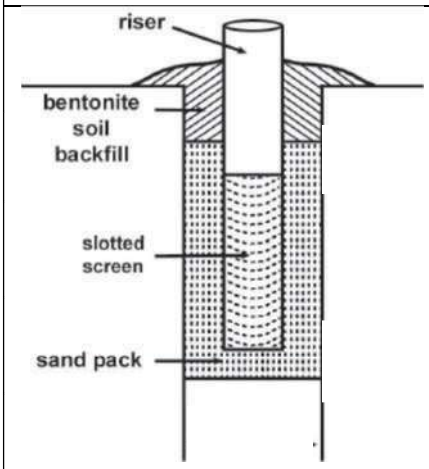
**Project Name:** Landsford Tract PRM
**Date of Installation:** 7 JAN 2020
**Length of PVC:** 10 feet
**Personnel:** Tory Grayson, Chris Carter
**Well Identification Code:** Well 1
**Serial Number:** 20769713 / 20766456
**General Notes:** Located in northern end of existing wetland as reference hydrology condition.

**Type of Instrument**
Source of Instrument / well stock: Onset MX-2001

Material of well stock: Schedule 40 PVC
Diameter of pipe: 2 inches
Slot size: 0.01 inch
Slot spacing: 1.0 inch
Kind of well cap: Onset locking cap
Kind of end plug: PVC Cone

**Nature of Installation Materials**
Nature of packing sand: 20-40 inch silica
Kind of bentonite: N/A
Nature of backfill: All-purpose sand
Depth of backfill: 4.35 ft
Was bentonite installed below groundwater depth at installation? No
Was water added to bentonite for expansion? No
Method of measuring water levels in instrument: Barometric Pressure
Was instrument checked for clogging after installation? Yes
Distance from calibration point to ground level: 5.65 ft

**Typical Instrument Diagram**




**Soil Characteristics**

| Depth (inches) | Texture | Munsell Soil Color | Roots | Consistency | Redox Features |
|---|---|---|---|---|---|
| 0-5 | Loam | 7.5YR 4/1 | | | |
| 5-22 | Sandy Loam | 7.5 YR 5/3 | | | |
| 22-48 | Loamy Clay | 7.5YR 6/1 | | | 5YR 4/6 (25%) |
| 48-54 | Clay | Gley w/ redox | | | |

**Notes:**
Saturated at ~6 to 7 inches below surface. Water was present upon installation within the hole. Gauge was launched dry with a reference water elevation of 0.

Well 1 - Reference

| | |
|---|---|
| **Project** | Landsford Tract Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina |

Palustrine Group

# Installation Data Sheet

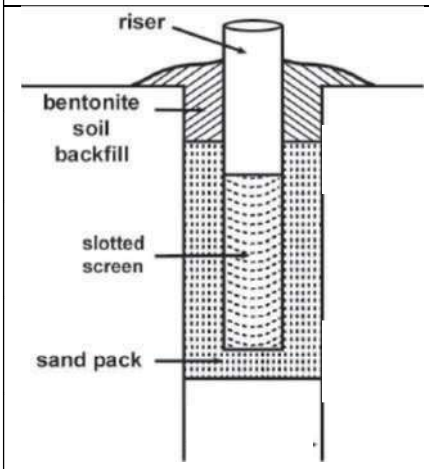
**Project Name:** Landsford Tract PRM
**Date of Installation:** 7 JAN 2020
**Length of PVC:** 10 feet
**Personnel:** Tory Grayson, Chris Carter
**Well Identification Code:** Well 2
**Serial Number:** 20769713 / 20766456
**General Notes:** Located in southern end of existing wetland near existing drainage ditch

**Type of Instrument**
Source of Instrument / well stock: Onset MX-2001

Material of well stock: Schedule 40 PVC
Diameter of pipe: 2 inches
Slot size: 0.01 inch
Slot spacing: 1.0 inch
Kind of well cap: Onset locking cap
Kind of end plug: PVC Cone

**Nature of Installation Materials**
Nature of packing sand: 20-40 inch silica
Kind of bentonite: N/A
Nature of backfill: All-purpose sand
Depth of backfill: 4.1ft
Was bentonite installed below groundwater depth at installation? No
Was water added to bentonite for expansion? No
Method of measuring water levels in instrument: Barometric Pressure
Was instrument checked for clogging after installation? Yes
Distance from calibration point to ground level: 5.9 ft

**Typical Instrument Diagram**




**Soil Characteristics**

| Depth (inches) | Texture | Munsell Soil Color | Roots | Consistency | Redox Features |
|---|---|---|---|---|---|
| 0-6 | Loam | 7.5YR 4/1 | | | |
| 6-30 | Silt Loam | 7.5 YR 4/2 | | | 7.5 YR 6/4 (50%) |
| 30-41 | Clay | 7.5YR 7/1 | | | 5YR 4/6 (30%) |
| 41-58 | Clay | Gley w/ redox | | | 5YR 4/6 (40%) |

**Notes:**
Dry. Gauge was launched dry with a reference water elevation of 0. Logging interval = 30 min.

Well 2 - Soil

| | |
|---|---|
| **Project** | Landsford Tract Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina |

Palustrine Group

Well 1 - Reference

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

Well 1 – Reference Soil

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

Well 2

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

Well 2 - Soil

| | | |
|---|---|---|
| **Project** | Landsford Tract Final Permittee-Responsible Mitigation Plan<br>Chester County, South Carolina | Palustrine Group |

# APPENDIX K

# WATER QUALITY SAMPLING RESULTS

Rogers & Callcott ENVIRONMENTAL

Laboratory Services

# Laboratory Report

| | | | |
|---|---|---|---|
| **Client** | Palustrine Group - Tory Greyson<br>9 Avondale Ave<br>Charleston, SC 29407 | **Project:**<br>**Work Order:**<br>**Received:** | Miscellaneous<br>0011170<br>01/22/2020 15:00 |

Dear Client:

Rogers and Callcott appreciates the opportunity to be of service to you. The attached laboratory services report includes analytical results and chain of custody for samples that were received on January 22, 2020. Rogers and Callcott maintains a formal QA/QC program. Unless otherwise noted, all analyses performed under NELAP certification have complied with all the requirements for the TNI standard. The analyses met the QA/QC confidence interval for each test method unless otherwise qualified. Estimated uncertainty is available upon request.

Privileged / Confidential information may be contained in this report and is intended only for the use of the addressee. If you are not the addressee, or the person responsible for delivering to the person addressed, you may not copy or deliver this message to anyone else. If you receive this message by mistake, please notify Rogers and Callcott immediately.

We strive to provide excellent service to our clients. Please contact Jessica Meyers, your Project Manager, at jessica.meyers@rogersandcallcott.com or (864)-232-1556 if you have any questions about this report.

Report Approved By:

Jessica Meyers
Project Manager

PO Box 5655 | Greenville, SC 29606 | 426 Fairforest Way | Greenville, SC 29607 | main 864.232.1556 | fax 864.232.6140 rogersandcallcott.com
an employee-owned company

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Rogers & Callcott ENVIRONMENTAL

# Certificate of Analysis

*South Carolina Greenville Laboratory Identification 23105*
*South Carolina Columbia Laboratory Identification 40572*
*North Carolina Laboratory Certification Number 27*
*North Carolina Drinking Water Lab Number 45710*
*NELAP Utah Certificate Number SC000042014-1*
*Georgia Drinking Water Lab ID 880*

**Client** Palustrine Group - Tory Greyson
9 Avondale Ave
Charleston, SC 29407

**Project:** Miscellaneous
**Work Order:** 0011170
**Received:** 01/22/2020 15:00

| Sample Number | Sample Description | Matrix | Sampled | Type |
|---|---|---|---|---|
| 0011170-01 | UT2 Section 1 | Surface Water | 01/22/20 12:30 | Grab |
| 0011170-02 | UT2 Section 3 | Surface Water | 01/22/20 12:55 | Grab |
| 0011170-03 | UT3 Section 1 | Surface Water | 01/22/20 13:25 | Grab |


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Rogers & Callcott ENVIRONMENTAL

| | | | |
|---|---|---|---|
| Palustrine Group - Tory Greyson | | Project: | Miscellaneous |
| 9 Avondale Ave | | Work Order: | 0011170 |
| Charleston, SC 29407 | | Reported: | 01/27/20 15:27 |

## Sample Data

**Sample Number** 0011170-01
**Sample Description** UT2 Section 1 collected on 01/22/20 12:30

| Parameter | Result | Reporting Limit | Units | DF | Analyzed | Method | Flag | Analyst | Batch | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| **Microbiological Parameters** | | | | | | | | | | |
| Fecal Coliform | **220** | 20 | MPN/100 mL | 20.0 | 01/22/20 16:23 | Colilert 18 | | BNE | B0A1112 | RC-C |
| **General Chemistry Parameters** | | | | | | | | | | |
| Turbidity (Lab) | **6.0** | 1.0 | NTU | 1.00 | 01/23/20 10:45 | EPA 180.1 | | TLT | B0A1101 | RC-G |

**Sample Number** 0011170-02
**Sample Description** UT2 Section 3 collected on 01/22/20 12:55

| Parameter | Result | Reporting Limit | Units | DF | Analyzed | Method | Flag | Analyst | Batch | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| **Microbiological Parameters** | | | | | | | | | | |
| Fecal Coliform | **82** | 20 | MPN/100 mL | 20.0 | 01/22/20 16:23 | Colilert 18 | | BNE | B0A1112 | RC-C |
| **General Chemistry Parameters** | | | | | | | | | | |
| Turbidity (Lab) | **11** | 1.0 | NTU | 1.00 | 01/23/20 10:45 | EPA 180.1 | | TLT | B0A1101 | RC-G |

**Sample Number** 0011170-03
**Sample Description** UT3 Section 1 collected on 01/22/20 13:25

| Parameter | Result | Reporting Limit | Units | DF | Analyzed | Method | Flag | Analyst | Batch | Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| **Microbiological Parameters** | | | | | | | | | | |
| Fecal Coliform | **20920** | 20 | MPN/100 mL | 20.0 | 01/22/20 16:23 | Colilert 18 | | BNE | B0A1112 | RC-C |
| **General Chemistry Parameters** | | | | | | | | | | |
| Turbidity (Lab) | **8.6** | 1.0 | NTU | 1.00 | 01/23/20 10:45 | EPA 180.1 | | TLT | B0A1101 | RC-G |



*01/27/2020 15:27* *This report may not be reproduced, except in full, without written permission from Rogers & Callcott, Inc.*

Rogers & Callcott ENVIRONMENTAL

| | | | |
|---|---|---|---|
| Palustrine Group - Tory Greyson | | Project: | Miscellaneous |
| 9 Avondale Ave | | Work Order: | 0011170 |
| Charleston, SC 29407 | | Reported: | 01/27/20 15:27 |

## Data Qualifiers and Definitions

| | |
|---|---|
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not reported |

Laboratory Reference:

RC-G = Rogers and Callcott, 426 Fairforest Way, Greenville, SC 29607 / SC Lab ID 23105
RC-C = Rogers and Callcott, 215B Stoneridge Drive, Columbia, SC 29210 / SC Lab ID 40572


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# Rogers & Callcott ENVIRONMENTAL

*Half a century of commitment and quality*

# CHAIN OF CUSTODY RECORD

WORK ORDER 001170


Mailing Address: PO Box 5655, Greenville, SC 29606, Phone (864) 232-1556

Shipping Address: 426 Fairforest Way, Greenville, SC 29607, Fax (864) 232-6140

215B Stoneridge Drive, Columbia, SC 29210, Phone (803) 509-8999


Client Name: Palmetto Group

Address: 9 Avondale Ave, Charleston, SC 29407

Report To: ~~Tommy Cassis~~ Tory Greyson

Email Address: TGreyson@Palmettogroup.com

Telephone #: 703 969 9245

PO #: _____ Project # Landfield

| R & C WORK ORDER | YR 20 DATE | TIME | SAMPLE DESCRIPTION | Total Number of Containers | Parameter(s) → Fecal coliform | Turbidity | | | | | | Filtered (Yes/No) | Cooled (Yes/No) | Container Type (Plastic/Glass) | Container Volume (mL) | Sample Type (Grab/Composite) | Sample Source (WW, GW, DW, SW, S, Other) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Y | Y | | | | | | Y | Y | P | 120 | G | SW | F |
| -01 | 1/22 | 12:30 | UT2 Section 1 | 1 | ✓ | | | | | | | | | | | | | |
| -01 | 1/22 | 12:30 | UT2 Section 1 | 1 | | ✓ | | | | | | | | | | | | |
| -02 | 1/22 | 12:55 | UT2 Section 3 | 1 | ✓ | | | | | | | | | | | | | |
| -02 | 1/22 | 12:55 | UT2 Section 3 | 1 | | ✓ | | | | | | | | | | | | |
| -03 | 1/22 | 1:25 | UT3 Section 1 | 1 | ✓ | | | | | | | | | | | | | |
| -03 | 1/22 | 1:25 | UT3 Section 1 | 1 | | ✓ | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
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Preservation Code(s)

| | | |
|---|---|---|
| A - None | E - HCl | I - Zn Acetate |
| B - $HNO_3$ | F - $Na_2S_2O_3$ | J - $H_3PO_4$ |
| C - $H_2SO_4$ | G - Boric Acid | K - $NaH_2PO_4$ |
| D - NaOH | H - Ascorbic Acid | L - $NH_4Cl$ |

| | DATE/TIME: | | DATE/TIME: |
|---|---|---|---|
| SAMPLER – RELINQUISHED BY: 1. Tory Greyson | 1/22/20 15:00 | RECEIVED BY: 2. | 1-22-20 1500 |
| RELINQUISHED BY: 3. | DATE/TIME: | RECEIVED BY: 4. | DATE/TIME: |
| RELINQUISHED BY: 5. | DATE/TIME: | RECEIVED BY: 6. | DATE/TIME: |
| RELINQUISHED BY: 7. | DATE/TIME: | RECEIVED BY: 8. | DATE/TIME: |

Composite Start Date/Time: _____

Composite End Date/Time: _____

Time or Flow (Circle one) Initials: _____

Temperature of blank or representative sample

At time of collection _____ °C

At time of lab receipt 1.8 °C

Possible Hazards associated with samples: ○ Non-Hazard ○ Flammable ○ Skin Irritant ○ Poison ○ Unknown ○ Other _____

Form Revised March, 2019

Rogers & Callcott
ENVIRONMENTAL

426 Fairforest Way, Greenville, SC 29607
215 Suite B Stoneridge Dr, Columbia, SC 29210
T: 864-232-1556
F: 864-232-6140

# Interlab Transfer COC from Columbia to Greenville

**Client:** Walk-In O-Q **Project:** Miscellaneous-Cola

Received: 01/22/20 15:00 Received By: Bailey Branham

**0011170-01**

| Sample Number | Analysis | Container | Number of Containers | Date/Time Sampled |
|---|---|---|---|---|
| 0011170-01 | Turbidity Lab | Poly Unpres - 250ml | 1 | 01/22/20 12:30 |

**0011170-02**

| Sample Number | Analysis | Container | Number of Containers | Date/Time Sampled |
|---|---|---|---|---|
| 0011170-02 | Turbidity Lab | Poly Unpres - 250ml | 1 | 01/22/20 12:55 |

**0011170-03**

| Sample Number | Analysis | Container | Number of Containers | Date/Time Sampled |
|---|---|---|---|---|
| 0011170-03 | Turbidity Lab | Poly Unpres - 250ml | 1 | 01/22/20 13:25 |

| Removed from secure lab fridge in Columbia by: | Date | Time |
|---|---|---|
| [signature] | 1-22-20 | 1600 |
| Received by: (Signature) | Date | Time |
| [signature] | 1-22-20 | 1600 |
| Relinquished by: (Signature) | Date | Time |
| [signature] | 1.23.20 | 1040 |
| Received by: (Signature) | Date | Time |
| [signature] | 1.23.20 | 1040 |
| Relinquished by: (Signature) | Date | Time |
| | | |
| Received by: (Signature) | Date | Time |
| | | |

Revised: April 2016

Rogers & Callcott ENVIRONMENTAL
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# Sample Receipt Verification

Client: Palustrine Group  Date Received: 1-22-20  Work Order: 0011170

Carrier Name: (to Columbia) (Client) FedEx UPS US Mail Courier Field Services Other: _____
Tracking Number: _____

Carrier Name: (to Greenville) Client FedEx UPS US Mail (Courier) Field Services Other: _____
Tracking Number: 971081

| Receipt Criteria | Yes | No | NA | Comments |
|---|---|---|---|---|
| Shipping container / cooler intact? | X | | | Damaged Leaking Other: |
| Custody seals intact? | | | X | |
| COC included with samples? | X | | | |
| COC signed when relinquished and received? | X | | | |
| Sample bottles intact? | X | | | Damaged Leaking Other: |
| Sample ID on COC agree with label on bottle(s)? | X | | | |
| Date / time on COC agree with label on bottle(s)? | X | | | |
| Number of bottles on COC agrees with number of bottles received? | X | | | |
| Samples received within holding time? | X | | | |
| Sample volume sufficient for analysis? | X | | | |
| VOA vials free of headspace (<6mm bubble)? | | | X | |
| Samples requiring pH preservation at proper pH? Note: Samples for metals analysis may be preserved upon receipt in the lab. Note: Samples for O&G and VOA analysis – preservation checked at bench. | | | X | |
| Samples dechlorinated for parameters requiring chlorine removal at the time of sample collection? Note: Chlorine checked at bench for samples requiring Bacterial, VOA, and HAA analysis. | X | | | |
| Samples cooled when received in **Columbia** ? Temp at time of receipt 1.8 °C; Temp measured with IR SN: 36301069WS | X | | | (Ice) Cold Packs Dry Ice None |
| Samples cooled when received in **Greenville** ? Temp at time of receipt 1.9 °C; Temp measured with IR SN: 97050067 | X | | | (Ice) Cold Packs Dry Ice None |

If in-house preservation used – record Lot #

| | | | |
|---|---|---|---|
| HCL | | $H_3PO_4$ | |
| $H_2SO_4$ | | NaOH | |
| $HNO_3$ | | Other | |

Comments:

Were non-conformance issues noted at initial sample receipt? Yes or (No)

Non-Conformance issue other than noted above:

*Note: Samples received initially in Columbia Facility. Sample preservation checks performed at Columbia Facility.* Revised March 2019

Completed by: [signature]

# APPENDIX L

# BENTHIC MACROINVERTEBRATE SAMPLING DATA

# MACROINVERTEBRATE ASSESSMENT OF THE LANDSFORD TRACT CHESTER COUNTY, SOUTH CAROLINA

JANUARY 2020

Submitted To:

PALUSTRINE GROUP
Charleston, South Carolina

Submitted by:

CARNAGEY BIOLOGICAL SERVICES, LLC
636 Westwood Drive
Lexington, South Carolina
803-233-6952

SCDHEC Laboratory Certification No. 32572

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## I. SUMMARY

On 21 January 2020, CARNAGEY BIOLOGICAL SERVICES, LLC (SCDHEC Laboratory Certification Number 32572) conducted an instream macroinvertebrate community assessment of the Landsford Tract, Chester County, South Carolina. The objective of this assessment was to determine the condition of the macroinvertebrate community at three sampling locations in tributaries of the Catawba River, prior to restoration.

All three of the tributaries had NCBI bioclassification scores of “excellent”. Station UT 2 Upstream had a SCDHEC bioclassification of “good” while Stations UT 2 Downstream and UT 3 had scores of “good-fair”. The EPT index value at UT 2 Upstream was average and low at the other stations.

All physicochemical parameters monitored were within water quality standards for Class FW waters of the State of South Carolina (SCDHEC, 1998).

## II. INTRODUCTION

On 21 January 2020, an instream macroinvertebrate assessment was conducted on the Landsford Tract, Chester County, South Carolina. The objective of this assessment was to determine the condition of the macroinvertebrate community at three sampling locations in tributaries of the Catawba River utilizing the South Carolina Multi-habitat Rapid Bioassessment after the streams were restored.

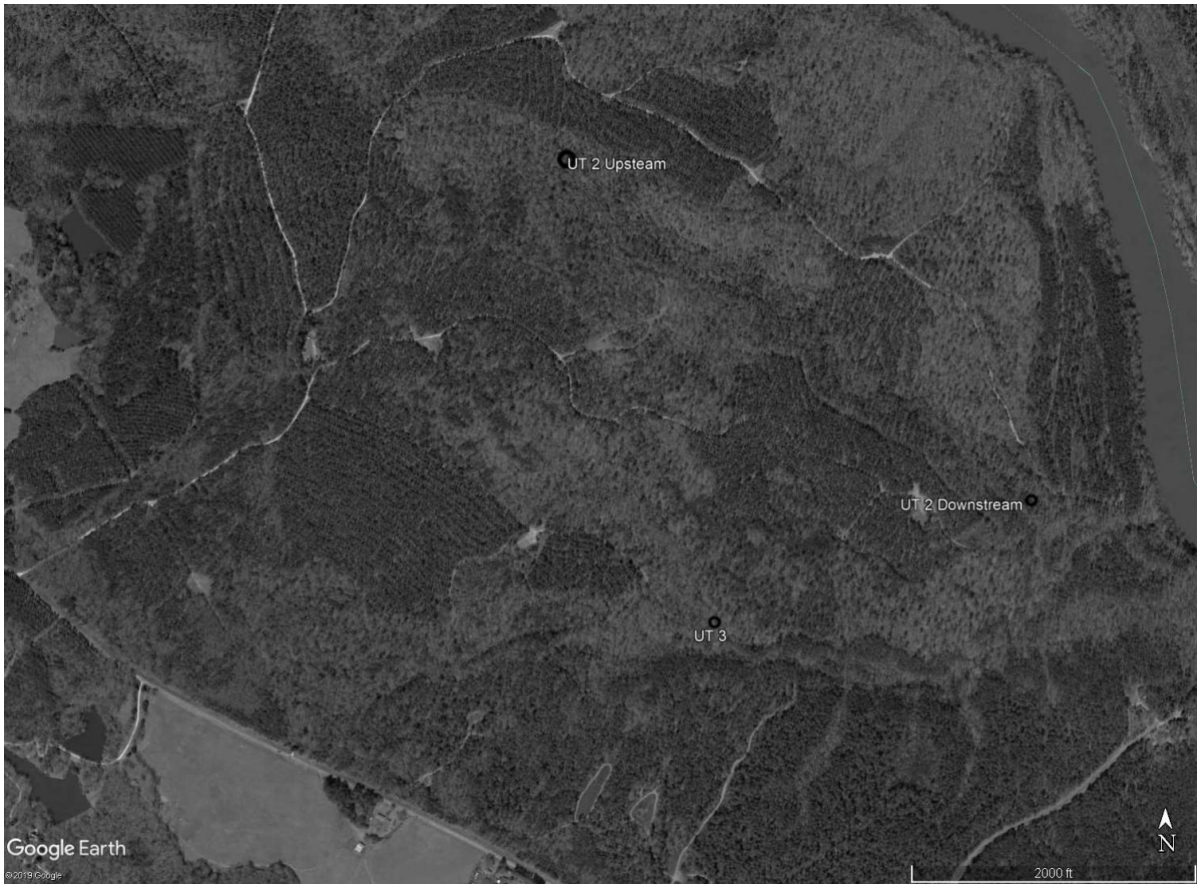
## III. DESCRIPTION OF STUDY AREA

Aquatic macroinvertebrates were collected at six sampling sites in the Landsford Tract, Chester County, South Carolina (Figure 1). As indicated in Figure 1, the sampling sites were located in tributaries of the Catawba River.

Station UT 2 Upstream was located approximately 1.8 kilometer above its confluence with the Catawba River. The stream at this station was approximately 0.2 to 0.5 meters wide and less than 0.1 to 0.2 meters deep. The canopy provided approximately 80% cover. Substrates available for macroinvertebrate colonization included bedrock, some large rocks and gravel, with macrophyte roots along the stream margins, a few small snags and sticks, and some aquatic vegetation.

Station UT 2 Downstream was located approximately 330 meters above its confluence with the Catawba River. The stream at this station was approximately 0.2 to 0.5 meters wide and less than 0.1 to 0.2 meters deep. The canopy provided approximately 80% cover. Substrates available for macroinvertebrate colonization included bedrock, some large rocks and gravel, with macrophyte roots along the stream margins, a few small snags and sticks, and some aquatic vegetation.

Figure 1. Sampling locations for macroinvertebrates collected from the Landsford Tract, Chester County, South Carolina



Station UT 3 was located approximately 68 meters above the tributary's confluence with another unnamed tributary and 1.2 kilometers above the Catawba River. The stream at this station was approximately 0.2 to 0.6 meters wide and less than 0.1 to 0.3 meters deep. The canopy provided approximately 80% cover. Substrates available for macroinvertebrate colonization included bedrock, some large rocks and gravel, with macrophyte roots along the stream margins, a few small snags and sticks, and some aquatic vegetation.

## IV. METHODS

### A. Field Sampling

Aquatic macroinvertebrates were qualitatively collected with a D-frame aquatic dip net, a U.S. Standard No. 30 sieve, and by hand picking organisms from substrates with forceps. The multiple habitat approach, where specimens from all available habitats (stream margins, leaf packs, water-soaked logs, and sand deposits) are pooled to form one aggregate sample, was utilized as the sampling procedure. Samples were preserved in the field with 70% ethanol. Each sample represented two man-hours per station. Sampling procedures and habitat types were kept similar at each station to enable species and numerical population comparisons between stations. Habitat scores were determined using the *Habitat Assessment Field Data Sheet for Low Gradient Streams* (Barbour *et al*., 1999).

### B. Water Chemistry

Water chemistry parameters measured at each station in conjunction with the macroinvertebrate sampling included pH, conductivity, dissolved oxygen, and temperature.

### C. Sample Processing

Upon return to the laboratory, macroinvertebrates were removed from the associated sample debris with the aid of a Meiji RZ stereo microscope. The macroinvertebrates which required higher magnification for identification were identified using an Olympus BH-2 compound microscope equipped with a phase contrast. Identifications were made to the lowest positive taxonomic level and enumerated with the aid of appropriate microscopic techniques and taxonomic keys. All specimens will be maintained in the CARNAGEY BIOLOGICAL SERVICES, LLC voucher collection for five years or placed into the permanent reference collection.

D. Data Analysis

Comparisons of the macroinvertebrate communities were based on changes in taxonomic composition between sampling sites and on the known tolerance levels and life history strategies of the organisms encountered. Changes in taxonomic composition were determined using metrics outlined in Rapid Bioassessment Protocol III of the US EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin *et al.* 1989) and SCDHEC's *Standard Operating and Quality Control Procedures for Macroinvertebrate Sampling* (SCDHEC, 1999). These metrics included the following:

1) Taxa richness - The number of different taxa found at a particular location is an indication of diversity. Reductions in community diversity have been positively associated with various forms of environmental pollution, including nutrient loading, toxic substances, and sedimentation (Barbour *et al*., 1996; Fore *et al*., 1996; Rosenberg and Resh, 1993; Shackleford, 1988).

2) EPT index - EPT Index is the number of taxa from the insect orders Ephemeroptera, Plecoptera and Trichoptera found at a station. These three insect orders are considered to be intolerant of adverse changes in water quality, especially temperature and dissolved oxygen, and therefore, a reduction in these taxa is indicative of reduced water quality (Barbour *et al*., 1996; Lenat, 1988).

3) Chironomidae taxa and abundance - The Chironomidae are a taxonomically and ecologically diverse group with many taxa that are tolerant of various forms of pollution. The chironomids are often the dominant group encountered at impacted or stressed sites (Rosenberg and Resh, 1993).

4) Ratio of EPT and Chironomidae abundance - The relative abundance of these four indicator groups is a measure of community balance. When compared to a reference site, good biotic conditions are reflected in a fairly even distribution among these four groups (Plafkin *et al*., 1989). The value of this ratio is reduced by impact due to the general reduction of the more sensitive EPT taxa and an increase in the more tolerant chironomid taxa.

5) Ratio of scraper/scraper and filtering collectors - When compared to a reference site, shifts in the dominance of a particular feeding type may indicate a community responding to an over-abundance of a particular food source or toxicants bound to a particular food source (Rosenberg and Resh, 1993).

6) Shredder/total number of specimens collected - When compared to a reference or control site, reductions in the relative abundance of shredders can indicate changes in the quality or quantity of riparian zone vegetation or the presence of toxic substances bound to

organic carbon contained in the leaf and woody material which comprises their food source (Plafkin *et al*., 1989).

7) Percent contribution of dominant taxon - This measures the redundancy and evenness of the community structure. It assumes a highly redundant community reflects an impaired community because as the more sensitive taxa are eliminated, there is often a significant increase in the remaining tolerant forms (Barbour *et al*., 1996; Shackleford, 1988).

8) Dominant taxa in common - When compared to a reference site, major shifts in the composition and abundance of dominant taxa can indicate environmental stress (Barbour *et al*., 1996; Shackleford, 1988).

9) Community loss index (Table 1) - This index measures the loss of taxa between a reference or control station and a study site. It is an index of dissimilarity, with values increasing as the degree of dissimilarity from the reference station increases (Courtemanch and Davies, 1987; Plafkin *et al*., 1989).

10) Jaccard coefficient of community similarity (Table 1) - This coefficient represents the degree of similarity in taxonomic composition between two stations in terms of taxon presence or absence. Values range from 0 to 1.0, increasing as the degree of similarity increases (Jaccard, 1912; Plafkin *et al*., 1989).

11) Sörensen coefficient (Table 1) - This coefficient represents the degree of similarity in taxonomic composition between two stations in terms of taxon presence or absence. Values range from 0 to 1.0, increasing as the degree of similarity increases (Breitenmoser-Würsten and Satori, 1995).

12) North Carolina biotic index (Table 1) - This index utilizes a pollution tolerance value developed over a wide range of conditions and pollution types to assess the amount of impact (North Carolina Department of Environment, Health and Natural Resources, 1997). The values range from 0-10, increasing as water quality decreases. Taxa are designated as Rare (1-2 specimens), Common (3-9 specimens), or Abundant (▪ 10 specimens) and assigned a 1, 3, or 10 abundance code, respectively, for calculation of the NCBI.

13) SCDHEC bioclassification – Bioclassification is determined by averaging scores for the NCBI and EPT index at each station, then rating sites as "Excellent, Good, Good-Fair, Fair, or Poor" (SCDHEC, 2017). The score will result in a value between 1 and 5. Bioclassification are assigned from these: 4.5-5.0 = Excellent, 3.5-4.4 = Good, 2.5-3.4 = Good-Fair, 1.5-2.4 = Fair, and 1.0-1.5 = Poor. Note that the calculation method for this score changed in late 2017. All scores after January 2018 will use the new calculations.

V. RESULTS

A. Physicochemical Analysis

The water chemistry parameters measured in conjunction with the macroinvertebrate assessment are presented in Table 1.

Table 1. Physicochemical data collected in conjunction with the macroinvertebrate assessment of the Landsford Tract, Chester County, South Carolina, 21 January 2020.

| | Station | | |
|---|---|---|---|
| **Parameter** | **UT 2 Upstream** | **UT 2 Downstream** | **UT 3** |
| Water Temperature (ºC) | 8.47 | 8.51 | 7.47 |
| pH (SU) | 7.09 | 6.85 | 6.29 |
| Conductivity (µmhos/cm) | 52 | 63 | 39 |
| Dissolved Oxygen (mg/l) | 8.53 | 8.31 | 4.80 |

B. Macroinvertebrate Community Analysis

A total of 425 specimens representing 53 taxa were collected from the three sampling locations during this assessment. The results are presented in tabular form. The taxa list, number of specimens collected, and relative abundance for each taxon are presented in Table 2 for each station. Bioassessment metrics for each sampling station are presented in Table 3. The numbers of specimens and relative abundance of the dominant taxa (>5%) are listed in Table 4 for each sampling station.

The sampling effort at Station UT 2 Upstream, yielded 196 specimens representing 41 taxa (Table 2). An EPT index of 16 was calculated for this station, and the North Carolina biotic index value of 4.86 resulted in a water quality rating of "excellent" (Table 3). The SC Bioclassification score of 3.693 indicated a “good” rating for this reach. The Chironomidae were represented by 7 taxa and contributed 12% of the collection. The dominant functional feeding group was the collector-filterers, which contributed 30% of the collection. The dominant taxon was *Neoleptophlebia assimilis*, which contributed 22% of the specimens collected (Table 4).

The sampling effort at Station UT 2 Downstream, yielded 113 specimens representing 15 taxa (Table 2). An EPT index of 6 was calculated for this station, and the North Carolina biotic index value of 4.98 resulted in a water quality rating of "excellent" (Table 3). The SC Bioclassification score of 2.994 indicated a “good-fair” rating for this reach. The

Chironomidae were represented by 1 taxon and contributed 2% of the collection. The dominant functional feeding group was the shredders, which contributed 63% of the collection. The dominant taxon was *Allocapnia* sp., which contributed 51% of the specimens collected (Table 4).

The sampling effort at Station UT 3, yielded 116 specimens representing 19 taxa (Table 2). An EPT index of 6 was calculated for this station, and the North Carolina biotic index value of 5.07 resulted in a water quality rating of "excellent" (Table 3). The SC Bioclassification score of 2.931 indicated a “good-fair” rating for this reach. The Chironomidae were represented by 3 taxa and contributed 3% of the collection. The dominant functional feeding group was the collector-filterers, which contributed 34% of the collection. The dominant taxon was *Gammarus* sp., which contributed 32% of the specimens collected (Table 4).

## VI. DISCUSSION

All physicochemical parameters monitored were within water quality standards for Class FW waters of the State of South Carolina (SCDHEC, 1998).

All three of the tributaries had NCBI bioclassification scores of “excellent”. Station UT 2 Upstream had a SCDHEC bioclassification of “good” while Stations UT 2 Downstream and UT 3 had scores of “good-fair”. The EPT index value at UT 2 Upstream was average and low at the other stations.

## VII. REFERENCES


Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates, and fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

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South Carolina Department of Health and Environmental Control. 2017. Standard Operating and Quality Control Procedures for Macroinvertebrate Sampling. Technical Report No. 0914-17. Bureau of Water. Columbia, SC. 80 pp.

Table 2. Macroinvertebrates, their tolerance values (TV), functional feeding groups (FG), and relative abundance collected from three Landsford Tract sampling stations, Chester County, South Carolina, 21 January 2020.

| | | | | No. of Individuals | | | Relative Abundance | | |
|---|---|---|---|---|---|---|---|---|---|
| **Seq** | **Taxon** | **TV** | **FG** | **UT 2 Upstr.** | **UT 2 Downstr.** | **UT 3** | **UT 2 Upstr.** | **UT 2 Downstr.** | **UT 3** |
| **Annelida** | | | | | | | | | |
| **Oligochaeta** | | | | | | | | | |
| **Haplotaxida** | | | | | | | | | |
| **Megascolecidae** | | | | | | | | | |
| **1** | Megascolecidae Genus species | | SC | | 2 | 1 | | 0.02 | 0.01 |
| **Lumbriculida** | | | | | | | | | |
| **Lumbriculidae** | | | | | | | | | |
| **2** | Eclipidrilus lacustris | | SC | 1 | 1 | 1 | 0.01 | 0.01 | 0.01 |
| **Tubificida** | | | | | | | | | |
| **Naididae** | | | | | | | | | |
| **3** | Aulodrilus americanus | | SC | | 1 | 3 | | 0.01 | 0.03 |
| **4** | Bratislavia unidentata | | SC | | | 2 | | | 0.02 |
| **Arthropoda** | | | | | | | | | |
| **Insecta** | | | | | | | | | |
| **Coleoptera** | | | | | | | | | |
| **Dytiscidae** | | | | | | | | | |
| **5** | Neoporus clypealis | 8.72 | P | 1 | | | 0.01 | | |
| **6** | Neoporus sp. | 8.72 | P | 1 | | | 0.01 | | |
| **Elmidae** | | | | | | | | | |
| **7** | Dubiraphia quadrinotata | 5.60 | CG | 1 | | | 0.01 | | |
| **8** | Stenelmis sp. | 5.70 | SC | 2 | 1 | 6 | 0.01 | 0.01 | 0.05 |
| **Diptera** | | | | | | | | | |
| **Ceratopogonidae** | | | | | | | | | |
| **9** | Bezzia/Palpomyia sp. | | P | 1 | | | 0.01 | | |
| **Chironomidae** | | | | | | | | | |
| **10** | Corynoneura sp. | 5.80 | CG | | 2 | | | 0.02 | |
| **11** | Cricotopus bicinctus | 8.80 | SH | 2 | | | 0.01 | | |
| **12** | Larsia sp. | 6.60 | P | 5 | | 1 | 0.03 | | 0.01 |
| **13** | Nilotanypus fimbriatus | 5.00 | P | 1 | | | 0.01 | | |
| **14** | Orthocladius sp. | 4.50 | SH | | | 1 | | | 0.01 |
| **15** | Phaenopsectra punctipes gr. | 7.20 | SC | 1 | | | 0.01 | | |
| **16** | Polypedilum flavum | 5.80 | SH | 3 | | | 0.02 | | |
| **17** | Rheocricotopus unidentatus | 4.80 | CG | 1 | | 1 | 0.01 | | 0.01 |
| **18** | Tanytarsus sp. | 6.70 | CF | 11 | | | 0.06 | | |

* CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 2. Continued.

| Seq | Taxon | TV | FG | No. of Individuals | | | Relative Abundance | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | UT 2 Upstr. | UT 2 Downstr. | UT 3 | UT 2 Upstr. | UT 2 Downstr. | UT 3 |
| **Dixidae** | | | | | | | | | |
| **19** | Dixa sp. | 2.60 | CG | 1 | | | 0.01 | | |
| **Simuliidae** | | | | | | | | | |
| **20** | Prosimulium mixtum | 3.70 | CF | 2 | 3 | 8 | 0.01 | 0.03 | 0.07 |
| **21** | Stegopterna sp. | | CF | 17 | 1 | 24 | 0.09 | 0.01 | 0.21 |
| **Tipulidae** | | | | | | | | | |
| **22** | Hexatoma sp. | 3.60 | P | | | 1 | | | 0.01 |
| **Ephemeroptera** | | | | | | | | | |
| **Ameletidae** | | | | | | | | | |
| **23** | Ameletus tertius | 2.48 | CG | | 4 | | | 0.04 | |
| **Ephemerellidae** | | | | | | | | | |
| **24** | Eurylophella doris | 7.10 | CG | 6 | 1 | | 0.03 | 0.01 | |
| **Heptageniidae** | | | | | | | | | |
| **25** | Maccaffertium modestum | 5.80 | SC | 3 | | | 0.02 | | |
| **Leptophlebiidae** | | | | | | | | | |
| **26** | Neoleptophlebia assimilis | 1.30 | CG | 43 | | 7 | 0.22 | | 0.06 |
| **Heteroptera** | | | | | | | | | |
| **Veliidae** | | | | | | | | | |
| **27** | Microvelia sp. | | P | 1 | | | 0.01 | | |
| **Megaloptera** | | | | | | | | | |
| **Corydalidae** | | | | | | | | | |
| **28** | Nigronia fasciatus | 6.20 | P | 1 | | | 0.01 | | |
| **Odonata** | | | | | | | | | |
| **Calopterygidae** | | | | | | | | | |
| **29** | Calopteryx sp. | 7.60 | P | 3 | | | 0.02 | | |
| **Plecoptera** | | | | | | | | | |
| **Capniidae** | | | | | | | | | |
| **30** | Allocapnia recta | 3.40 | SH | | 9 | | | 0.08 | |
| **31** | Allocapnia sp. | 3.40 | SH | | 58 | 4 | | 0.51 | 0.03 |
| **Nemouridae** | | | | | | | | | |
| **32** | Amphinemura wui | 3.43 | SH | 19 | 4 | 9 | 0.10 | 0.04 | 0.08 |
| **Peltoperlidae** | | | | | | | | | |
| **33** | Tallaperla sp. | 1.40 | SH | 1 | | | 0.01 | | |
| **Perlidae** | | | | | | | | | |
| **34** | Eccoptura xanthenes | 4.80 | P | 2 | | | 0.01 | | |
| **35** | Perlesta sp. | 3.00 | P | 2 | | 1 | 0.01 | | 0.01 |

* CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 2. Continued.

| Seq | Taxon | TV | FG | No. of Individuals | | | Relative Abundance | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | UT 2 Upstr. | UT 2 Downstr. | UT 3 | UT 2 Upstr. | UT 2 Downstr. | UT 3 |
| **Trichoptera** | | | | | | | | | |
| **Hydropsychidae** | | | | | | | | | |
| **36** | Diplectrona modesta Morphotype 1 | 2.40 | CF | 8 | | | 0.04 | | |
| **Lepidostomatidae** | | | | | | | | | |
| **37** | Lepidostoma sp. | 1.10 | SH | 1 | | | 0.01 | | |
| **Leptoceridae** | | | | | | | | | |
| **38** | Triaenodes taenia | 4.20 | SH | 2 | | | 0.01 | | |
| **Limnephilidae** | | | | | | | | | |
| **39** | Pycnopsyche sp. | 2.60 | SH | 4 | | | 0.02 | | |
| **Philopotamidae** | | | | | | | | | |
| **40** | Chimarra sp. | 3.40 | CF | 17 | | | 0.09 | | |
| **41** | Wormaldia sp. | 2.50 | CF | 4 | | | 0.02 | | |
| **Polycentropodidae** | | | | | | | | | |
| **42** | Cyrnellus fraternus | 6.90 | CF | | | 6 | | | 0.05 |
| **Rhyacophilidae** | | | | | | | | | |
| **43** | Rhyacophila fenestra/ledra | 4.70 | P | 1 | 8 | 2 | 0.01 | 0.07 | 0.02 |
| **Sericostomatidae** | | | | | | | | | |
| **44** | Agarodes sp. | 0.79 | SH | 2 | | | 0.01 | | |
| **Thremmatidae** | | | | | | | | | |
| **45** | Neophylax atlanta | 1.70 | SC | 1 | | | 0.01 | | |
| **Malacostraca** | | | | | | | | | |
| **Amphipoda** | | | | | | | | | |
| **Gammaridae** | | | | | | | | | |
| **46** | Gammarus sp. | 7.20 | OM | 2 | 11 | 37 | 0.01 | 0.10 | 0.32 |
| **Decapoda** | | | | | | | | | |
| **Cambaridae** | | | | | | | | | |
| **47** | Cambarus sp. | 7.60 | OM | 1 | | | 0.01 | | |
| **Isopoda** | | | | | | | | | |
| **Asellidae** | | | | | | | | | |
| **48** | Caecidotea sp. | 8.50 | SC | 10 | | | 0.05 | | |
| **Mollusca** | | | | | | | | | |
| **Bivalvia** | | | | | | | | | |
| **Unionoida** | | | | | | | | | |
| **Pisidiidae** | | | | | | | | | |
| **49** | Pisidiidae Genus species | | CF | | | 1 | | | 0.01 |

* CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 2. Continued.

| | | | | No. of Individuals | | | Relative Abundance | | |
|---|---|---|---|---|---|---|---|---|---|
| **Seq** | **Taxon** | **TV** | **FG** | **UT 2 Upstr.** | **UT 2 Downstr.** | **UT 3** | **UT 2 Upstr.** | **UT 2 Downstr.** | **UT 3** |
| **Gastropoda** | | | | | | | | | |
| **Limnophila** | | | | | | | | | |
| **Ancylidae** | | | | | | | | | |
| **50** | Ferrissia rivularis | 6.65 | SC | 1 | | | 0.01 | | |
| **Physidae** | | | | | | | | | |
| **51** | Physa sp. | 8.80 | SC | | 7 | | | 0.06 | |
| **Mesogastropoda** | | | | | | | | | |
| **Pleuroceridae** | | | | | | | | | |
| **52** | Goniobasis catenaria catenaria | | SC | 9 | | | 0.05 | | |
| **Platyhelminthes** | | | | | | | | | |
| **Turbellaria** | | | | | | | | | |
| **Tricladida** | | | | | | | | | |
| **Planariidae** | | | | | | | | | |
| **53** | Dugesia tigrina | 7.20 | OM | 1 | | | 0.01 | | |

* CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 3. Rapid bioassessment metrics calculated for three Landsford Tract sampling stations, Chester County, South Carolina, 21 January 2020.

| | UT 2 Upstream | UT 2 Downstream | UT 3 |
|---|---|---|---|
| **Taxa Richness** | 41 | 15 | 19 |
| **Number of Specimens** | 196 | 113 | 116 |
| **EPT Index** | 16 | 6 | 6 |
| **EPT Abundance** | 116 | 84 | 29 |
| **Chironomidae Taxa** | 7 | 1 | 3 |
| **Chironomidae Abundance** | 24 | 2 | 3 |
| **EPT/Chironomidae Abundance** | 4.83 | 42.00 | 9.67 |
| **North Carolina Biotic Index** | 4.86 | 4.98 | 5.07 |
| **SCDHEC Bioclassification** | 3.693 | 2.994 | 2.931 |
| | | | |
| **Percent Collector-Filterers** | 30.10 | 3.54 | 33.62 |
| **Percent Collector-Gatherers** | 26.53 | 6.19 | 6.90 |
| **Percent Omnivores** | 2.04 | 9.73 | 31.90 |
| **Percent Predators** | 9.69 | 7.08 | 4.31 |
| **Percent Scrapers** | 14.29 | 10.62 | 11.21 |
| **Percent Shredders** | 17.35 | 62.83 | 12.07 |
| | | | |
| **Scraper/Collector-Filterers** | 0.47 | 3.00 | 0.33 |
| **Shredders/Total** | 0.17 | 0.63 | 0.12 |
| | | | |
| **Percent Dominant Taxon** | 21.94 | 51.33 | 31.90 |
| **Number of Dominant Taxa** | 6 | 5 | 7 |

Table 4. Dominant taxa (> 5% of the collection) for three Landsford Tract sampling stations, Chester County, South Carolina, 21 January 2020.

| **Reach UT 2 Upstream** | | | **Reach UT 2 Downstream** | | | **Reach UT 3** | | |
|---|---|---|---|---|---|---|---|---|
| **Taxon** | **No.** | **Rel. Abd.** | **Taxon** | **No.** | **Rel. Abd.** | **Taxon** | **No.** | **Rel. Abd.** |
| Neoleptophlebia assimilis | 43 | 21.94 | Allocapnia sp. | 58 | 51.33 | Gammarus sp. | 37 | 31.90 |
| Amphinemura wui | 19 | 9.69 | Gammarus sp. | 11 | 9.73 | Stegopterna sp. | 24 | 20.69 |
| Stegopterna sp. | 17 | 8.67 | Allocapnia recta | 9 | 7.96 | Amphinemura wui | 9 | 7.76 |
| Chimarra sp. | 17 | 8.67 | Rhyacophila fenestra/ledra | 8 | 7.08 | Prosimulium mixtum | 8 | 6.90 |
| Tanytarsus sp. | 11 | 5.61 | Physa sp. | 7 | 6.19 | Neoleptophlebia assimilis | 7 | 6.03 |
| Caecidotea sp. | 10 | 5.10 | | | | Stenelmis sp. | 6 | 5.17 |
| | | | | | | Cyrnellus fraternus | 6 | 5.17 |

# APPENDIX M

# LARGE WOODY DEBRIS EVALUATION

| Restoration Reach | Length of Sample | Bridge | Ramp | Submersed | Buried | Total |
|---|---|---|---|---|---|---|
| UT 2 Section 1 | 100 meter | 0 | 1 | 1 | 1 | 3 |
| UT 2 Section 3 | 100 meter | 0 | 3 | 1 | 0 | 4 |
| UT 3 Section 1 | 100 meter | 1 | 1 | 0 | 0 | 2 |
| UT 3 Section 2 (Ref) | 100 meter | 3 | 2 | 1 | 0 | 6 |

UT 3 Section 1 - LWD (Bridge)

UT 2 Section 3 - LWD (Submerged)

UT 2 Section 1 - LWD (Ramp)

# APPENDIX N

# MITIGATION WORKSHEETS

| Buffer Score Factors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Section | Sides | Buffer Slope | Required Minimum | Buffer Width | Tree Age | Vegetation Composition | | Buffer Score | | Combined Score |
| | | | | | | | % Preservation | % Enhancement | Preservation | Enhancement | |
| 1 Preservation | UT 2 Section 4 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| | UT 3 Section 2 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| | UT 4 Section 2 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| | UT 5 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| 2 Enhancement | UT 2 Section 2 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| 3 Restoration | UT 2 Section 1 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 0% | 100% | 0.17 | 0.34 | 0.34 |
| | UT 2 Section 3 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| | UT 3 Section 1 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |
| | UT 4 Section 1 | 2 | < 5% | 75 ft. | 150 ft. (2x min) | 50+ | 100% | 0% | 0.17 | 0.34 | 0.17 |

| Stream Credit Worksheet | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Reach | Stream Type | Priority | Net Improvement | Credit Schedule | Location | Riparian Buffer A | Riparian Buffer B | Sum | LF | Credits |
| 1 Preservation | UT 2 Section 4 | 0.4 | 0.3 | 0.0 | 0.0 | 0.1 | 0.17 | 0.17 | 1.14 | 158 | 180 |
| | UT 3 Section 2 | 0.4 | 0.3 | 0.0 | 0.0 | 0.1 | 0.17 | 0.17 | 1.14 | 504 | 575 |
| | UT 4 Section 2 | 0.4 | 0.3 | 0.0 | 0.0 | 0.1 | 0.17 | 0.17 | 1.14 | 306 | 349 |
| | UT 5 | 0.4 | 0.3 | 0.0 | 0.0 | 0.1 | 0.17 | 0.17 | 1.14 | 111 | 127 |
| | | | | | | | | | | Unit 1 - Total Preservation Credit | 1,230 |
| 2 Enhancement | UT 2 Section 2 | 0.4 | 0.3 | 2.0 | 0.02 | 0.1 | 0.17 | 0.17 | 3.16 | 622 | 1,966 |
| | | | | | | | | | | Unit 2 - Total Enhancement Credit | 1,966 |
| 3 Restoration | UT 2 Section 1 | 0.4 | 0.3 | 3.0 | 0.02 | 0.1 | 0.34 | 0.34 | 4.5 | 4,713 | 21,209 |
| | UT 2 Section 3 | 0.4 | 0.3 | 2.0 | 0.02 | 0.1 | 0.17 | 0.17 | 3.16 | 746 | 2,357 |
| | UT 3 Section 1 | 0.4 | 0.3 | 3.0 | 0.02 | 0.1 | 0.17 | 0.17 | 4.16 | 1,782 | 7,413 |
| | UT 4 Section 1 | 0.4 | 0.3 | 2.0 | 0.02 | 0.1 | 0.17 | 0.17 | 3.16 | 61 | 193 |
| | | | | | | | | | | Unit 3 - Total Restoration Credit | 31,172 |
| | | | | | | | | | | Total Stream Credit | 34,368 |

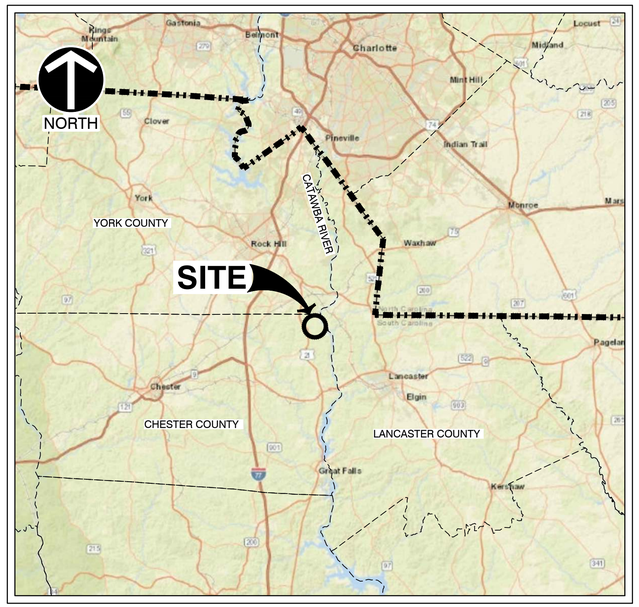
| Wetland Credit Worksheet | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wetland Area | Net Improvement | Upland Buffer | Credit Schedule | Temporal Loss | Kind | Location | Sum | AC | Credits |
| Wetland Enhancement | 2.0 | 1.0 | 0.1 | -0.1 | 0.4 | 0.4 | 3.8 | 2.99 | **11.36** |
| Wetland Preservation | 0.0 | 1.0 | 0.0 | 0.0 | 0.4 | 0.4 | 1.8 | 0.26 | **0.47** |
| | | | | | | | | Total Wetland Credit | **11.83** |

# APPENDIX O

# MITIGATION WORK PLAN EXHIBITS

# SOUTH CAROLINA DEPT. OF COMMERCE
# LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN
# CHESTER COUNTY, SC
## ISSUED FOR PERMITS

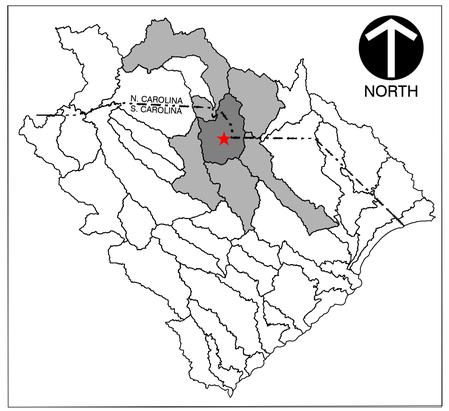
| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
| | | |
| | | |
| | | |




**LOCATION MAP**

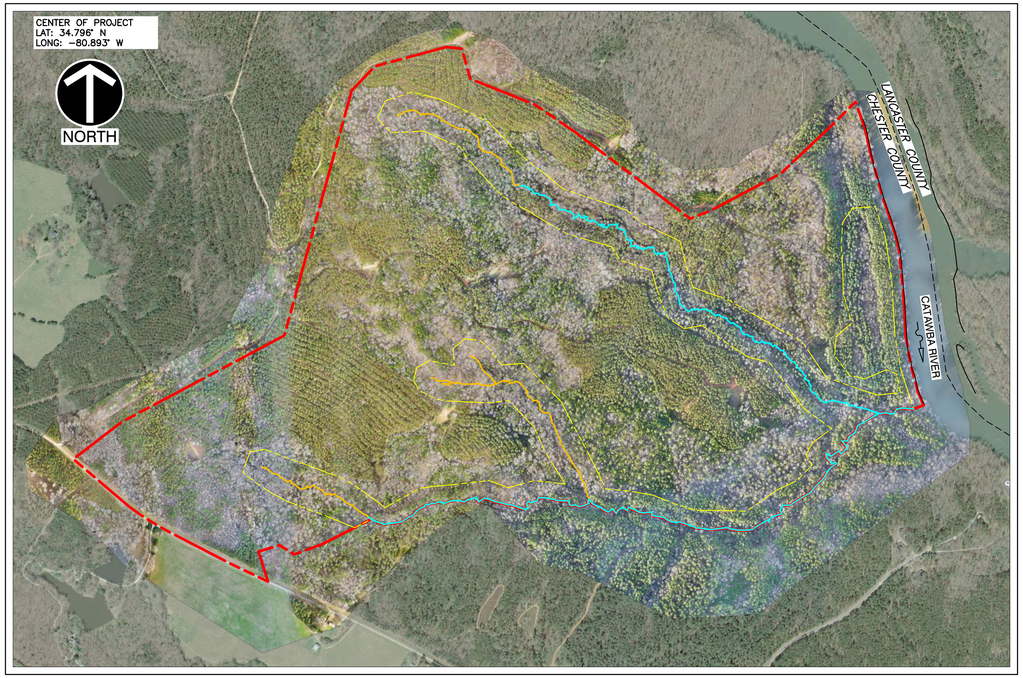
ESRI WORLD TOPOGRAPHIC MAP / ARCGIS MAP SERVICE
ARCGIS CIVIL 3D PLUG-IN ACCESSED ON 01/15/2020

SCALE: 1" = 8 MILES




**USGS 8-DIGIT HUC BOUNDARY MAP**

**LOWER CATAWBA RIVER WATERSHED**
**HUC ID: 03050103**
**NOT TO SCALE**




**VICINITY MAP**

IMAGES PROVIDED BY CEC AERIAL MAPPING AND ARCGIS WORLD IMAGERY (2020)

SCALE: 1"=700'

VICINITY MAP LEGEND
- SEASONAL STREAM
- PERENNIAL STREAM
- MITIGATION BANK BOUNDARY
- PROPERTY BOUNDARY

NOTE:
THESE PLANS HAVE BEEN CREATED ON ANSI D FULL BLEED (22" X 34") PAPER. FOR REDUCTIONS, REFER TO GRAPHIC SCALE. WHEN PLOTTED ON 11" X 17" PAPER, THIS PLAN SET WILL NOT BE TO SCALE.

THE PLANS HAVE BEEN CREATED FOR FULL COLOR PLOTTING. ANY SET OF THE PLANS THAT IS NOT PLOTTED IN FULL COLOR SHALL NOT BE CONSIDERED ADEQUATE FOR CONSTRUCTION PURPOSES.

**WARNING**: INFORMATION MAY BE LOST IN COPYING AND/OR GRAY SCALE PLOTTING.

## SHEET INDEX


| Sheet Number | Sheet Title |
|---|---|
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| 02 | GENERAL & SPECIAL NOTES |
| 03 | PROJECT KEYMAP & PROPOSED STRUCTURES LEGEND |
| 04 | STREAM MORPHOLOGY TABLES UT2 SEC 3 & UT2 SEC 1 |
| 05 | STREAM MORPHOLOGY TABLES UT3 SEC 1 & UT4 SEC 1 |
| 06 | UT2 SEC 3 EXISTING CONDITIONS |
| 07 | UT2 SEC 3 EXISTING CONDITIONS |
| 08 | UT2 SEC 1 EXISTING CONDITIONS |
| 09 | UT2 SEC 1 EXISTING CONDITIONS |
| 10 | UT3 SEC 1 & UT4 SEC 1 EXISTING CONDITIONS |
| 11 | UT2 SEC 3 GRADING PLAN & PROFILE STA 0+00 TO 4+00 |
| 12 | UT2 SEC 3 GRADING PLAN & PROFILE STA 4+00 TO 7+46 |
| 13 | UT2 SEC 1 GRADING PLAN & PROFILE STA 0+00 TO 4+20 |
| 14 | UT2 SEC 1 GRADING PLAN & PROFILE STA 4+20 TO 8+80 |
| 15 | UT2 SEC 1 GRADING PLAN & PROFILE STA 8+80 TO 13+40 |
| 16 | UT2 SEC 1 GRADING PLAN & PROFILE STA 13+40 TO 18+00 |
| 17 | UT2 SEC 1 GRADING PLAN & PROFILE STA 18+00 TO 22+60 |
| 18 | UT2 SEC 1 GRADING PLAN & PROFILE STA 22+60 TO 27+20 |
| 19 | UT2 SEC 1 GRADING PLAN & PROFILE STA 27+20 TO 31+80 |
| 20 | UT2 SEC 1 GRADING PLAN & PROFILE STA 31+80 TO 36+40 |
| 21 | UT2 SEC 1 GRADING PLAN & PROFILE STA 36+40 TO 41+00 |
| 22 | UT2 SEC 1 GRADING PLAN & PROFILE STA 41+00 TO 45+60 |
| 23 | UT2 SEC 1 GRADING PLAN & PROFILE STA 45+60 TO 47+14 |
| 24 | UT3 SEC 1 GRADING PLAN & PROFILE STA 0+00 TO 4+50 |
| 25 | UT3 SEC 1 GRADING PLAN & PROFILE STA 4+50 TO 9+00 |
| 26 | UT3 SEC 1 GRADING PLAN & PROFILE STA 9+00 TO 13+50 |
| 27 | UT3 SEC 1 GRADING PLAN & PROFILE STA 13+50 TO 17+82 |
| 28 | UT4 SEC 1 GRADING PLAN & PROFILE |
| 29 | UT2 SEC 3 STRUCTURES PLAN STA 0+00 TO 7+46 |
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| 48 | IN-STREAM STRUCTURE DETAILS |
| 49 | IN-STREAM STRUCTURE DETAILS |


**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

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**SOUTH CAROLINA DEPT. OF COMMERCE**
**LANDSFORD TRACT PERMITTEE**
**RESPONSIBLE MITIGATION PLAN**
**CHESTER COUNTY, SC**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

TITLE SHEET

DRAWING NO.: 01

P:\2019\196-626.0004\-CADD\dwg\CIVIL\196-626EC01-TITLE SHEET.dwg|01 TITLE SHEET| LS:(1)1/2020 - ekahlaw| - LP: 2/4/2020 8:19 AM

## SPECIAL NOTES FOR NATURAL STREAM DESIGN

A. AS–BUILT DRAWINGS – DURING CONSTRUCTION, THE CONTRACTOR AND THE ENGINEER SHALL WORK TOGETHER TO MAINTAIN A SET OF PRINTS SHOWING ANY CHANGES OR CORRECTIONS IN RED. THESE PRINTS SHALL BE SUBMITTED TO THE ENGINEER AT THE COMPLETION OF THE WORK.

B. STREAM MITIGATION DEFINITIONS

1. BANKFULL ELEVATION – BANKFULL ELEVATION IS THE POINT OF INCIPIENT FLOODING IN AN ALLUVIAL CHANNEL.
2. FLOODPLAIN SILL – A FLOODPLAIN SILL IS THE BURIED EXTENSION OF THE STRUCTURE AND IS PERPENDICULAR TO THE FLOW DIRECTION OF THE BANKFULL CHANNEL ACROSS THE BANKFULL BENCH OR FLOODPLAIN
3. FOOTER BOULDERS – FOOTER BOULDERS ARE PLACED TO PROVIDE A FOUNDATION FOR THE SURFACE BOULDERS IN EACH HYDRAULIC STRUCTURE. THE LOWEST COURSE OF FOOTER BOULDERS ARE BURIED IN THE CHANNEL TO A DEPTH BELOW THE CALCULATED OR MEASURED SCOUR DEPTH. FOOTER BOULDERS SHALL BE DURABLE LIMESTONE WITH DIMENSIONS SHOWN IN THE DETAILS. TYPICALLY, FOOTER BOULDERS ARE BURIED IN THE CHANNEL BOTTOM AND NOT SEEN WHEN THE STRUCTURE IS COMPLETED. ALL SURFACE BOULDERS FOR ALL STRUCTURES REQUIRE FOOTER BOULDERS UNLESS BEDROCK IS ENCOUNTERED AT THE PROPOSED ELEVATION OF FOOTER BOULDERS.
4. SURFACE BOULDERS – SURFACE BOULDERS ARE THE TOP–MOST COURSE OF BOULDERS USED IN EACH CROSS–VANE OR OTHER ROCK STRUCTURE. ALL SURFACE BOULDERS CAN BE SEEN PROTRUDING FROM THE WATER SURFACE DURING EXTREMELY LOW FLOWS. SURFACE BOULDERS SHALL BE DURABLE LIMESTONE WITH DIMENSIONS SHOWN IN THE DETAILS.
5. THALWEG – THE THALWEG IS THE LOWEST POINT OF THE BANKFULL CHANNEL DESCRIBED BY THE STREAM PROFILE. THIS ELEVATION IS THE REFERENCE FOR ALL ELEVATIONS ON OR ALONG THE CHANNEL AND HYDRAULIC STRUCTURES DESCRIBED IN THIS SECTION AND IN THE PROJECT DRAWINGS.
6. VANE ANGLE – THE VANE ANGLE IS THE SMALLEST ANGLE MEASURED BETWEEN A VANE AND A LINE TANGENT TO THE BANKFULL ELEVATION AT THE POINT WHERE THE VANE INTERSECTS THE BANK. THE VANE ANGLE SHALL BE BETWEEN TWENTY PERCENT (20%) AND THIRTY PERCENT (30%), OR AS SPECIFIED IN THE STREAM MITIGATION DATA TABLE.
7. VANE LENGTH – THE VANE LENGTH IS THE DISTANCE BETWEEN THE UPSTREAM LIMIT OF THE VANE ARM AT THE CHANNEL BED TO THE DOWNSTREAM INSERTION POINT OF THE VANE ARM INTO THE STREAM BANK.
8. VANE SLOPE – THE VANE SLOPE IS THE SLOPE OF THE VANE ARM FROM THE UPSTREAM LIMIT AT THE CHANNEL BED TO THE DOWNSTREAM INSERTION POINT OF THE VANE ARM INTO THE STREAM BANK. THE VANE SLOPE SHALL BE BETWEEN TWO PERCENT (2%) AND SEVEN PERCENT (7%) OR AS SPECIFIED IN THE STREAM MITIGATION DATA TABLE AND THE VANE ARMS SHALL TIE INTO THE BANKS AT HALF TO THREE QUARTERS OF THE BANKFULL ELEVATION.
9. SUBSTRATE RESTORATION – SUBSTRATE RESTORATION IS DESIGNED TO REPLACE AND RESTORE COARSE SUBSTRATE (GRAVEL, COBBLE, AND BOULDER) TO THE STREAM CHANNEL IN CASES WHERE COARSE SUBSTRATES OR BEDROCK ARE ABSENT FOLLOWING CHANNEL EXCAVATION. THE PURPOSE OF SUBSTRATE RESTORATION IS TO PROVIDE NATURAL SUBSTRATE AND EROSION AND SCOUR PROTECTION IN THE CHANNEL.
10. BASE FLOW – FOR THE PURPOSE OF THESE STREAM DESIGN SPECIFICATIONS, A FLOW EQUAL TO ONE CUBIC FOOT PER SECOND PER SQUARE MILE OF DRAINAGE AREA.

C. FLOODPLAIN AND CHANNEL CONSTRUCTION

1. THE CONTRACTOR SHALL STAKE OUT THE PROPOSED STREAM CENTERLINE AND STRUCTURE LOCATIONS FOR APPROVAL BY THE ENGINEER BEFORE INITIATING EXCAVATION. DEPENDING ON THE SITE CONDITIONS, SOME SHIFTING OF THE STREAM CHANNEL AND VANE STRUCTURES MAY BE NECESSARY. ANY COST ASSOCIATED WITH CHANGING CHANNEL ALIGNMENT AND STRUCTURE LOCATIONS SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
2. THE PROPOSED STREAM CHANNEL SHALL BE CONSTRUCTED BY FIRST EXCAVATING THE FLOODPLAIN TO THE ELEVATIONS AND DIMENSIONS SPECIFIED ON THE STREAM MITIGATION GRADING PLAN. THE PROPOSED STREAM CHANNEL SHALL THEN BE EXCAVATED TO THE PROPER DEPTHS INDICATED ON THE PROFILE AND CROSS–SECTIONS. THIS SHALL BE DONE AS UNCLASSIFIED EXCAVATION AND IS TYPICALLY ACCOMPLISHED WITH A TRACK EXCAVATOR WITH HYDRAULIC THUMB. ANY STOCKPILING OR DOUBLE–HANDLING OF MATERIALS NECESSARY TO BUILD THE CHANNEL SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

D. FILTER FABRIC

1. NON–WOVEN FILTER FABRIC SHALL ONLY BE USED WHEN COVERING THE ROCK SECTION OF A STRUCTURE. CONTRACTOR SHALL USE US FABRICS US205NW FABRIC OR EQUIVALENT.
2. WOVEN FILTER FABRIC SHALL ONLY BE USED WHEN COVERING THE WOODY SECTION OF A STRUCTURE. CONTRACTOR SHALL USE US FABRICS US315 FABRIC OR EQUIVALENT.

## GENERAL NOTES

CONTRACTOR SHALL REVIEW ALL APPLICABLE PERMITS FOR THIS PROJECT AND ALL WORK SHALL BE IN STRICT CONFORMANCE WITH THE CONDITIONS OF EACH PERMIT.

GOVERNING SPECIFICATIONS
THE SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (DHEC) STORM WATER MANAGEMENT BEST MANAGEMENT PRACTICES (BMP) FIELD MANUAL, DATED JULY 2005, SHALL BE THE GOVERNING PROVISIONS FOR STORMWATER POLLUTION PREVENTION ASSOCIATED WITH CONSTRUCTION ACTIVITIES.

BENCHMARKS
THE CONTRACTOR SHALL BE RESPONSIBLE FOR HOLDING BENCHMARK LOCATIONS THROUGHOUT THE LIFE OF THE PROJECT. IN THE EVENT THAT A BENCHMARK IS DISTURBED, THE CONTRACTOR, AS DIRECTED BY THE ENGINEER, WILL RELOCATE OR REESTABLISH THE BENCHMARK. NO ADDITIONAL PAYMENT OR COMPENSATION WILL BE MADE FOR THIS WORK.

ELEVATIONS
ALL ELEVATIONS SHOWN REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), GEOID 12B.

COORDINATES
PROJECT COORDINATES ON THESE PLANS ARE BASED UPON THE SOUTH CAROLINA STATE PLANE SYSTEM. THE HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1983 (NAD83 2011).

VERIFICATIONS OF DIMENSIONS
THE CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF ALL PLAN AND ELEVATION DIMENSIONS PRIOR TO ORDERING MATERIALS FOR THE CONSTRUCTION OF THE VARIOUS BID ITEMS IN THIS CONTRACT.

WASTE MATERIAL
ALL MATERIAL EXCAVATED AND NOT REUSED IN THE CONSTRUCTION OF THIS PROJECT SHALL BE REMOVED FROM THE PROJECT AND DISPOSED OF BY THE CONTRACTOR.

UTILITIES
THE CONTRACTOR IS RESPONSIBLE FOR THE INVESTIGATION, LOCATION, SUPPORT, PROTECTION, AND RESTORATION OF ALL EXISTING UTILITIES AND APPURTENANCES WHETHER SHOWN ON THESE PLANS OR NOT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ASCERTAIN THE STATUS AND LOCATION OF EACH UTILITY WHEN PERFORMING WORK WHICH MAY AFFECT THESE FACILITIES, INCLUDING PROBING, EXCAVATION, OR ANY OTHER PRECAUTION REQUIRED TO CONFIRM LOCATION. THE CONTRACTOR SHALL EXPOSE ALL UTILITIES OR STRUCTURES PRIOR TO CONSTRUCTION TO VERIFY THE VERTICAL AND HORIZONTAL EFFECT ON PROPOSED CONSTRUCTION. THE CONTRACTOR SHALL CALL SC811 (1–888–721–7877) TWO DAYS PRIOR TO CONSTRUCTION AND SHALL NOTIFY ALL UTILITY COMPANIES AT LEAST 48 HOURS PRIOR TO WORK IN THE VICINITY OF THEIR UNDERGROUND LINES. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY DAMAGE OR DISRUPTION TO UTILITY LINES WHICH ARE KNOWN ACTIVE AND ARE TO REMAIN IN OPERATION.

EROSION AND SEDIMENT CONTROL
SEE EROSION & SEDIMENT CONTROL NOTES SHEETS ## & 07.

FEDERAL, STATE, AND LOCAL LAWS AND SAFETY REGULATIONS
THE CONTRACTOR AND ANY SUB–CONTRACTORS SHALL CONFORM TO APPLICABLE OSHA SAFETY REGULATIONS. THE CONTRACTOR AND ANY SUB–CONTRACTORS SHALL BE SOLELY RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE, AND LOCAL SAFETY REQUIREMENTS TOGETHER WITH EXERCISING PRECAUTIONS AT ALL TIMES FOR THE PROTECTION OF PERSONS INCLUDING EMPLOYEES AND PROPERTY. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND SUB–CONTRACTOR TO INITIATE, MAINTAIN, AND SUPERVISE ALL SAFETY REQUIREMENTS, PRECAUTIONS, AND PROGRAMS IN CONNECTION WITH THE WORK.

CLEARING & GRUBBING LIMITS
CLEARING LIMITS SHALL BE EXTENDED TO A MAXIMUM LIMIT NECESSARY FOR CONSTRUCTION MATERIALS AND SHALL NOT EXTEND BEYOND CONSTRUCTION BOUNDARIES WHERE EARTHWORK ACTIVITIES ARE TO BE PERFORMED. GRUBBING SHALL ONLY TAKE PLACE WITHIN THE AREA AS NECESSARY. ALL COSTS ASSOCIATED WITH CLEARING & GRUBBING SHALL BE CONSIDERED INCIDENTAL TO BID ITEM CLEARING AND GRUBBING.

TIE–IN OF EXISTING DRAINAGE FEATURES
CONTRACTOR SHALL TIE IN ANY DRAINAGE FEATURES THAT ARE ADJACENT TO THE RESTORATION REACHES, PER DIRECTION OF ENGINEER.

## CONSTRUCTION SEQUENCE

1. LAYOUT THE LIMITS OF WORK AND ESTABLISH BENCHMARKS.
2. IDENTIFY ENVIRONMENTAL BOUNDARIES AND SENSITIVE AREAS. PLACE APPROPRIATE CONTROLS TO AVOID DISTURBANCE TO THESE AREAS.
3. INSTALL ROCK CONSTRUCTION ENTRANCES AND TEMPORARY STREAM CROSSINGS AS SHOWN ON THE E&S PLAN AND IN ACCORDANCE WITH THE STANDARD DETAIL.
4. INSTALL EROSION AND SEDIMENT CONTROLS ALONG ACCESS ROADS, CONSTRUCTION ENTRANCES, TEMPORARY STREAM CROSSINGS, AND TEMPORARY STOCKPILE AREAS.
5. BEGIN PREPARATION OF THE TEMPORARY SITE ACCESS ALONG THE ALIGNMENT SHOWN ON THE PLAN. CLEAR VEGETATION ONLY AS NECESSARY WITHIN THE LIMITS OF DISTURBANCE SHOWN ON THE PLAN. REMOVE TOPSOIL AS NECESSARY AND STOCKPILE IN THE LOCATION SHOWN ON THE PLANS. STOCKPILES WILL NOT BE CONSTRUCTED WITHIN ANY STREAM'S 50 FOOT FLOODWAY. INSTALL EROSION & SEDIMENT CONTROLS AROUND THE PERIMETER OF THE TOPSOIL STOCK PILE. GRAVEL MAY BE ADDED AS NEEDED ALONG THE ACCESS ALIGNMENT TO IMPROVE GROUND SURFACES. UTILIZE THE AREAS SPECIFIED ON THE PLAN FOR LAYDOWN, TRANSFER AND STAGING OF MATERIALS AND EQUIPMENT NEEDED TO PERFORM WORK.
6. IN GENERAL STREAM RESTORATION WILL BE COMPLETED FROM UPSTREAM TO DOWNSTREAM, AND STREAM WORK AREAS WILL BE APPROXIMATELY 1000 FEET IN LENGTH. TURBID WATER GENERATED WITHIN THE STREAM RESTORATION WORK AREA WILL BE PUMPED INTO A FILTER BAG PLACED IN A WELL VEGETATED AREA ALONG THE STREAM BANK DOWNSTREAM OF THE WORK AREA, IN ACCORDANCE WITH THE STANDARD DETAIL.
7. PERFORM GRADING AND INSTALL IN–STREAM STRUCTURES AS SPECIFIED ON THE RESTORATION PLANS.
8. CARE SHALL BE TAKEN AT SOIL BORROW AREAS ADJACENT TO THE STREAM AS TO ENSURE SEDIMENT LADEN RUNOFF DOES NOT ENTER THE FLOWING STREAM. 12" COMPOST FILTER SOCK SHALL BE INSTALLED BETWEEN THE SOIL BORROW AREA AND THE STREAM. IF THE SOCK IS DISTURBED DURING BORROW ACTIVITIES IT SHALL BE REINSTALLED AND IN GOOD WORKING ORDER BEFORE THE END OF EACH WORK DAY AND BEFORE ANY RAIN EVENT. THIS SOCK SHALL REMAIN IN PLACE UNTIL THE COMPLETION OF THE STREAM RESTORATION WORK IN ITS ENTIRETY, GRADES OF THE PROPOSED WETLAND ARE REACHED, TOPSOIL PLACED, AREA SEEDED, AND A MINIMUM OF 70% VEGETATIVE COVER IS ESTABLISHED.
9. ONCE IN–STREAM WORK IS COMPLETE FOR A WORK SECTION, REMOVE THE APPLICABLE STREAM DIVERSION AND ALLOW STREAM TO FLOW INTO RESTORED CHANNEL. INSTALL STREAM DIVERSION FOR THE NEXT SECTION OF STREAM AND COMPLETE IN–STREAM WORK. REPEAT PROCESS AS NECESSARY.
10. WHEN STREAM RESTORATION WORK IS COMPLETE, REMOVE ANY GRAVEL FROM THE TEMPORARY SITE ACCESS AND COMPLETELY RESTORE SITE TO ORIGINAL GRADES AND REPLACE TOPSOIL. SEED AND PLANT ACCORDING TO THE PLANTING PLAN. INSTALL EROSION CONTROL BLANKET IN DISTURBED AREAS GREATER THAN 3:1 SLOPE AND ANY DISTURBED AREAS WITHIN 50 FEET OF A STREAM.
11. ONCE ALL AREAS HAVE BEEN PERMANENTLY STABILIZED, AND A UNIFORM 70% PERENNIAL VEGETATIVE COVER HAS BEEN ESTABLISHED, REMOVE ALL EROSION AND SEDIMENTATION CONTROLS AND STABILIZE ANY DISTURBANCES ASSOCIATED WITH THE REMOVAL OF BMPS.

**SUBMITTAL & REVISION RECORD**

| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |
| | | |
| | | |
| | | |

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE

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www.cecinc.com

**SOUTH CAROLINA DEPT. OF COMMERCE
LANDSFORD TRACT PERMITTEE
RESPONSIBLE MITIGATION PLAN
CHESTER COUNTY, SC**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

GENERAL & SPECIAL NOTES

DRAWING NO.: 02

P:\2019\196-626.0004\-CADD\Dwg\EC01\196-626EC01-GENERAL NOTES & QUANTITIES.dwg{02 GENERAL & SPECIAL NOTES} LS:(1/31/2020 - cgriebling) - LP: 2/3/2020 9:19 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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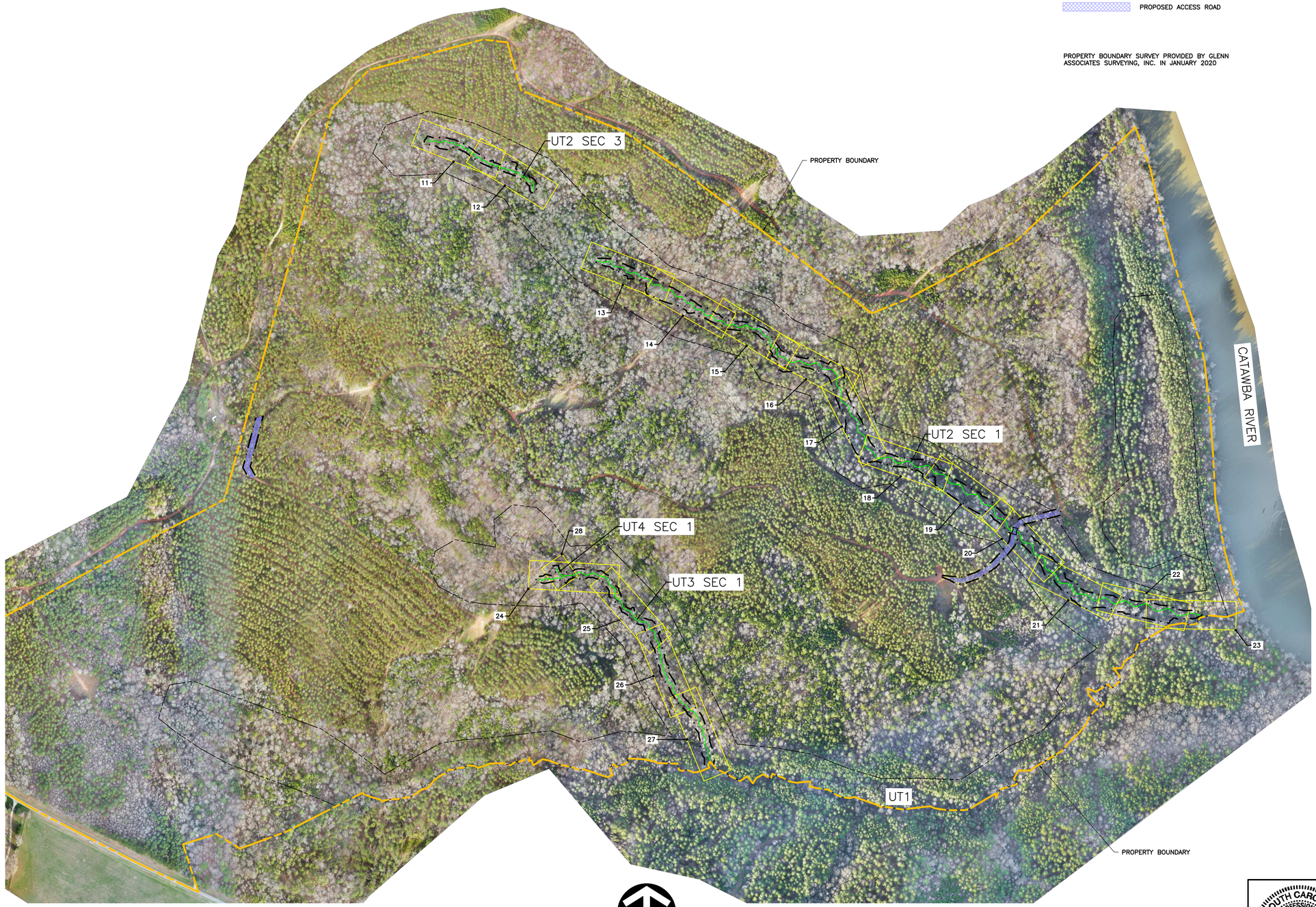
LEGEND

- SITE BENCHMARK
- PROPOSED RESTORATION STREAM CENTERLINE
- PROPOSED LIMIT OF DISTURBANCE
- MITIGATION BANK BOUNDARY
- PROPERTY BOUNDARY
- PROPOSED ACCESS ROAD

PROPERTY BOUNDARY SURVEY PROVIDED BY GLENN ASSOCIATES SURVEYING, INC. IN JANUARY 2020




STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME | |
|---|---|---|
| | LOG VANE, ROCK J-HOOK AND ROOT WAD | 1/45 |
| | ROCK CONSTRUCTED RIFFLE | 2/45 |
| | LOG RIFFLE | 3/46 |
| | TOE WOOD WITH REINFORCED EARTH AND LIVE BRUSH LAYERING | 4/46 |
| | BOULDER VANE AND J-HOOK | 5/47 |
| | ROOT WAD | 6/47 |
| | IMPERVIOUS STREAM CHANNEL PLUG | 8/48 |
| | DOUBLE DROP BOULDER LOG STEP POOL | 9/49 |

NORTH

SCALE IN FEET
0 300 600

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE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www.cecinc.com


# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

PROJECT KEYMAP & PROPOSED STRUCTURES LEGEND

DRAWING NO.: 03

P:\2019\196-626.0004\1-2400\Dwg\EC011\196-626E01-PROJECT KEYMAP-dwg[03 PROJECT KEYMAP & PROPOSED STRUCTURES LEGEND] LS(1/31/2020 - cgreeling) - LP: 2/5/2020 9:20 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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## UT2 SEC 3 REACH 1

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.698 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 116.653 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 53.577 | mm |
| Inner Berm Shear Stress (t) | 0.000 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 0.311 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 0.012 | mm |
| Bankfull Discharge (Mannings Qbkf) | 10.327 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.444 | fps |
| Bankfull Stream Power (w) | 2.403 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 0.000 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 0.016 | fps |
| Inner Berm Stream Power (w) | 0.000 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.040 | n |
| Bankfull Slope (Sbkf) | 0.025 | ft/ft |
| Drainage Area (DA) | 0.040 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 3.000 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 0.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 3.750 | xH:1V |
| Point Bar Slope | 2.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.000 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.000 | xH:1V |
| Bottom Width | 0.000 | ft |
| Glide | 4.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 0.531 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.000 | ft |
| Riffle Mean Depth (Dbkf) | 0.447 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.000 | ft |
| Riffle Bankfull Width (Wbkf) | 6.708 | ft |
| Riffle Inner Berm Width (Wib) | 0.002 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 2.291 | ft |
| Pool Max Depth (Dmbkf) | 1.677 | ft |
| Pool Bankfull Width (Wbkfp) | 6.708 | ft |
| Pool Bottom Width | 0.000 | ft |
| Point Bar Slope 1 | 2.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 4.000 | % |
| Drop (PC) | 0.000 | ft |

## UT2 SEC 3 REACH 2

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.806 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 129.671 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 62.240 | mm |
| Inner Berm Shear Stress (t) | 0.000 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 0.346 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 0.014 | mm |
| Bankfull Discharge (Mannings Qbkf) | 15.161 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.791 | fps |
| Bankfull Stream Power (w) | 3.054 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 0.000 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 0.018 | fps |
| Inner Berm Stream Power (w) | 0.000 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.040 | n |
| Bankfull Slope (Sbkf) | 0.025 | ft/ft |
| Drainage Area (DA) | 0.063 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 4.000 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 0.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 3.750 | xH:1V |
| Point Bar Slope | 2.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.000 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.000 | xH:1V |
| Bottom Width | 0.000 | ft |
| Glide | 6.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 0.613 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.000 | ft |
| Riffle Mean Depth (Dbkf) | 0.516 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.000 | ft |
| Riffle Bankfull Width (Wbkf) | 7.746 | ft |
| Riffle Inner Berm Width (Wib) | 0.002 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 2.645 | ft |
| Pool Max Depth (Dmbkf) | 1.936 | ft |
| Pool Bankfull Width (Wbkfp) | 7.746 | ft |
| Pool Bottom Width | 0.000 | ft |
| Point Bar Slope 1 | 2.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 6.000 | % |
| Drop (PC) | 0.000 | ft |

## UT2 SEC 1 REACH 1

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.556 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 98.769 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 42.323 | mm |
| Inner Berm Shear Stress (t) | 0.278 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 59.321 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 20.554 | mm |
| Bankfull Discharge (Mannings Qbkf) | 17.086 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.225 | fps |
| Bankfull Stream Power (w) | 1.794 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 2.692 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 2.032 | fps |
| Inner Berm Stream Power (w) | 0.565 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.040 | n |
| Bankfull Slope (Sbkf) | 0.015 | ft/ft |
| Drainage Area (DA) | 0.100 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 5.300 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 25.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 2.500 | xH:1V |
| Point Bar Slope | 6.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.300 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.500 | xH:1V |
| Bottom Width | 2.700 | ft |
| Glide | 4.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 0.855 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.353 | ft |
| Riffle Mean Depth (Dbkf) | 0.594 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.297 | ft |
| Riffle Bankfull Width (Wbkf) | 8.916 | ft |
| Riffle Inner Berm Width (Wib) | 4.458 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 1.225 | ft |
| Pool Max Depth (Dmbkf) | 1.486 | ft |
| Pool Bankfull Width (Wbkfp) | 11.591 | ft |
| Pool Bottom Width | 2.700 | ft |
| Point Bar Slope 1 | 6.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.500 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 4.000 | % |
| Drop (PC) | 0.000 | ft |

## UT2 SEC 1 REACH 2

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.653 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 111.110 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 50.006 | mm |
| Inner Berm Shear Stress (t) | 0.326 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 66.734 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 24.286 | mm |
| Bankfull Discharge (Mannings Qbkf) | 26.178 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.589 | fps |
| Bankfull Stream Power (w) | 2.343 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 4.126 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 2.261 | fps |
| Inner Berm Stream Power (w) | 0.738 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.040 | n |
| Bankfull Slope (Sbkf) | 0.015 | ft/ft |
| Drainage Area (DA) | 0.170 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 7.300 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 25.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 2.500 | xH:1V |
| Point Bar Slope | 6.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.300 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.500 | xH:1V |
| Bottom Width | 3.200 | ft |
| Glide | 5.000 | % |
| Run | 10.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 1.003 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.414 | ft |
| Riffle Mean Depth (Dbkf) | 0.698 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.349 | ft |
| Riffle Bankfull Width (Wbkf) | 10.464 | ft |
| Riffle Inner Berm Width (Wib) | 5.232 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 1.438 | ft |
| Pool Max Depth (Dmbkf) | 1.744 | ft |
| Pool Bankfull Width (Wbkfp) | 13.603 | ft |
| Pool Bottom Width | 3.200 | ft |
| Point Bar Slope 1 | 6.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.500 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 10.000 | % |
| Glide Grade | 5.000 | % |
| Drop (PC) | 0.000 | ft |

## UT2 SEC 1 REACH 3

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.580 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 101.838 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 44.199 | mm |
| Inner Berm Shear Stress (t) | 0.290 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 61.165 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 21.465 | mm |
| Bankfull Discharge (Mannings Qbkf) | 30.944 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.442 | fps |
| Bankfull Stream Power (w) | 1.996 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 4.878 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 2.168 | fps |
| Inner Berm Stream Power (w) | 0.629 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.040 | n |
| Bankfull Slope (Sbkf) | 0.012 | ft/ft |
| Drainage Area (DA) | 0.240 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 9.000 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 25.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 2.500 | xH:1V |
| Point Bar Slope | 6.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.300 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 3.000 | xH:1V |
| Bottom Width | 3.000 | ft |
| Glide | 6.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 1.113 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.459 | ft |
| Riffle Mean Depth (Dbkf) | 0.775 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.387 | ft |
| Riffle Bankfull Width (Wbkf) | 11.619 | ft |
| Riffle Inner Berm Width (Wib) | 5.809 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 1.597 | ft |
| Pool Max Depth (Dmbkf) | 1.936 | ft |
| Pool Bankfull Width (Wbkfp) | 15.105 | ft |
| Pool Bottom Width | 3.000 | ft |
| Point Bar Slope 1 | 6.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 3.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 6.000 | % |
| Drop (PC) | 0.000 | ft |

## UT2 SEC 1 REACH 4

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.608 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 105.471 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 46.449 | mm |
| Inner Berm Shear Stress (t) | 0.304 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 63.347 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 22.558 | mm |
| Bankfull Discharge (Mannings Qbkf) | 35.166 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.553 | fps |
| Bankfull Stream Power (w) | 2.161 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 5.539 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 2.238 | fps |
| Inner Berm Stream Power (w) | 0.681 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.040 | n |
| Bankfull Slope (Sbkf) | 0.012 | ft/ft |
| Drainage Area (DA) | 0.280 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 9.900 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 25.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 2.500 | xH:1V |
| Point Bar Slope | 6.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.300 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 3.000 | xH:1V |
| Bottom Width | 3.200 | ft |
| Glide | 6.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 1.169 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.482 | ft |
| Riffle Mean Depth (Dbkf) | 0.812 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.406 | ft |
| Riffle Bankfull Width (Wbkf) | 12.186 | ft |
| Riffle Inner Berm Width (Wib) | 6.093 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 1.673 | ft |
| Pool Max Depth (Dmbkf) | 2.031 | ft |
| Pool Bankfull Width (Wbkfp) | 15.842 | ft |
| Pool Bottom Width | 3.200 | ft |
| Point Bar Slope 1 | 6.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 3.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 6.000 | % |
| Drop (PC) | 0.000 | ft |

## UT2 SEC 1 REACH 5

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.603 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 104.822 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 46.044 | mm |
| Inner Berm Shear Stress (t) | 0.302 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 62.957 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 22.362 | mm |
| Bankfull Discharge (Mannings Qbkf) | 40.223 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.795 | fps |
| Bankfull Stream Power (w) | 2.289 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 6.336 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 2.391 | fps |
| Inner Berm Stream Power (w) | 0.721 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.038 | n |
| Bankfull Slope (Sbkf) | 0.012 | ft/ft |
| Drainage Area (DA) | 0.310 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 10.600 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 15.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 25.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 2.500 | xH:1V |
| Point Bar Slope | 7.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.400 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 3.000 | xH:1V |
| Bottom Width | 3.500 | ft |
| Glide | 6.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 1.210 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.499 | ft |
| Riffle Mean Depth (Dbkf) | 0.841 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.420 | ft |
| Riffle Bankfull Width (Wbkf) | 12.610 | ft |
| Riffle Inner Berm Width (Wib) | 6.305 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 1.732 | ft |
| Pool Max Depth (Dmbkf) | 2.102 | ft |
| Pool Bankfull Width (Wbkfp) | 17.653 | ft |
| Pool Bottom Width | 3.500 | ft |
| Point Bar Slope 1 | 7.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 3.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 6.000 | % |
| Drop (PC) | 0.000 | ft |

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

STREAM MORPHOLOGY TABLES
UT2 SEC 3 & UT2 SEC 1

DRAWING NO.: 04

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION


South Carolina 811 Call 811 Before You Dig


P:\2019\196-626.0004_CAD\Dwg\C0011\196-626-EC01-MORPH TABLES.dwg|04 STREAM MORPHOLOGY TABLES UT2 SEC 3 & UT2 SEC 1| LS:(1/31/2020 - cgmaling) - LP: 2/3/2020 9:20 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
| | | |
| | | |
| | | |

## UT3 SEC1 REACH 1

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.655 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 111.406 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 50.195 | mm |
| Inner Berm Shear Stress (t) | 0.000 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 0.297 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 0.01 | mm |
| Bankfull Discharge (Mannings Qbkf) | 11.308 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 3.776 | fps |
| Bankfull Stream Power (w) | 2.474 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 0.000 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 0.018 | fps |
| Inner Berm Stream Power (w) | 0.000 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.035 | n |
| Bankfull Slope (Sbkf) | 0.025 | ft/ft |
| Drainage Area (DA) | 0.055 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 3.000 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 17.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 0.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 3.000 | xH:1V |
| Point Bar Slope | 5.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.100 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.000 | xH:1V |
| Bottom Width | 2.500 | ft |
| Glide | 3.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 0.485 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.000 | ft |
| Riffle Mean Depth (Dbkf) | 0.420 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.000 | ft |
| Riffle Bankfull Width (Wbkf) | 7.141 | ft |
| Riffle Inner Berm Width (Wib) | 0.002 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 2.599 | ft |
| Pool Max Depth (Dmbkf) | 1.260 | ft |
| Pool Bankfull Width (Wbkfp) | 7.856 | ft |
| Pool Bottom Width | 2.500 | ft |
| Point Bar Slope 1 | 5.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 3.000 | % |
| Drop (PC) | 0.000 | ft |

## UT3 SEC 1 REACH 2

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.648 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 110.505 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 49.621 | mm |
| Inner Berm Shear Stress (t) | 0.324 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 66.370 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 24.098 | mm |
| Bankfull Discharge (Mannings Qbkf) | 23.808 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 4.037 | fps |
| Bankfull Stream Power (w) | 2.617 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 3.751 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 2.543 | fps |
| Inner Berm Stream Power (w) | 0.824 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.035 | n |
| Bankfull Slope (Sbkf) | 0.016 | ft/ft |
| Drainage Area (DA) | 0.120 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 5.900 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 14.000 | x:1 |
| Riffle Side Slopes | 2.500 | xH:1V |
| Inner Berm Percent | 25.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 3.500 | xH:1V |
| Point Bar Slope | 5.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.400 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.000 | xH:1V |
| Bottom Width | 2.000 | ft |
| Glide | 3.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 1.002 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.423 | ft |
| Riffle Mean Depth (Dbkf) | 0.649 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.325 | ft |
| Riffle Bankfull Width (Wbkf) | 9.088 | ft |
| Riffle Inner Berm Width (Wib) | 4.544 | ft |
| Riffle Side Slopes | 2.500 | xH:1V |
| Inner Berm Bench Width | 0.825 | ft |
| Pool Max Depth (Dmbkf) | 2.272 | ft |
| Pool Bankfull Width (Wbkfp) | 12.724 | ft |
| Pool Bottom Width | 2.000 | ft |
| Point Bar Slope 1 | 5.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 3.000 | % |
| Drop (PC) | 0.000 | ft |

## UT3 SEC 1 REACH 3

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 0.850 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 134.936 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 65.850 | mm |
| Inner Berm Shear Stress (t) | 0.000 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 0.360 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 0.015 | mm |
| Bankfull Discharge (Mannings Qbkf) | 30.298 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 4.662 | fps |
| Bankfull Stream Power (w) | 3.964 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 0.000 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 0.022 | fps |
| Inner Berm Stream Power (w) | 0.000 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.035 | n |
| Bankfull Slope (Sbkf) | 0.020 | ft/ft |
| Drainage Area (DA) | 0.120 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 6.500 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 14.000 | x:1 |
| Riffle Side Slopes | 2.500 | xH:1V |
| Inner Berm Percent | 0.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 3.000 | xH:1V |
| Point Bar Slope | 5.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.100 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.000 | xH:1V |
| Bottom Width | 2.000 | ft |
| Glide | 3.000 | % |
| Run | 5.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 0.887 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.000 | ft |
| Riffle Mean Depth (Dbkf) | 0.681 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.000 | ft |
| Riffle Bankfull Width (Wbkf) | 9.539 | ft |
| Riffle Inner Berm Width (Wib) | 0.003 | ft |
| Riffle Side Slopes | 2.500 | xH:1V |
| Inner Berm Bench Width | 2.548 | ft |
| Pool Max Depth (Dmbkf) | 2.044 | ft |
| Pool Bankfull Width (Wbkfp) | 10.493 | ft |
| Pool Bottom Width | 2.000 | ft |
| Point Bar Slope 1 | 5.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 5.000 | % |
| Glide Grade | 3.000 | % |
| Drop (PC) | 0.000 | ft |

## UT4 SEC 1

| Property | Value | Unit |
|---|---|---|
| **Flow/Entrainment** | | |
| Bankfull Shear Stress (t) | 1.154 | lbs/ft |
| Bankfull Entrainment (Rosgen/Colorado) | 168.952 | mm |
| Bankfull Entrainment (Leopold/Wolman & Miller) | 90.548 | mm |
| Inner Berm Shear Stress (t) | 0.000 | lbs/ft |
| Inner Berm Entrainment (Rosgen/Colorado) | 0.450 | mm |
| Inner Berm Entrainment (Leopold/Wolman & Miller) | 0.020 | mm |
| Bankfull Discharge (Mannings Qbkf) | 15.458 | cfs |
| Bankfull Velocity (ubkf=Q/A) | 5.159 | fps |
| Bankfull Stream Power (w) | 5.955 | lbs/ft/s |
| Inner Berm Discharge (Mannings Qbkf) | 0.000 | cfs |
| Inner Berm Velocity (ubkf=Q/A) | 0.024 | fps |
| Inner Berm Stream Power (w) | 0.000 | lbs/ft/s |
| | | |
| **Input-Flow** | | |
| Manning's N | 0.035 | n |
| Bankfull Slope (Sbkf) | 0.037 | ft/ft |
| Drainage Area (DA) | 0.037 | (SqMi) |
| | | |
| **Input - Pattern, Riffle** | | |
| Bankful Area (Abkf) | 3.000 | sf |
| Width/Depth Ratio (Wbkf/Dbkf) | 12.000 | x:1 |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Percent | 0.000 | % |
| | | |
| **Input - Pattern, Pool** | | |
| Max Depth Ratio (dmbkf/dbkf) | 3.000 | xH:1V |
| Point Bar Slope | 2.000 | xH:1V |
| Meander Width Ratio (Wblt/Wbkf) | 1.005 | x:1 |
| Outslope | 2.000 | xH:1V |
| Inslope | 2.000 | xH:1V |
| Bottom Width | 0.500 | ft |
| Glide | 0.000 | % |
| Run | 0.000 | % |
| Drop | 0.000 | ft |
| | | |
| **Output - SA Parameters** | | |
| Riffle Max Depth (Dmbkf) | 0.632 | ft |
| Riffle Inner Berm Max Depth (Dmib) | 0.000 | ft |
| Riffle Mean Depth (Dbkf) | 0.500 | ft |
| Riffle Inner Berm Mean Depth (Dib) | 0.000 | ft |
| Riffle Bankfull Width (Wbkf) | 6.000 | ft |
| Riffle Inner Berm Width (Wib) | 0.002 | ft |
| Riffle Side Slopes | 2.000 | xH:1V |
| Inner Berm Bench Width | 1.733 | ft |
| Pool Max Depth (Dmbkf) | 1.500 | ft |
| Pool Bankfull Width (Wbkfp) | 6.030 | ft |
| Pool Bottom Width | 0.500 | ft |
| Point Bar Slope 1 | 2.000 | xH:1V |
| Point Bar Slope 2 (Inslope) | 2.000 | xH:1V |
| Pool Outslope | 2.000 | xH:1V |
| Run Grade | 0.000 | % |
| Glide Grade | 0.000 | % |
| Drop (PC) | 0.000 | ft |

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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

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# SOUTH CAROLINA DEPT. OF COMMERCE
# LANDSFORD TRACT PERMITTEE
# RESPONSIBLE MITIGATION PLAN
# CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

STREAM MORPHOLOGY TABLES
UT3 SEC 1 & UT4 SEC 1

DRAWING NO.: 05

P:\2019\196-626.0004\-CAD\Dwg\COVER\196-626-ECO1-MORPH TABLES.dwg|05 STREAM MORPHOLOGY TABLES UT3 SEC 1 & UT4 SEC 1| LS(1/31/2020 - cgmaking) - LP: 2/3/2020 9:20 AM

| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |
| | | |
| | | |
| | | |

**SUBMITTAL & REVISION RECORD**

KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- DIRECTION OF SURFACE FLOW

NORTH

SCALE IN FEET

0 60 120

*HAND SIGNATURE ON FILE

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

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Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 3 EXISTING CONDITIONS

DRAWING NO.: 06

## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |
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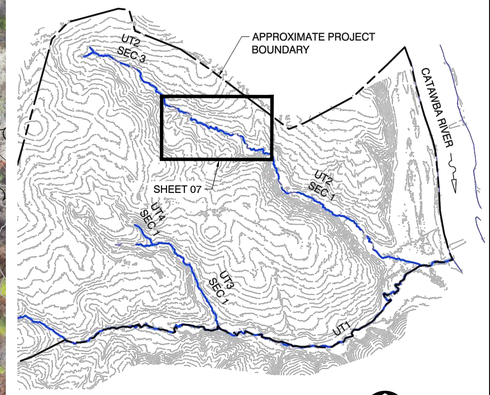


KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- DIRECTION OF SURFACE FLOW

NORTH

SCALE IN FEET

0 60 120

*HAND SIGNATURE ON FILE


CEC

Civil & Environmental Consultants, Inc.

530 Howell Road · Suite 203 · Greenville, SC 29615

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 3 EXISTING CONDITIONS

DRAWING NO.: 07

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-EXISTING_UT2-1 - (1).dwg\07 UT2 SEC 3 EXISTING CONDITIONS\ LS:(1/31/2020 - cgriebling) - LP: 2/3/2020 9:21 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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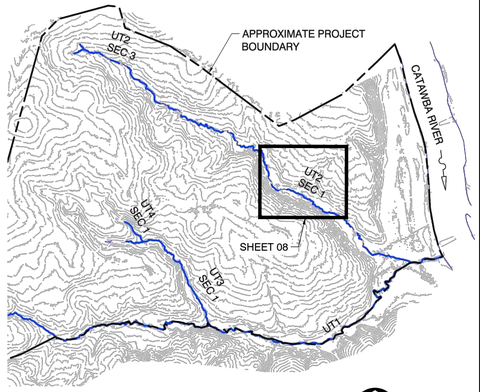


KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- DIRECTION OF SURFACE FLOW

NORTH

SCALE IN FEET

0 60 120

*HAND SIGNATURE ON FILE

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
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South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 EXISTING CONDITIONS

DRAWING NO.: 08

P:\2018\196-626.00041-CADD\Dwg\EC01\196626EC01-EXISTING_UT2-1 - (1).dwg|08 UT2 SEC 1 EXISTING CONDITIONS| 1/31/2020 - cgmeling - LP: 2/3/2020 9:22 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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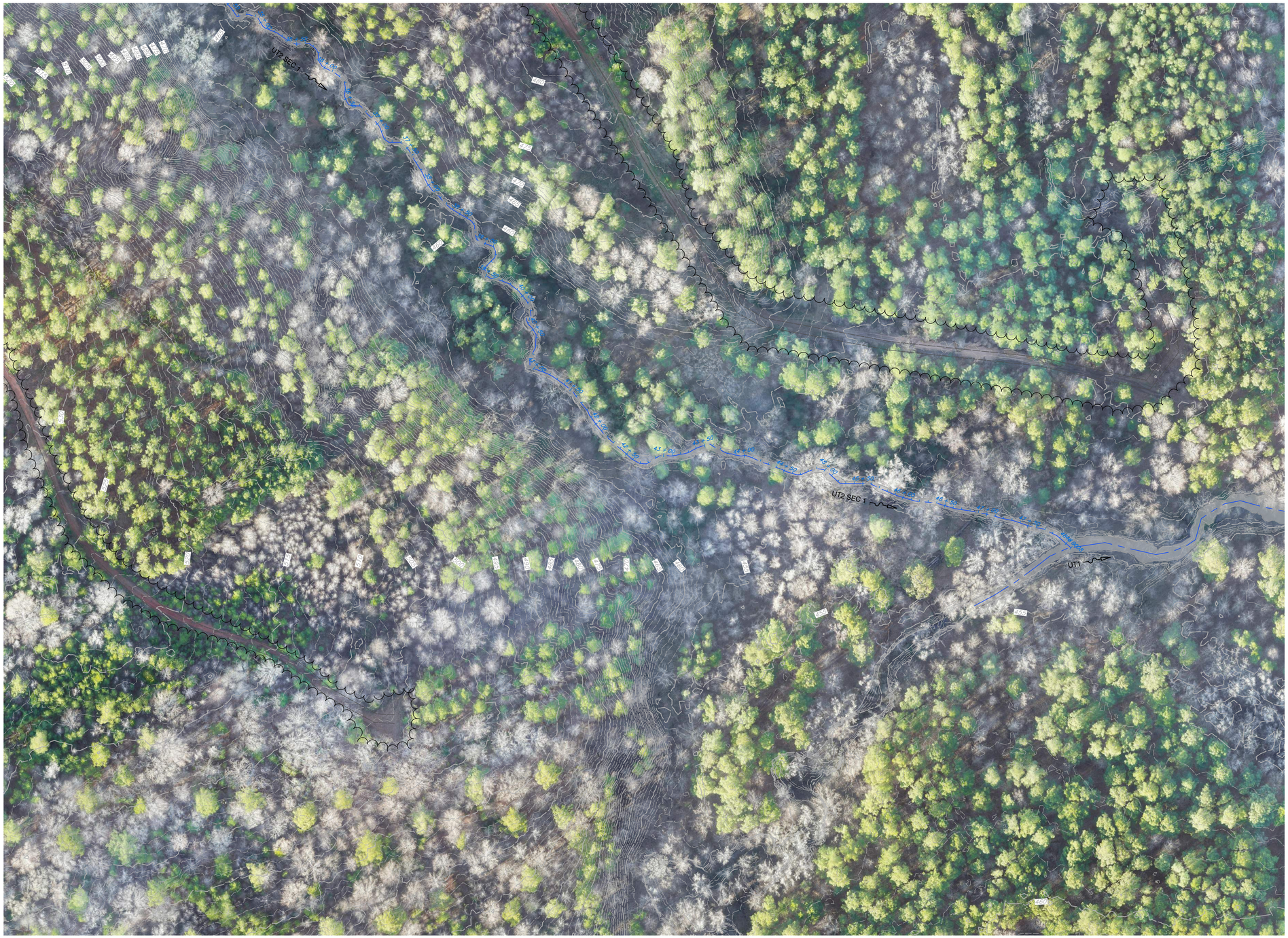


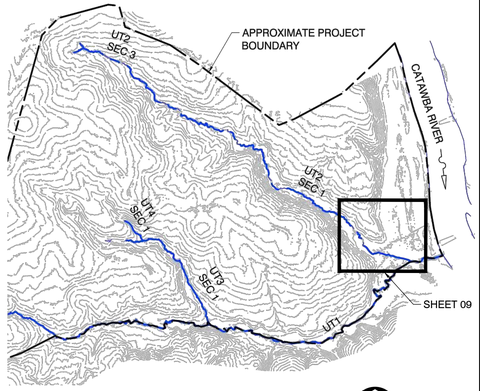


KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- EXISTING INDEX CONTOUR (850)
- EXISTING INTERMEDIATE CONTOUR (849)
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- DIRECTION OF SURFACE FLOW

NORTH

SCALE IN FEET

0 60 120

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 EXISTING CONDITIONS

DRAWING NO.: 09

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

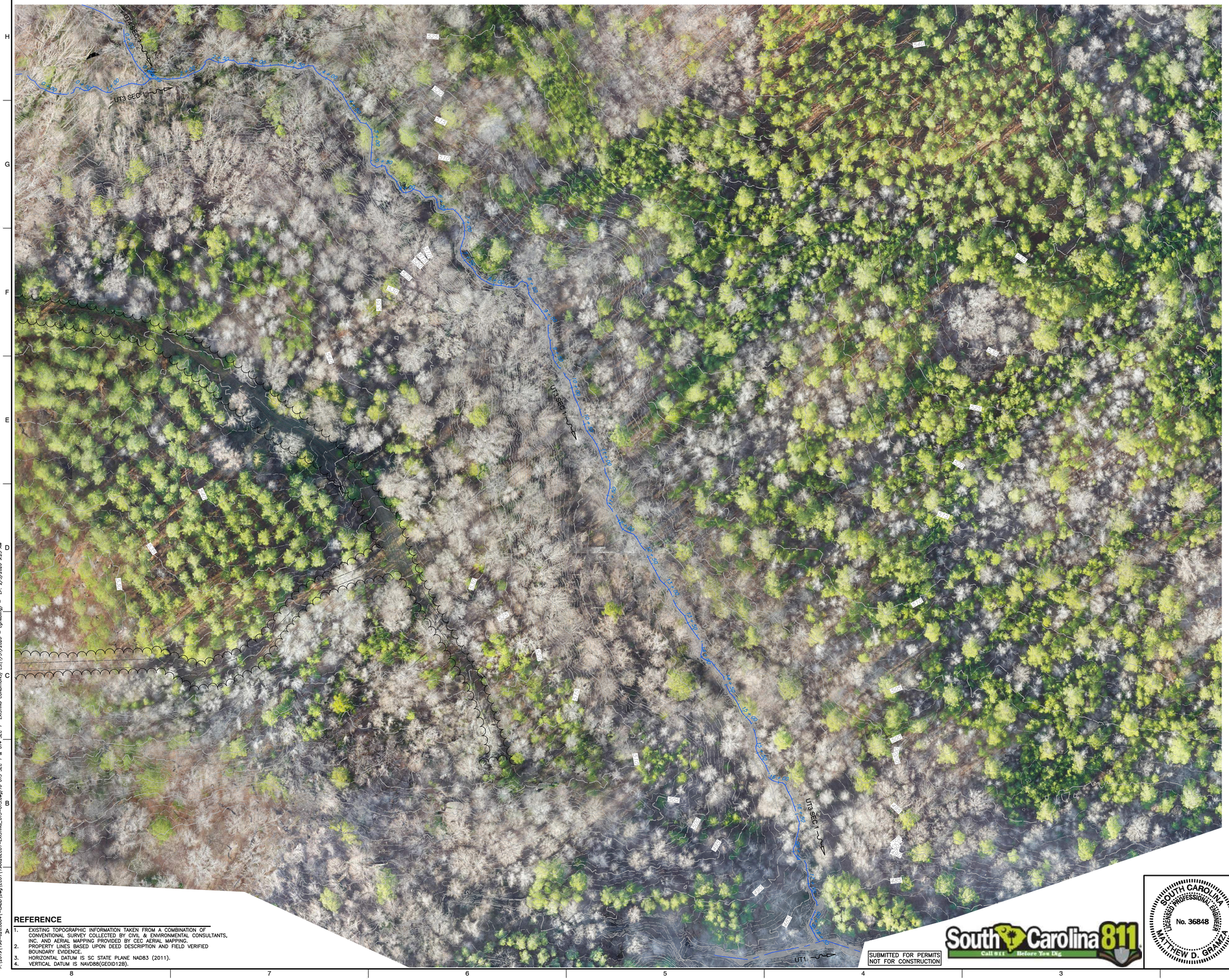
SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

P:\2019\196-626.0004\CADD\Dwg\ECD1\[196626ECD1-EXISTING_UT2-1 - (1)dwg]09 UT2 SEC 1 EXISTING CONDITIONS] LS(1/31/2020 - cgmaking) - LP: 2/3/2020 9:22 AM




## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |
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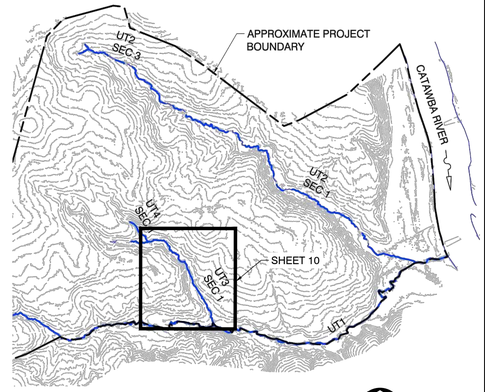


KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- DIRECTION OF SURFACE FLOW

NORTH

SCALE IN FEET

0 60 120

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 & UT4 SEC 1 EXISTING CONDITIONS

DRAWING NO.: 10

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-EXISTING_UT3-UT5.dwg\10 UT3 SEC 1 & UT4 SEC 1 EXISTING CONDITIONS\ LS:(1/31/2020 - cgriebling) - LP: 2/3/2020 9:23 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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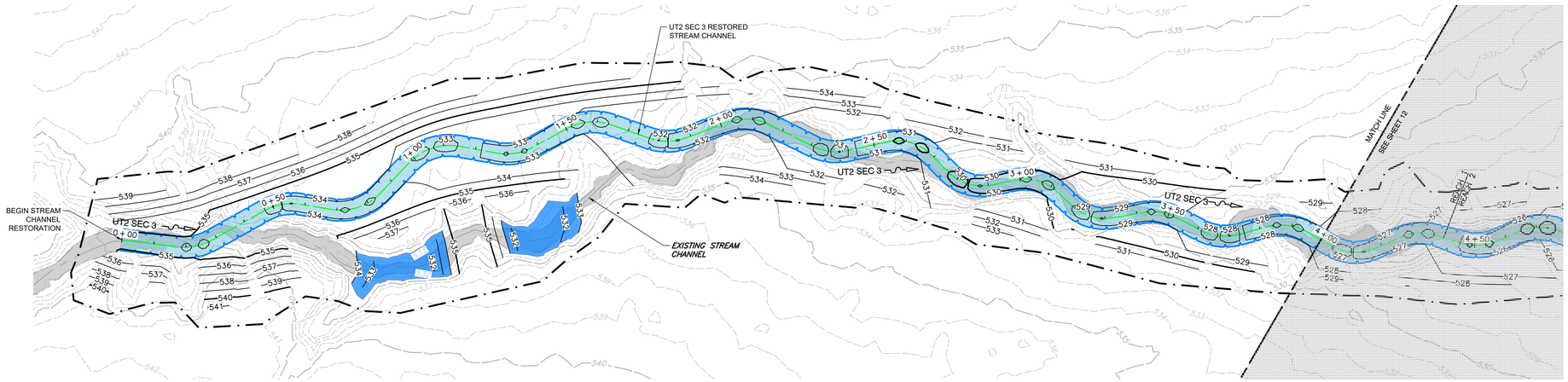
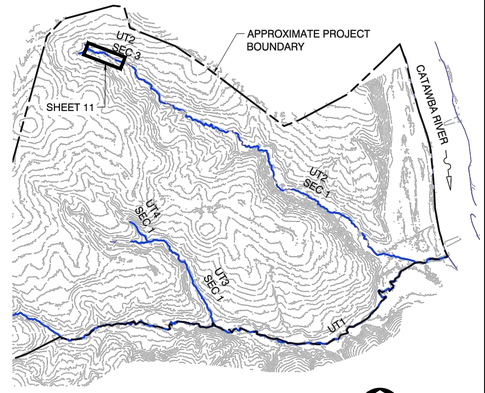
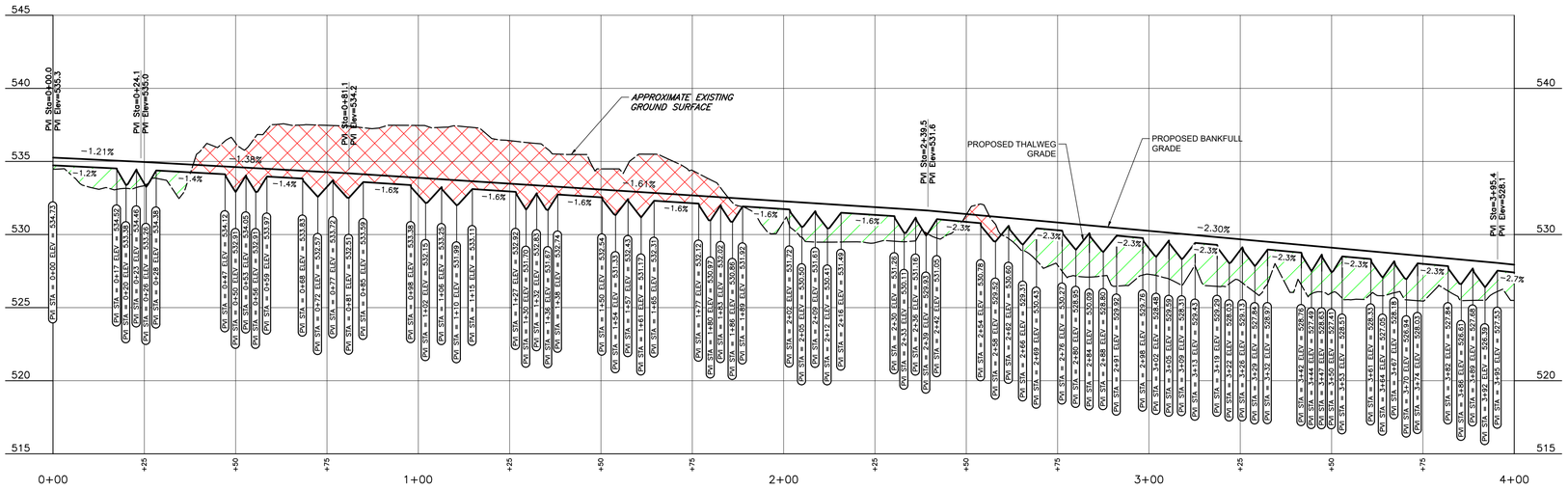
NORTH




PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




PROPOSED UT2 SEC 3 PROFILE

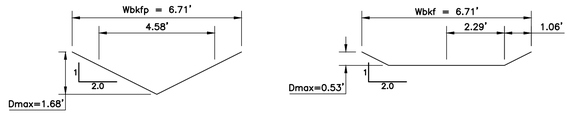
HORIZONTAL SCALE IN FEET
0 20 40

VERTICAL SCALE IN FEET
0 5 10

4X VERTICAL EXAGGERATION

LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION

TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Ddkf =MEAN BANKFULL DEPTH

## UT2 SEC 3 REACH 1 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 3 GRADING PLAN & PROFILE
STA 0+00 TO 4+00

DRAWING NO.: 11

P:\2019\196-626.0004\~CADD\Dwg\COVER\196626C01-PLAN_PROFILE_UT2-1 - (1).dwg[11 UT2 SEC 3 GRADING PLAN & PROFILE STA 0+00 TO 4+00] LS(1/31/2020 - cgmalling) - LP: 2/3/2020 8:24 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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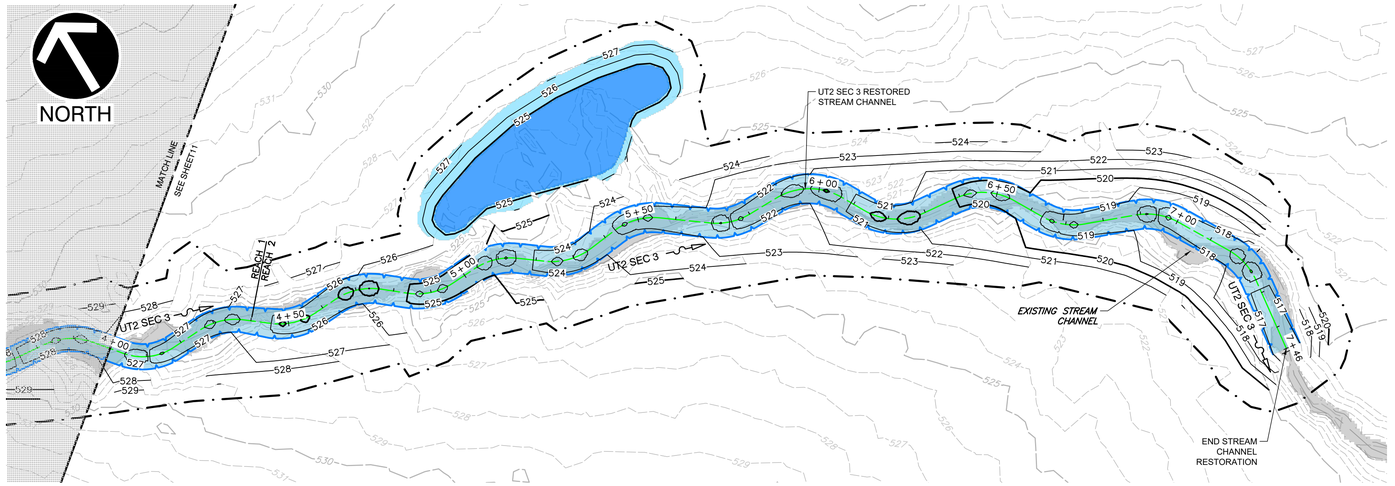
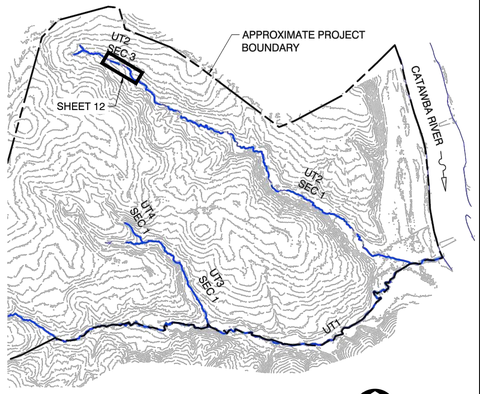
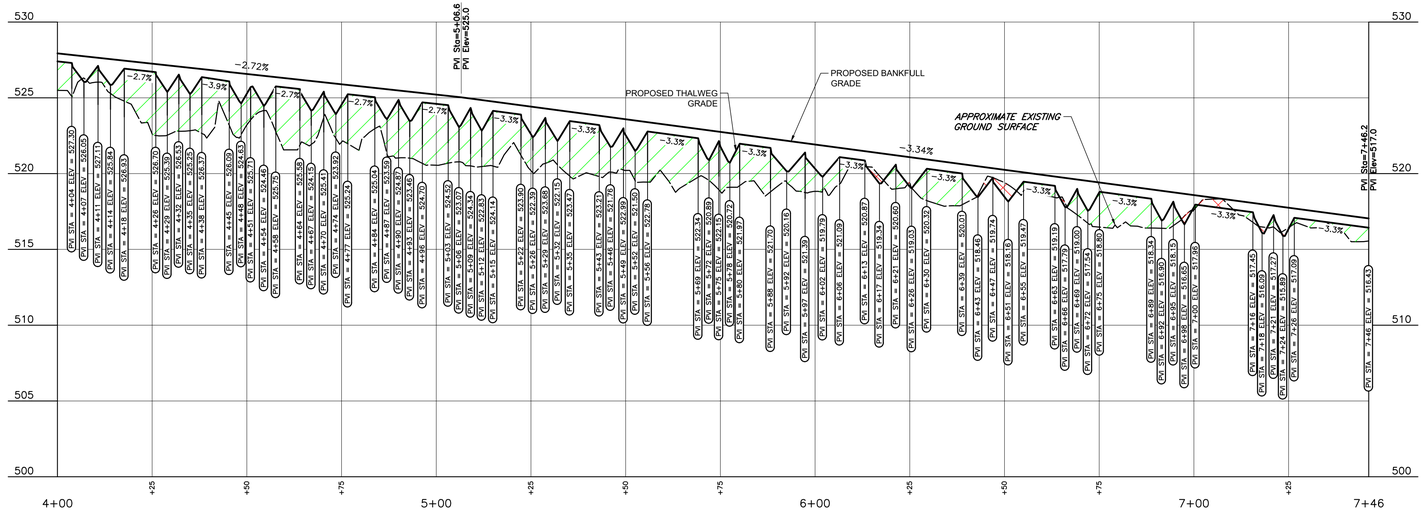



PLAN
SCALE IN FEET
0 20 40



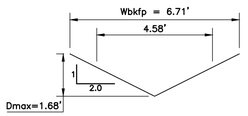

KEYMAP
SCALE IN FEET
0 1000 2000
NORTH



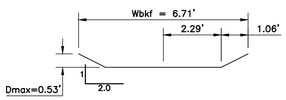

PROPOSED UT2 SEC 3 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION

LEGEND

- 850 EXISTING INDEX CONTOUR
- 849 EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 PROPOSED INDEX CONTOUR
- 842 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD



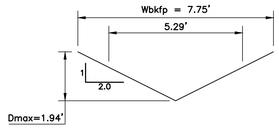

TYPICAL POOL SECTION



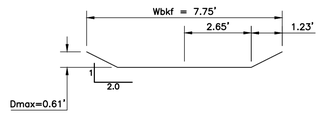

TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 3 REACH 1 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 3 REACH 2 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

REFERENCE

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3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

*HAND SIGNATURE ON FILE


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SOUTH CAROLINA DEPT. OF COMMERCE
LANDSFORD TRACT PERMITTEE
RESPONSIBLE MITIGATION PLAN
CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

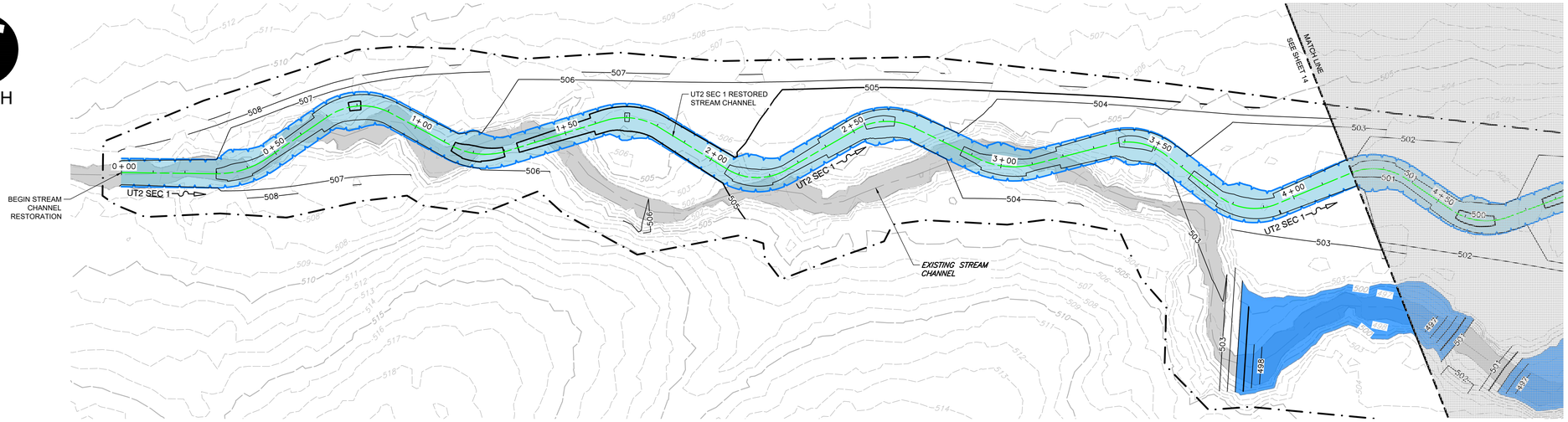
UT2 SEC 3 GRADING PLAN & PROFILE
STA 4+00 TO 7+46

DRAWING NO.: 12

P:\2019\196-626.0001-CAD\Dwg\CD1\196626CD1-PLAN_PROFILE_UT2-1 - (1).dwg[12 UT2 SEC 3 GRADING PLAN & PROFILE STA 4+00 TO 7+46] LS(1/31/2020 - cgreening) - LP: 2/3/2020 9:24 AM

## SUBMITTAL & REVISION RECORD

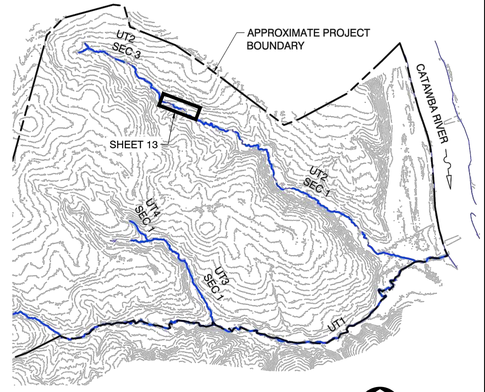
| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |




PLAN

SCALE IN FEET

0 20 40

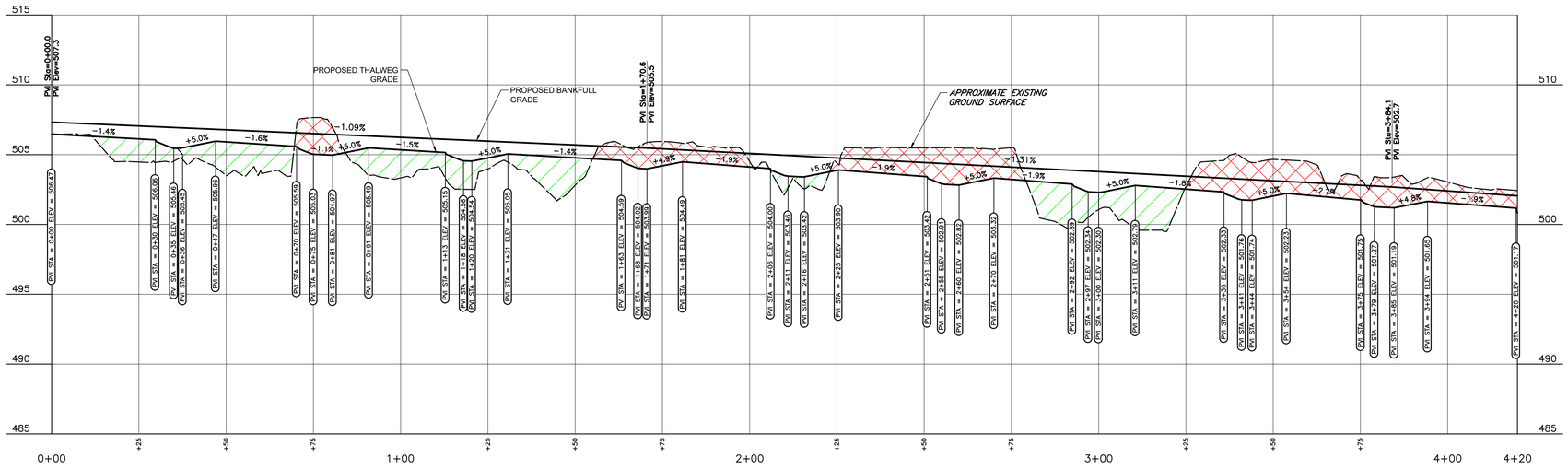



KEYMAP

SCALE IN FEET

0 1000 2000

NORTH




PROPOSED UT2 SEC 1 PROFILE

HORIZONTAL SCALE IN FEET

0 20 40

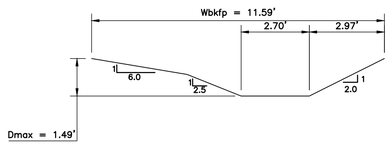
VERTICAL SCALE IN FEET

0 5 10

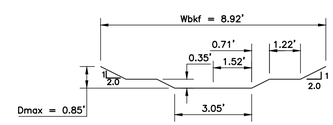
4X VERTICAL EXAGGERATION

LEGEND

- 850 EXISTING INDEX CONTOUR
- 849 EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 PROPOSED INDEX CONTOUR
- 842 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 1 REACH 1 BANKFULL TYPICAL STREAM SECTIONS

N.T.S.

### REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE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Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

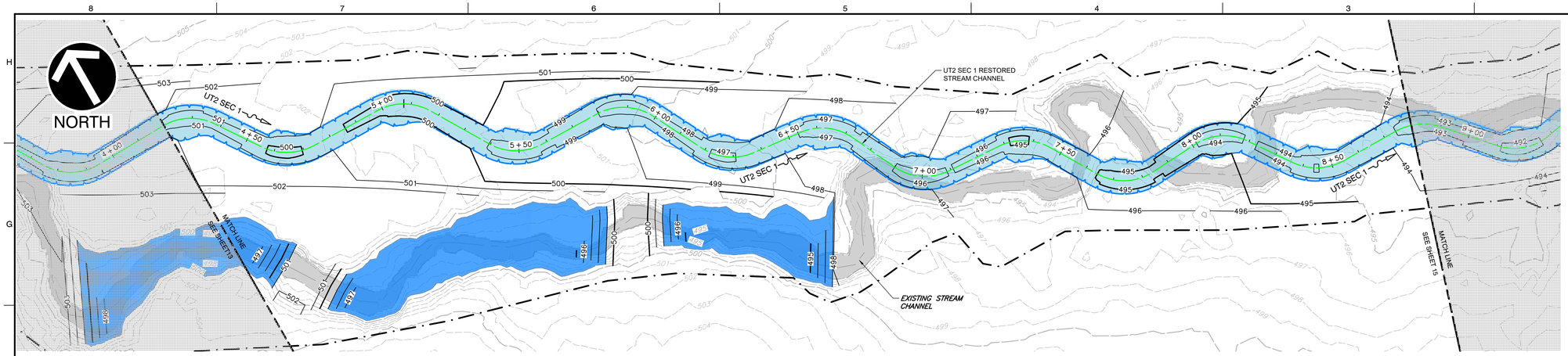
UT2 SEC 1 GRADING PLAN & PROFILE
STA 0+00 TO 4+20

DRAWING NO.: 13

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-PLAN_PROFILE_UT2-2 - (1).dwg\13 UT2 SEC 1 GRADING PLAN & PROFILE STA 0+00 TO 4+20\ LS(1/31/2020 - ekohinke) - LP: 2/3/2020 9:25 AM

## SUBMITTAL & REVISION RECORD

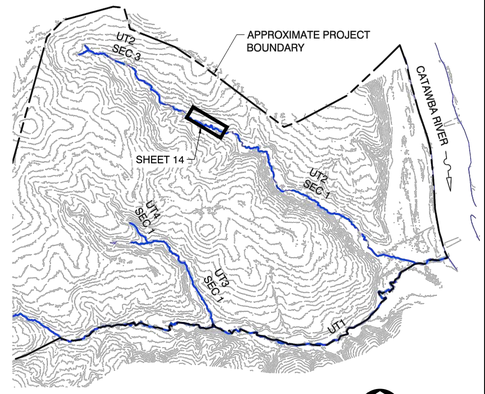
| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |




PLAN

SCALE IN FEET

0 20 40

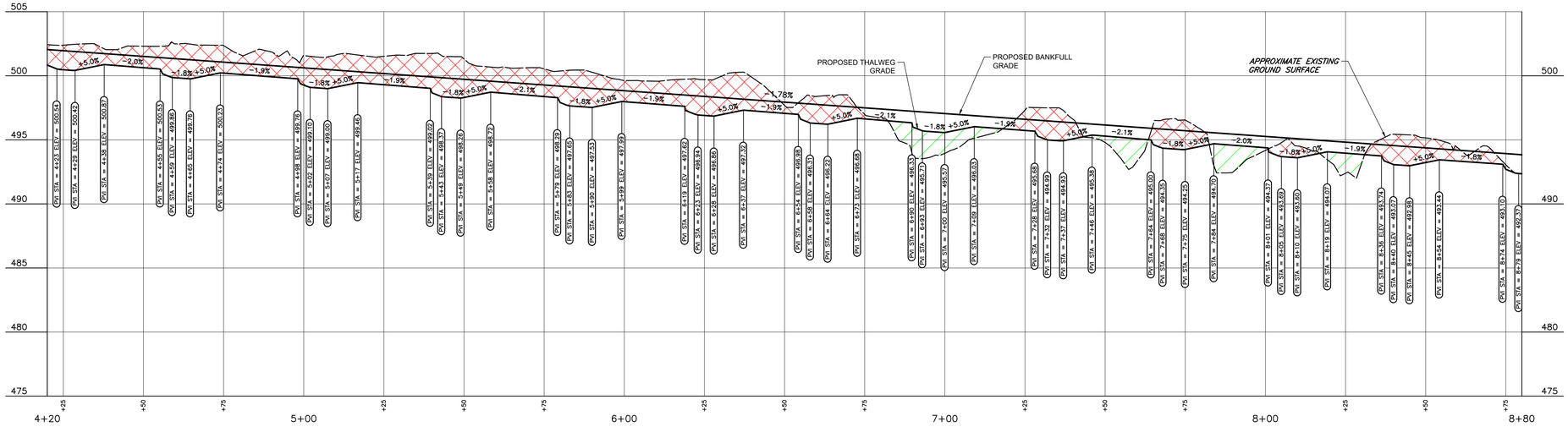



KEYMAP

SCALE IN FEET

0 1000 2000

NORTH




PROPOSED UT2 SEC 1 PROFILE

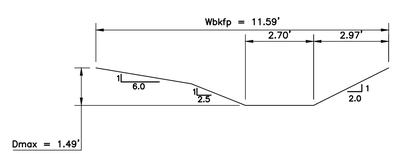
HORIZONTAL SCALE IN FEET 0 20 40

VERTICAL SCALE IN FEET 0 5 10

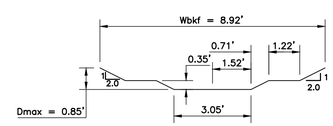
4X VERTICAL EXAGGERATION

LEGEND

- 850 EXISTING INDEX CONTOUR
- 849 EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 PROPOSED INDEX CONTOUR
- 842 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 1 REACH 1 BANKFULL TYPICAL STREAM SECTIONS

N.T.S.

### REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 4+20 TO 8+80

DRAWING NO.: 14

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-PLAN_PROFILE_UT2-2 - (1).dwg|14 UT2 SEC 1 GRADING PLAN & PROFILE STA 4+20 TO 8+80| LS:(1/31/2020 - elchinke) - LP: 2/3/2020 9:25 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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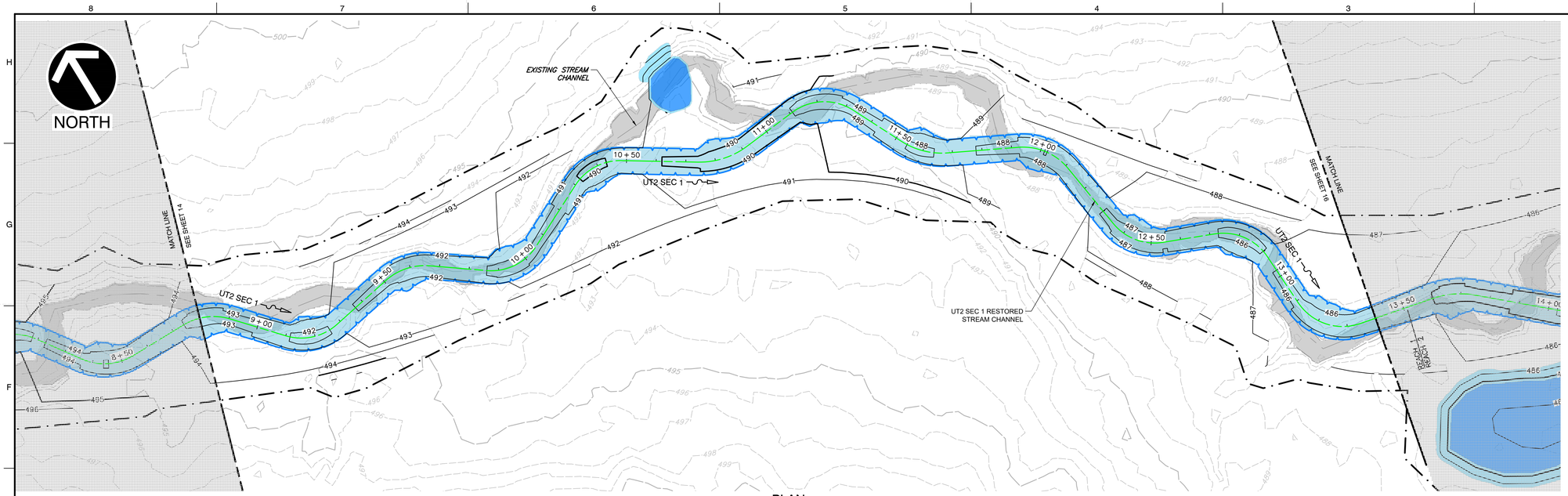
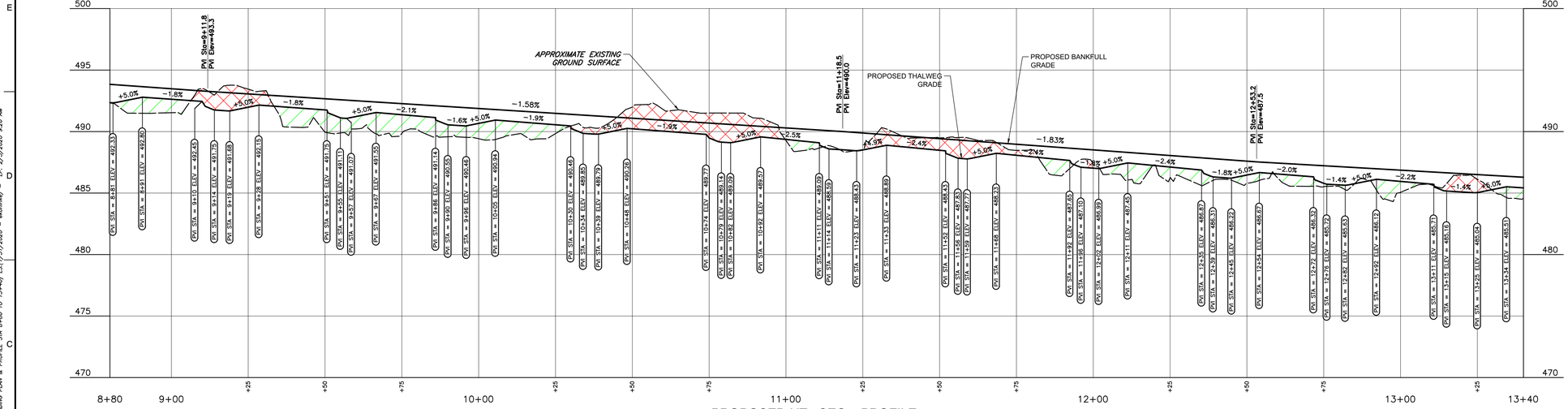
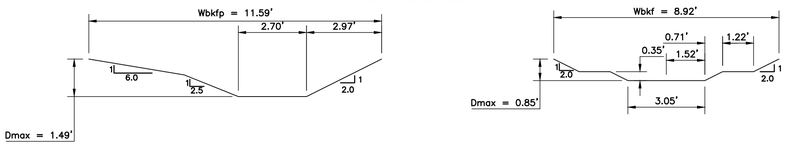



PLAN
SCALE IN FEET
0 20 40




PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION



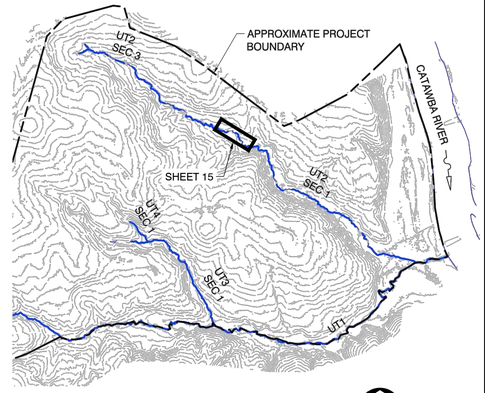

TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 1 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

LEGEND
- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 8+80 TO 13+40

DRAWING NO.: 15

P:\2019\196-626.0004\--CAD\Dwg\[C01]196626C01-PLAN_PROFILE_UT2-2 - (1).dwg[15 UT2 SEC 1 GRADING PLAN & PROFILE STA 8+80 TO 13+40] LS(1/31/2020 - eskinner) - LP: 2/3/2020 9:26 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
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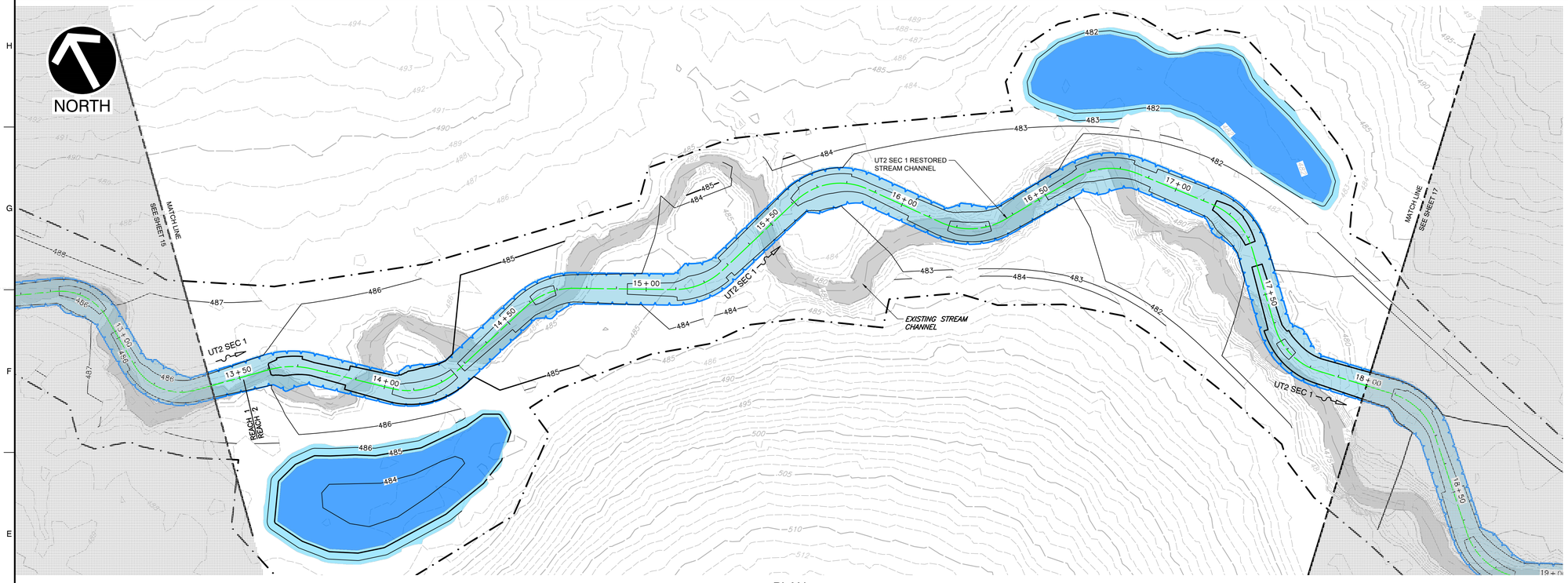
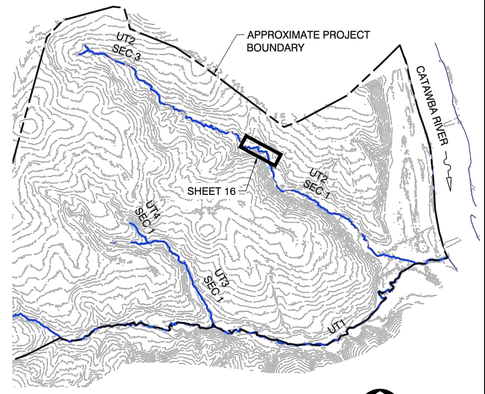
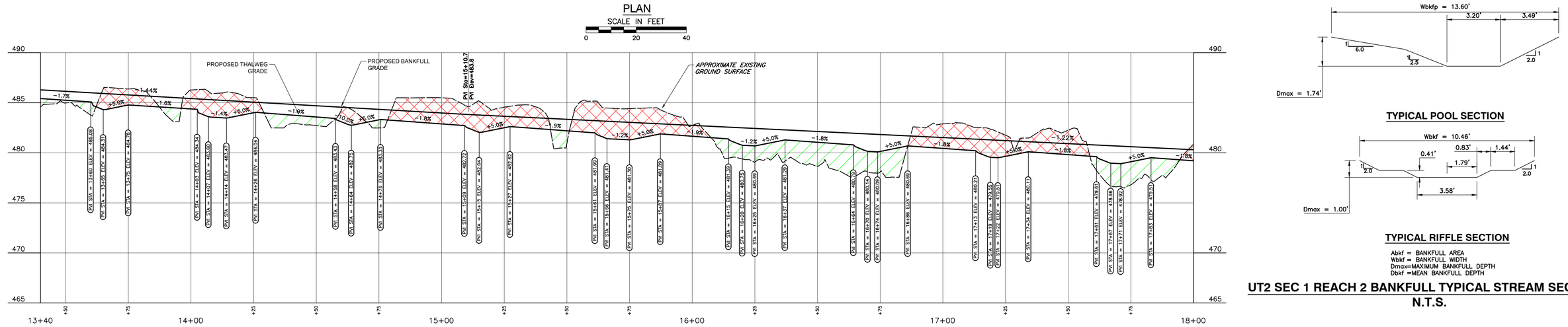



PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION

LEGEND
- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 2 BANKFULL TYPICAL STREAM SECTIONS
## N.T.S.

REFERENCE
1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
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SOUTH CAROLINA DEPT. OF COMMERCE
LANDSFORD TRACT PERMITTEE
RESPONSIBLE MITIGATION PLAN
CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 13+40 TO 18+00

DRAWING NO.: 16

P:\2019\196-626.00\41-CAD\Dwg\2020\196626C01-PLAN_PROFILE_UT2-2 - (1).dwg[16 UT2 SEC 1 GRADING PLAN & PROFILE STA 13+40 TO 18+00] LS(1/31/2020 - eashway) - LP: 2/3/2020 9:26 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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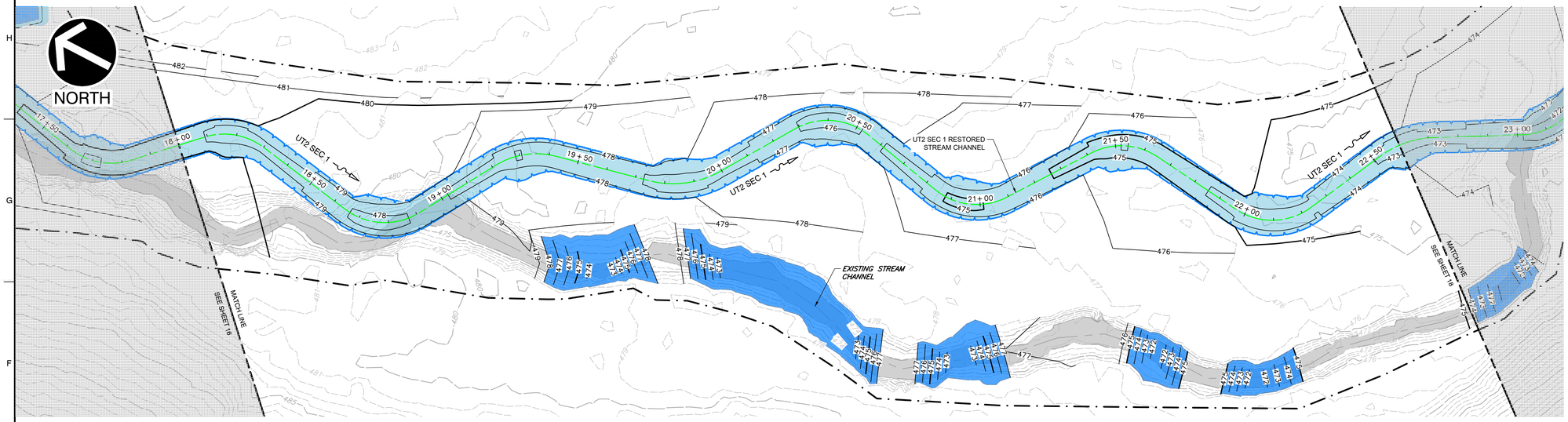
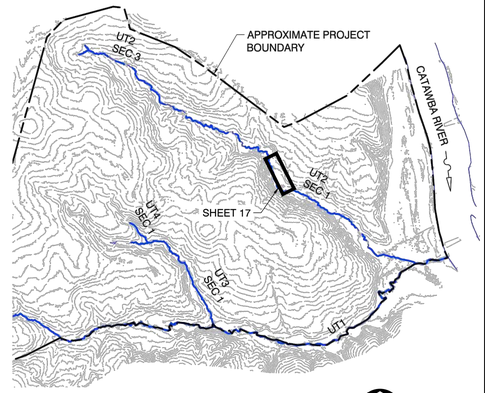
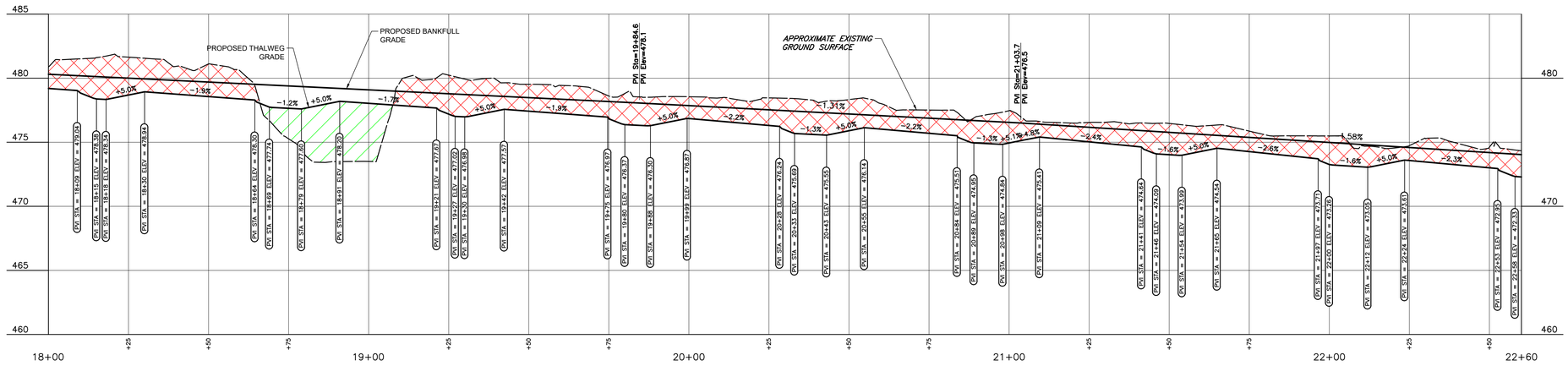



PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




PROPOSED UT2 SEC 1 PROFILE

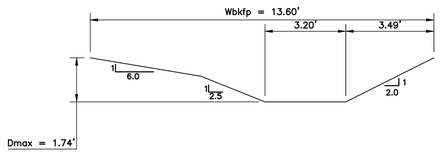
HORIZONTAL SCALE IN FEET
0 20 40

VERTICAL SCALE IN FEET
0 5 10

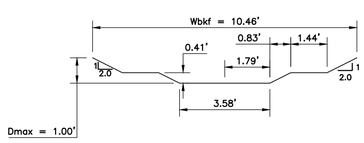
4X VERTICAL EXAGGERATION

LEGEND

- EXISTING INDEX CONTOUR (850)
- EXISTING INTERMEDIATE CONTOUR (849)
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR (845)
- PROPOSED INTERMEDIATE CONTOUR (842)
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 2 BANKFULL TYPICAL STREAM SECTIONS
## N.T.S.

**REFERENCE**

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 18+00 TO 22+60

DRAWING NO.: 17

P:\2019\196-626.00041-CADD\Dwg\C031\196626C031-PLAN_PROFILE_UT2-2 - (2).dwg[17 UT2 SEC 1 GRADING PLAN & PROFILE STA 18+00 TO 22+60] LS(1/31/2020 - cgreiling) - LP: 2/3/2020 9:29 AM

| SUBMITTAL & REVISION RECORD | | |
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| | 01/31/2020 | ISSUED FOR PERMITS |
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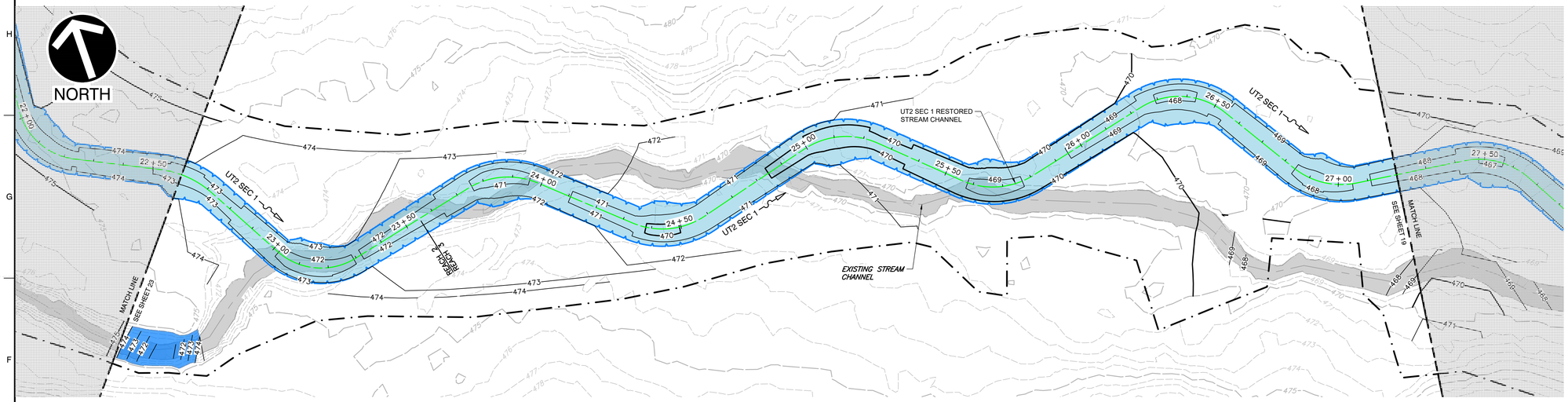
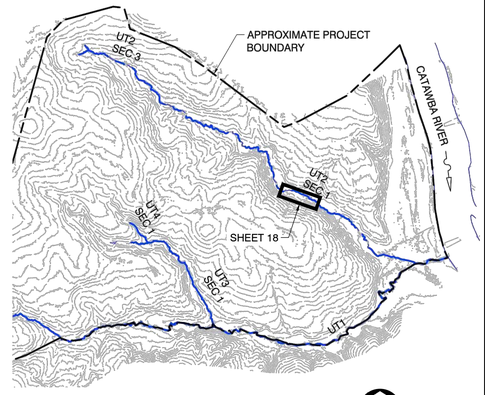
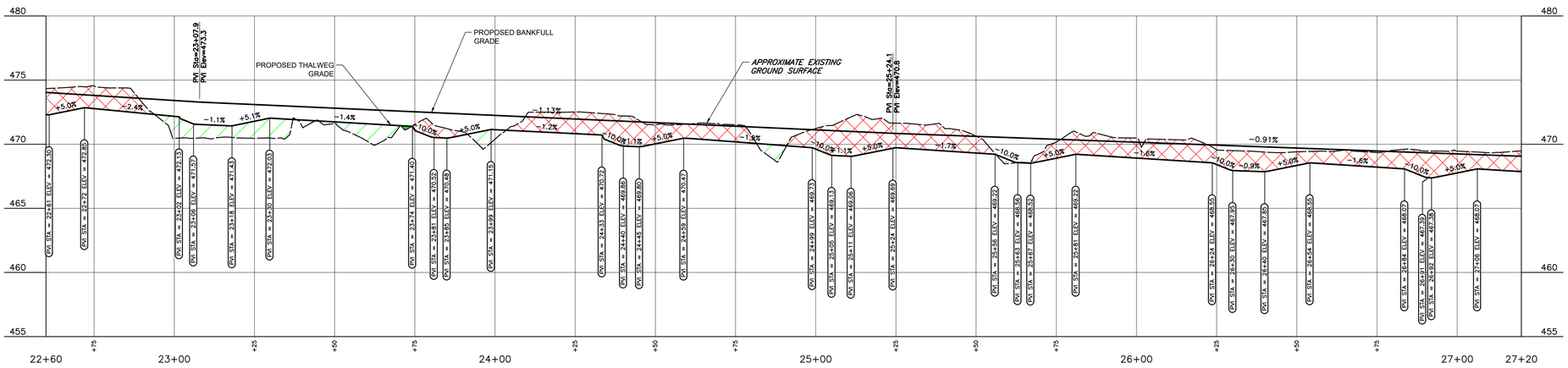



PLAN
SCALE IN FEET
0 20 40

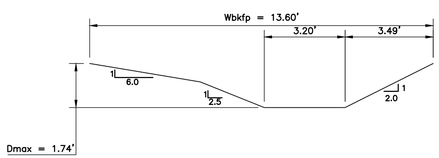



KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

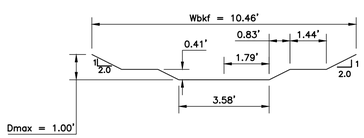



PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION

LEGEND
- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD



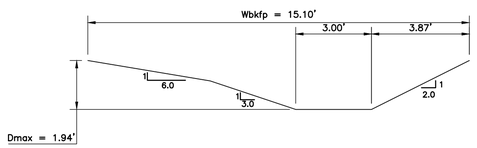

TYPICAL POOL SECTION



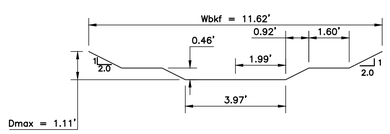

TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 1 REACH 2 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 1 REACH 3 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


Civil & Environmental Consultants, Inc.
530 Howell Road · Suite 203 · Greenville, SC 29615
Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
www.cecinc.com


# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 22+60 TO 27+20

DRAWING NO.: 18

P:\2019\196-626.0004\~CADD\dwg\[C01]\196626C01-PLAN_PROFILE_UT2-2 - [2]dwg[18 UT2 SEC 1 GRADING PLAN & PROFILE STA 22+60 TO 27+20] LS(1/31/2020 - cgmeking) - LP: 2/3/2020 9:28 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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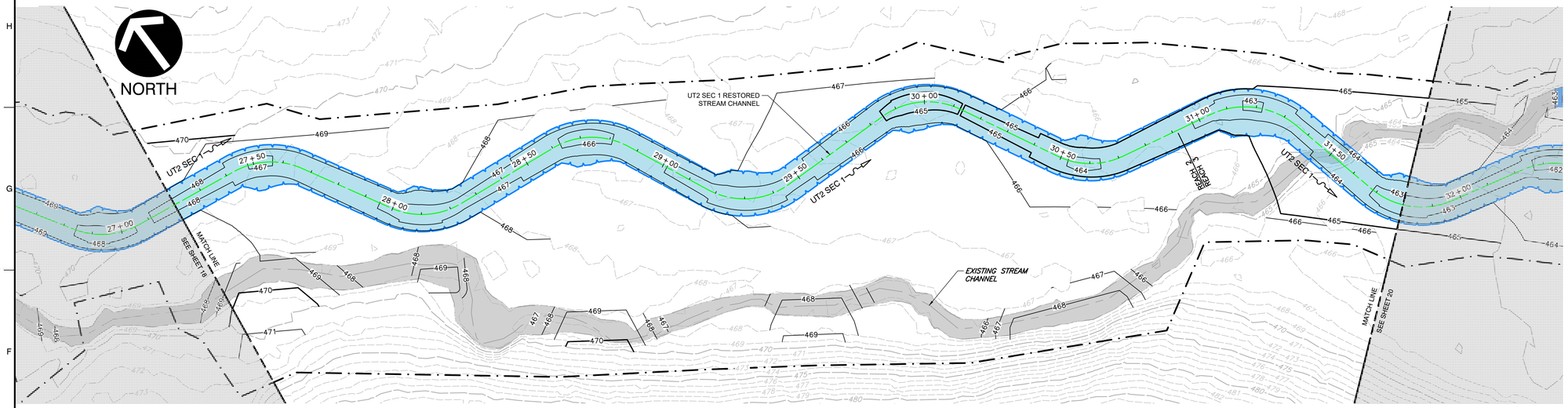
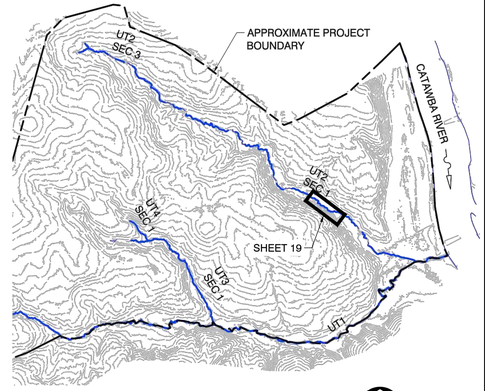
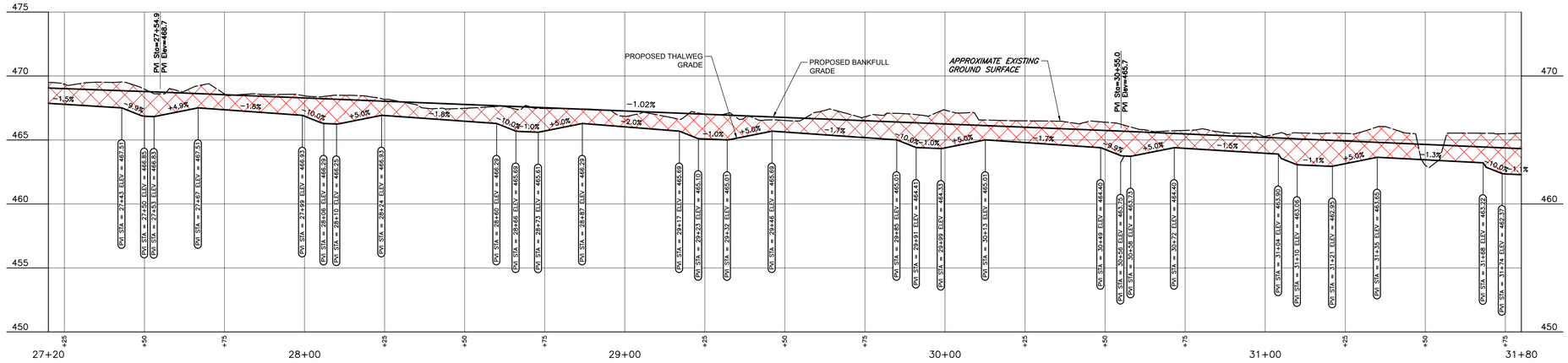



PLAN
SCALE IN FEET
0 20 40

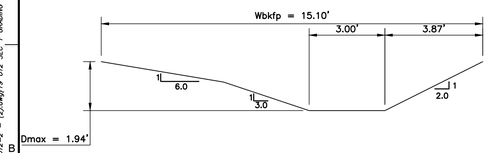



KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

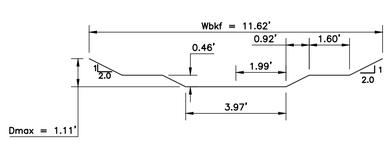



PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION

LEGEND
- 850 — EXISTING INDEX CONTOUR
- 843 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD



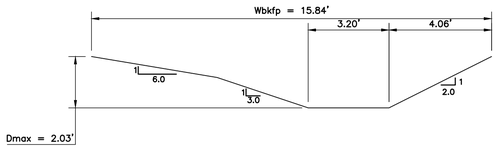

TYPICAL POOL SECTION



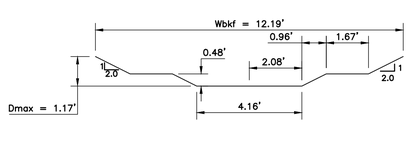

TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 3 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 4 BANKFULL STREAM SECTIONS
N.T.S.

**REFERENCE**

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4. VERTICAL DATUM IS NAVD88(GEOID12B).

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No. 36848
MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 27+20 TO 31+80

DRAWING NO.: 19

P:\2019\196-626.00041 - CAD\Dwg\ECD11\196262ECD1-PLAN_PROFILE_UT2-2 - (2).dwg[19 UT2 SEC 1 GRADING PLAN & PROFILE STA 27+20 TO 31+80] LS(1/31/2020 - cgmalling) - LP, 2/3/2020 9:28 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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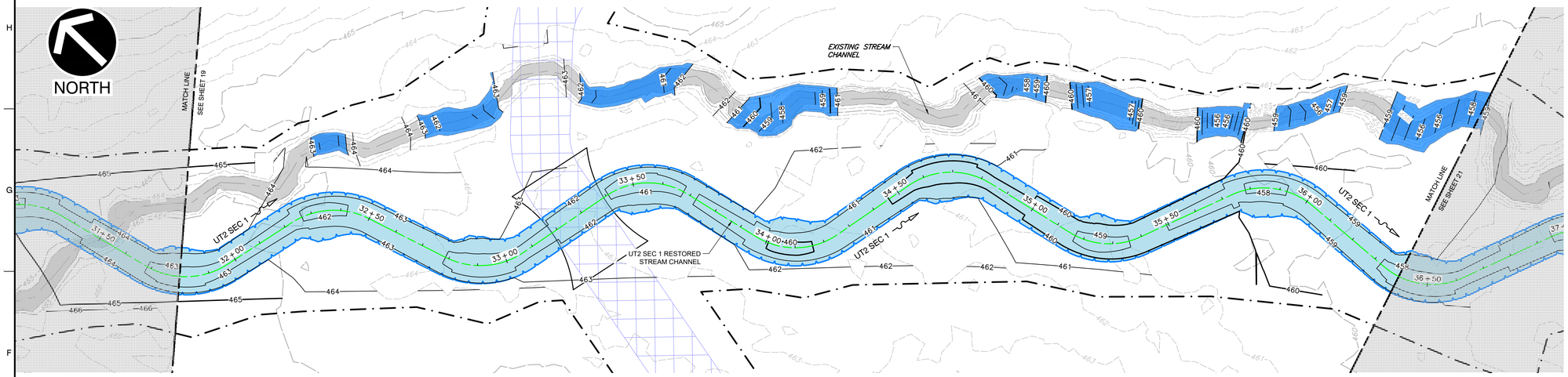
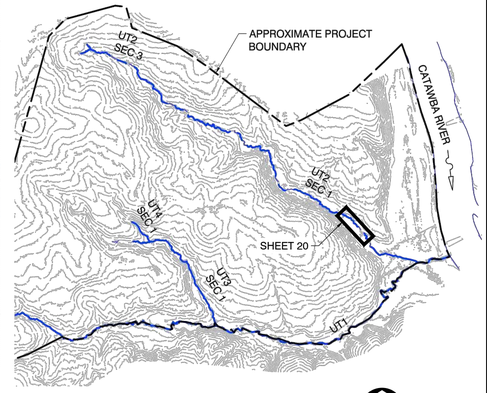
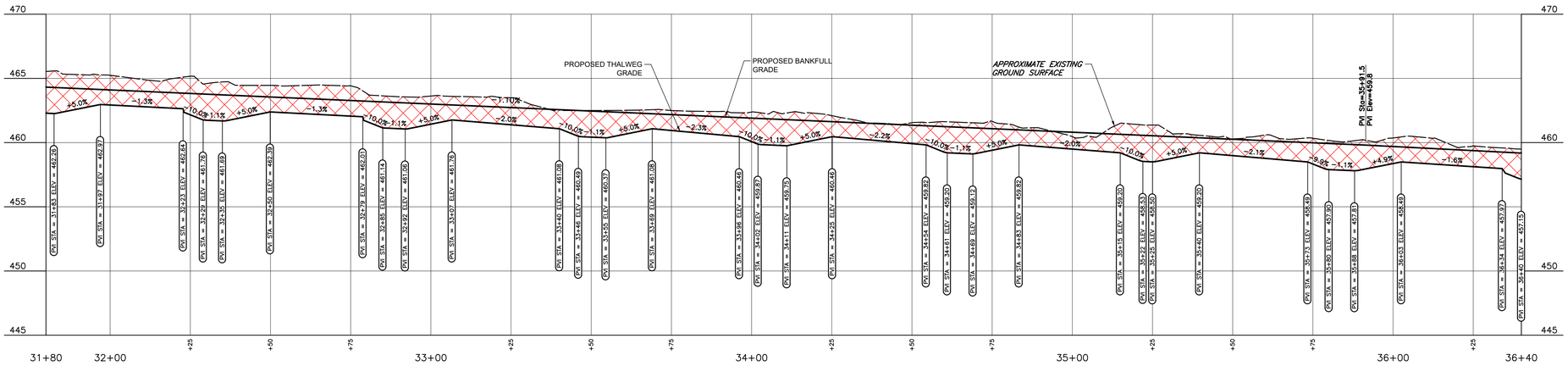



PLAN
SCALE IN FEET
0 20 40

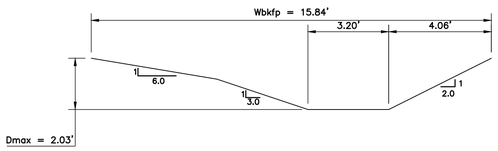



KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

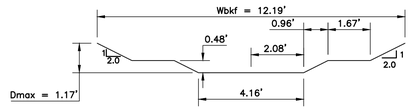



PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION

LEGEND
- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 4 BANKFULL STREAM SECTIONS
N.T.S.

**REFERENCE**
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3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 31+80 TO 36+40

DRAWING NO.: 20

P:\2019\196-626.00041-CAD\Dwg\EC011\196262EC01-PLAN_PROFILE_UT2-2 - (2)dwg20 UT2 SEC 1 GRADING PLAN & PROFILE STA 31+80 TO 36+40] LS(1/31/2020 - cgmabing) - LP: 2/3/2020 9:29 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
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| | 01/31/2020 | ISSUED FOR PERMITS |
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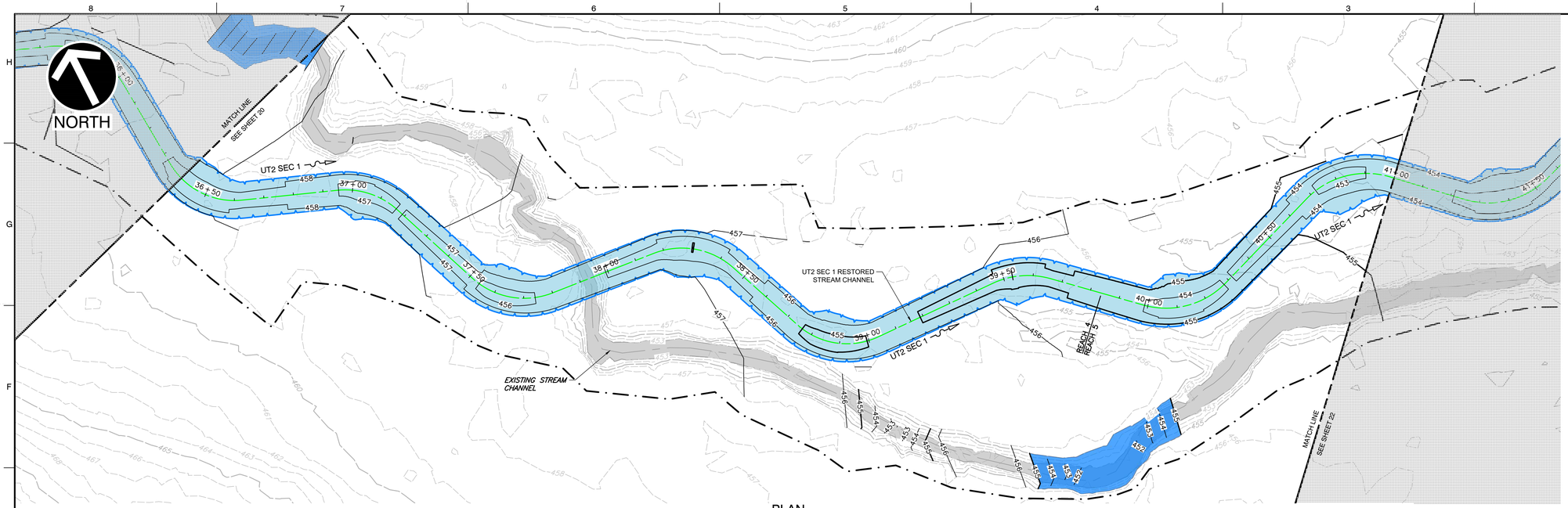
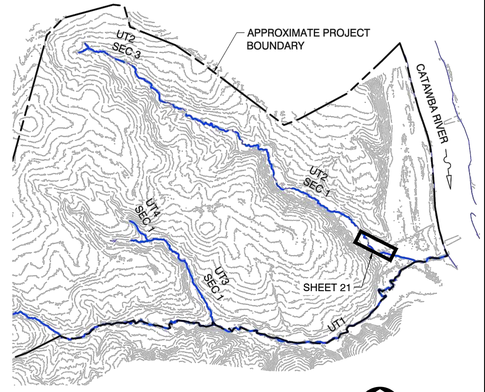
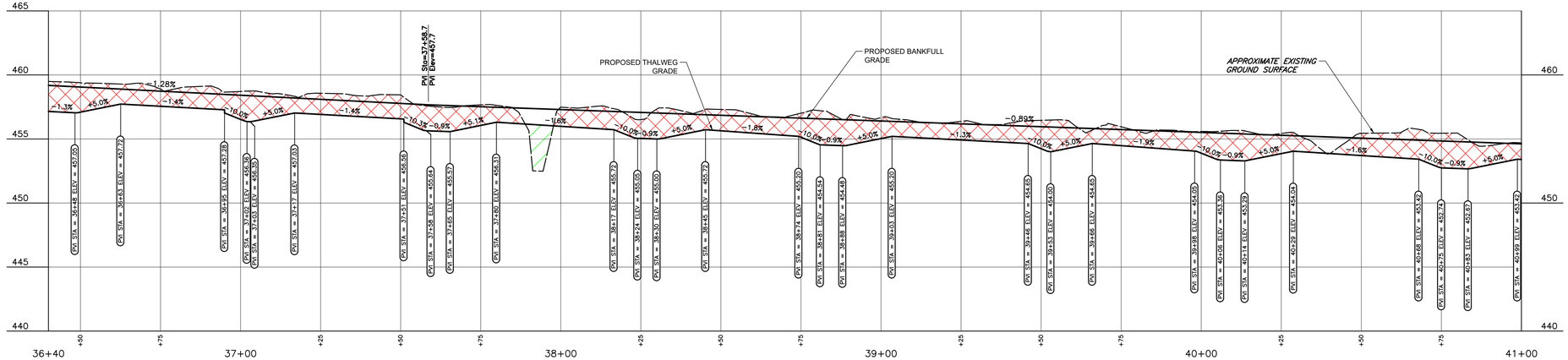



PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH



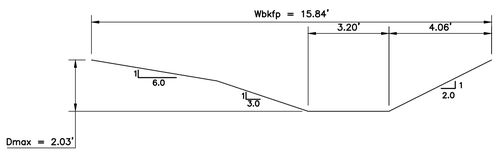

PROPOSED UT2 SEC 1 PROFILE

HORIZONTAL
SCALE IN FEET
0 20 40

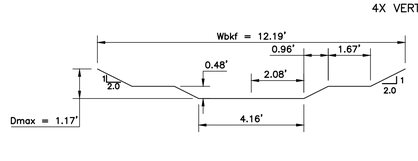
VERTICAL
SCALE IN FEET
0 5 10

4X VERTICAL EXAGGERATION

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL
- PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD



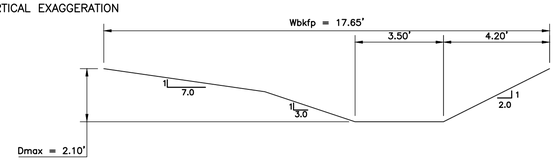

TYPICAL POOL SECTION



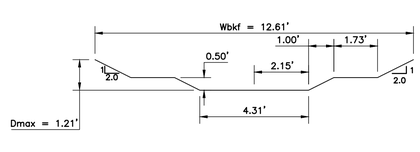

TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 1 REACH 4 BANKFULL STREAM SECTIONS
N.T.S.




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT2 SEC 1 REACH 5 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

REFERENCE

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4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 36+40 TO 41+00

DRAWING NO.: 21

P:\2019\196-626.0004\...\CADD\Dwg\EC011196626EC01-PLAN_PROFILE_UT2-2 - (3).dwg[21 UT2 SEC 1 GRADING PLAN & PROFILE STA 36+40 TO 41+00] LS(1/31/2020 - cgmaking) - LP: 2/3/2020 9:30 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
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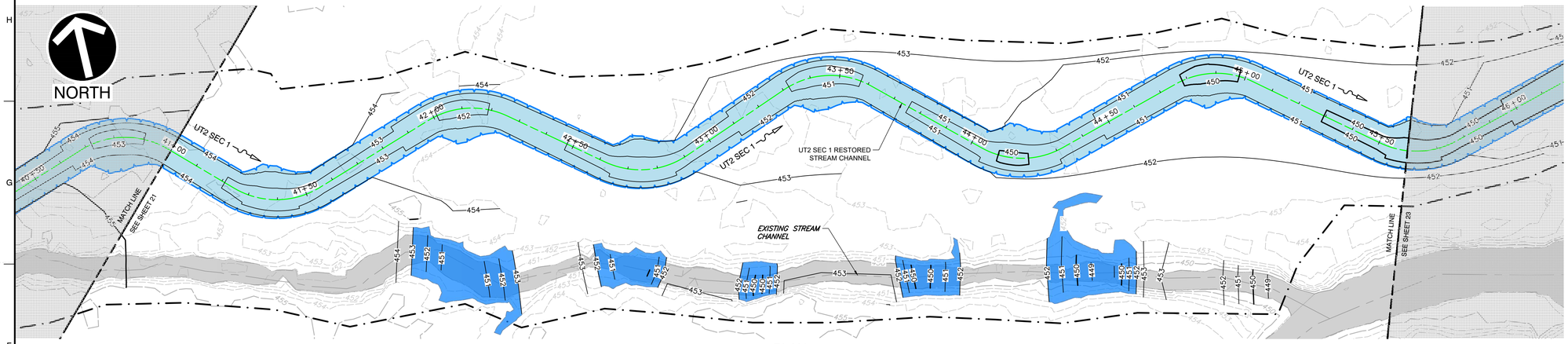
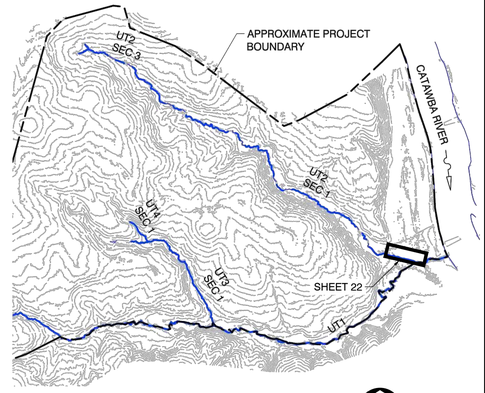
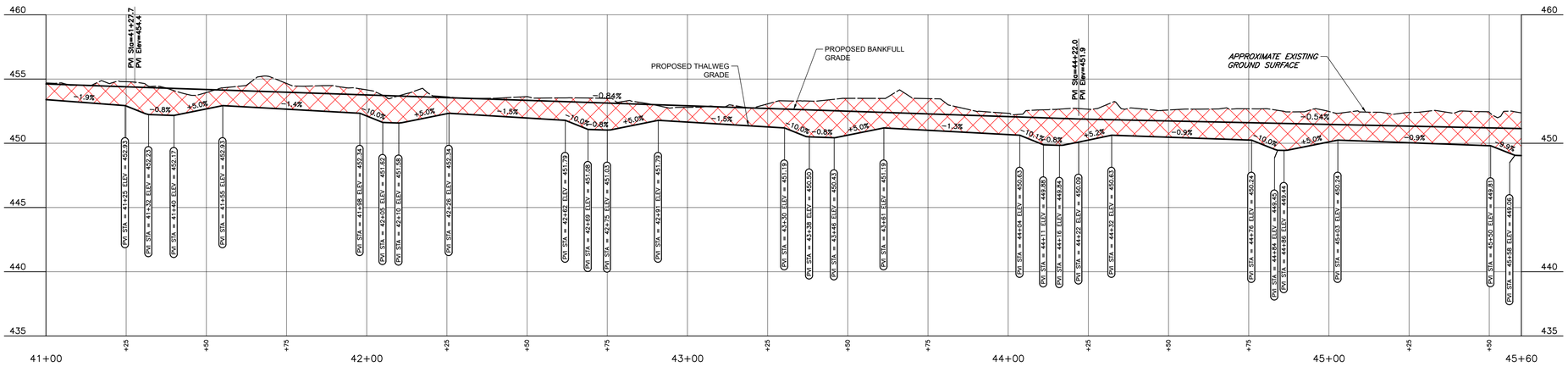



PLAN
SCALE IN FEET
0 20 40

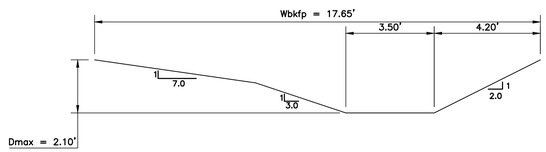



KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

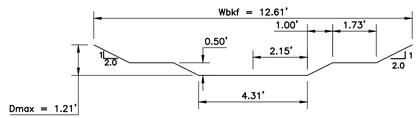



PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION

LEGEND
- EXISTING INDEX CONTOUR (850)
- EXISTING INTERMEDIATE CONTOUR (849)
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR (845)
- PROPOSED INTERMEDIATE CONTOUR (842)
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL POOL SECTION




TYPICAL RIFFLE SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 5 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

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| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 41+00 TO 45+60

DRAWING NO.: 22

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

P:\2019\196-626.0004\~CADD\Dwg\E201\[196626E201-PLAN_PROFILE_UT2-2 - (3).dwg]22 UT2 SEC 1 GRADING PLAN & PROFILE STA 41+00 TO 45+60] LS(1/31/2020 - cgmelling) - LP: 2/3/2020 9:30 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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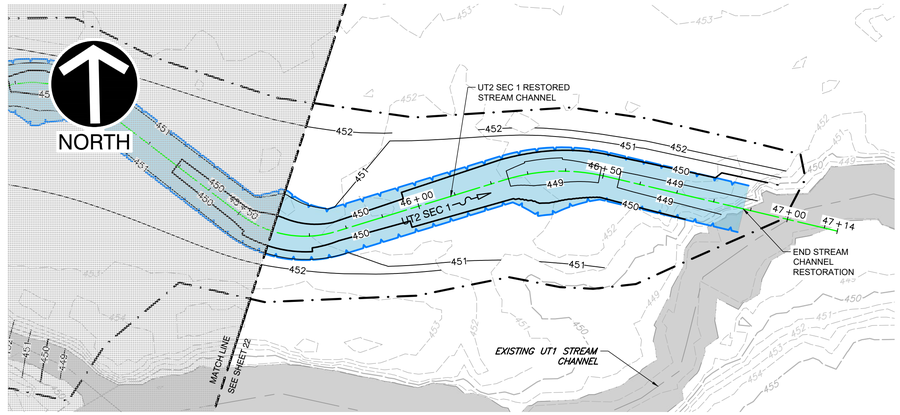
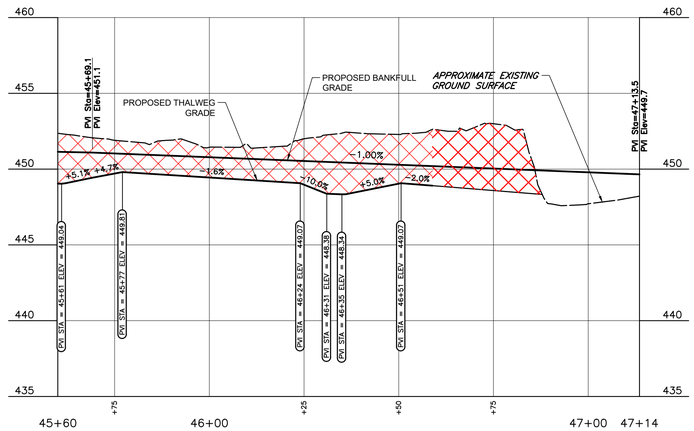
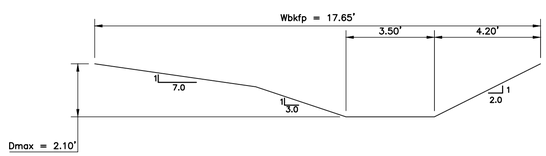
| | | |



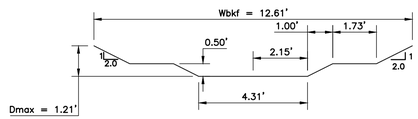

PLAN
SCALE IN FEET
0 20 40




PROPOSED UT2 SEC 1 PROFILE
HORIZONTAL SCALE IN FEET 0 20 40
VERTICAL SCALE IN FEET 0 5 10
4X VERTICAL EXAGGERATION



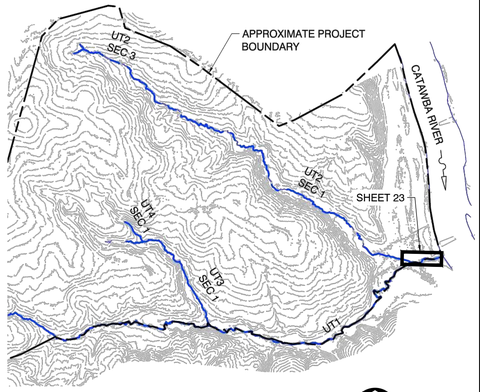

**TYPICAL POOL SECTION**




**TYPICAL RIFFLE SECTION**

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

## UT2 SEC 1 REACH 5 BANKFULL TYPICAL STREAM SECTIONS
## N.T.S.




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

LEGEND
- EXISTING INDEX CONTOUR (850)
- EXISTING INTERMEDIATE CONTOUR (849)
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR (845)
- PROPOSED INTERMEDIATE CONTOUR (842)
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


Civil & Environmental Consultants, Inc.
530 Howell Road · Suite 203 · Greenville, SC 29615
Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
www.cecinc.com


# SOUTH CAROLINA DEPT. OF COMMERCE
# LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN
# CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 GRADING PLAN & PROFILE
STA 45+60 TO 47+14

DRAWING NO.: 23

P:\2019\196-626.0004\-CADD\Dwg\[C01]\196626C01-PLAN_PROFILE_UT2-2 - (3).dwg[23 UT2 SEC 1 GRADING PLAN & PROFILE STA 45+60 TO 47+14] LS(1/31/2020 - cgmabing) - LP: 2/3/2020 9:30 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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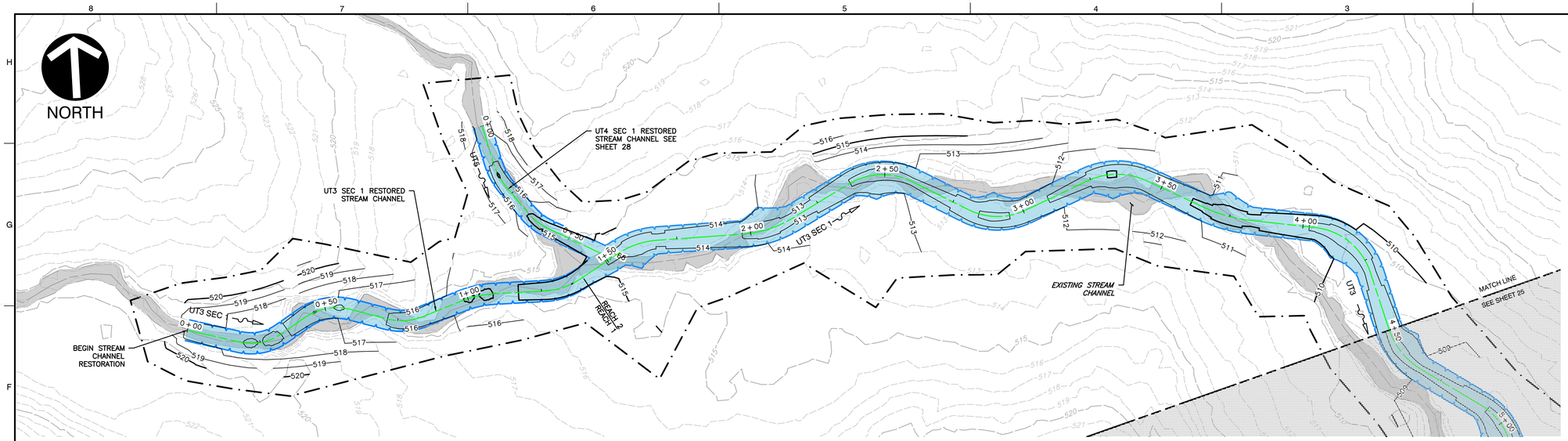
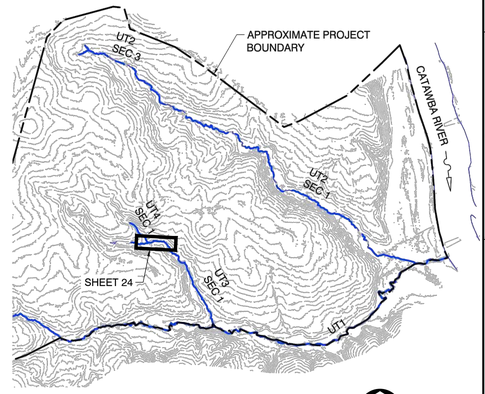
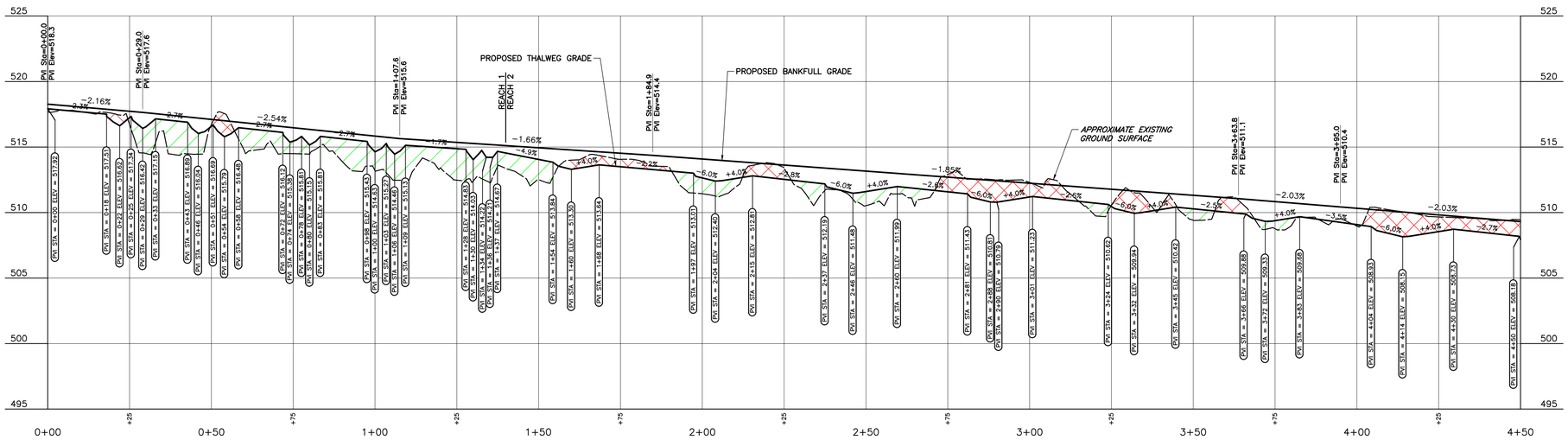



PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




PROPOSED UT3 SEC 1 PROFILE

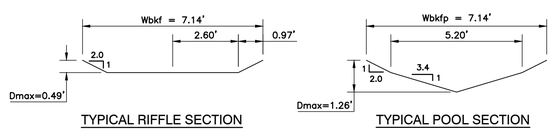
HORIZONTAL
SCALE IN FEET
0 20 40

VERTICAL
SCALE IN FEET
0 5 10

4X VERTICAL EXAGGERATION

LEGEND

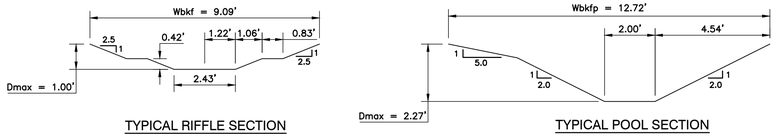
- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD




TYPICAL RIFFLE SECTION — TYPICAL POOL SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT3 SEC 1 REACH 1 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.




TYPICAL RIFFLE SECTION — TYPICAL POOL SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT3 SEC 1 REACH 2 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

REFERENCE

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2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

*HAND SIGNATURE ON FILE


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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 GRADING PLAN & PROFILE
STA 0+00 TO 4+50

DRAWING NO.: 24

P:\2019\196-626.0004\--CAD\Dwg\EGV11\196262021-PLAN_PROFILE_UT3.dwg[24 UT3 SEC 1 GRADING PLAN & PROFILE STA 0+00 TO 4+50] 1:5(2/3/2020 - cgmeding) - LP: 2/3/2020 9:32 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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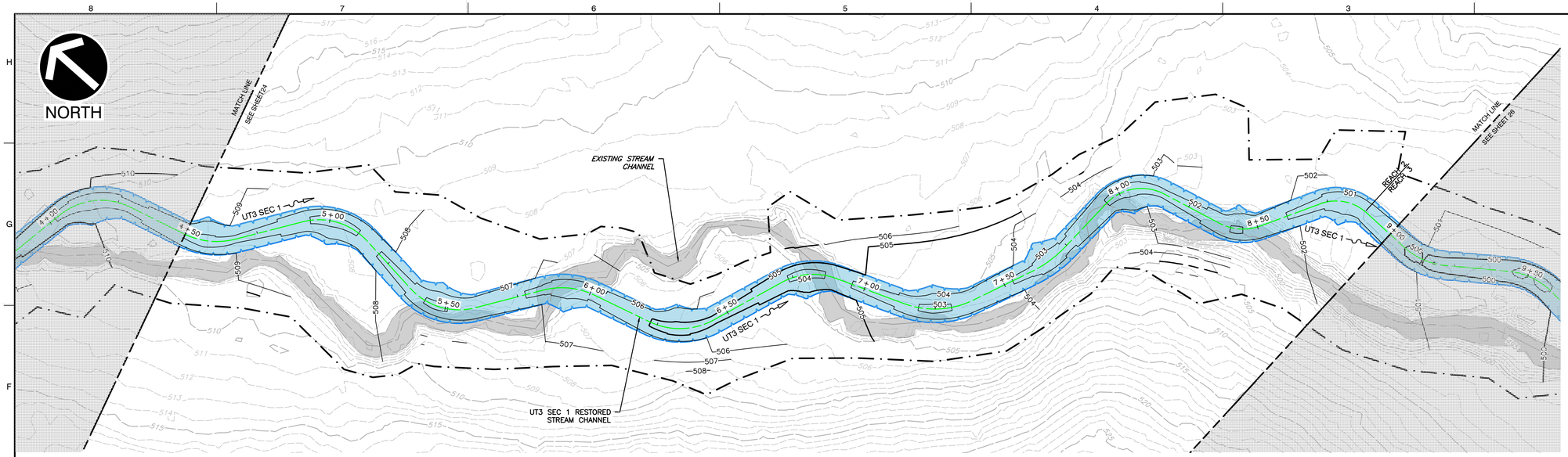
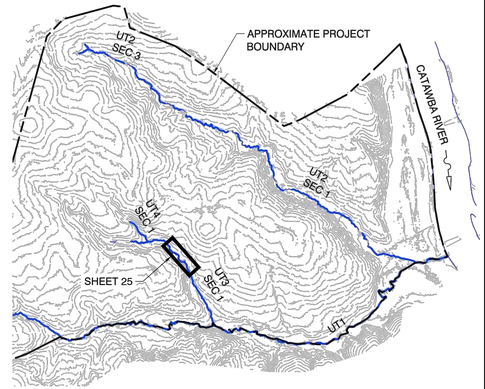
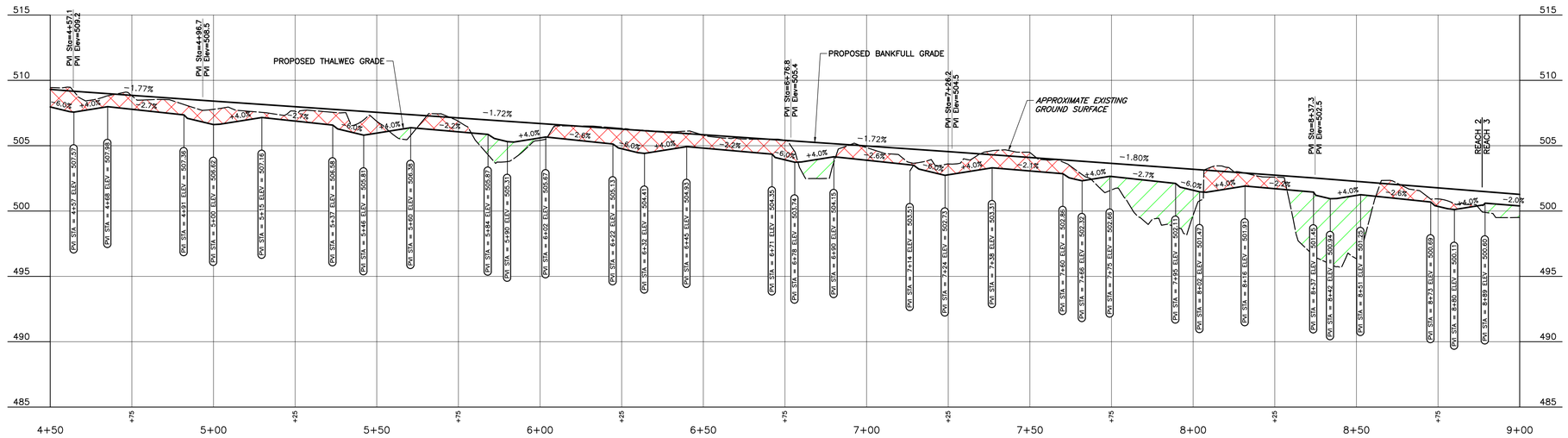



PLAN
SCALE IN FEET
0 20 40



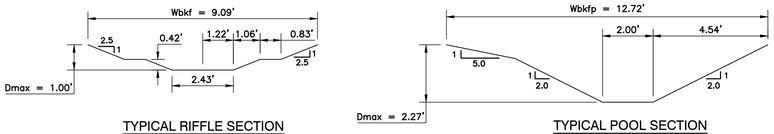

KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




PROPOSED UT3 SEC 1 PROFILE

HORIZONTAL SCALE IN FEET: 0 20 40
VERTICAL SCALE IN FEET: 0 5 10

4X VERTICAL EXAGGERATION




TYPICAL RIFFLE SECTION

TYPICAL POOL SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT3 SEC 1 REACH 2 BANKFULL TYPICAL STREAM SECTIONS
N.T.S.

LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD

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4. VERTICAL DATUM IS NAVD88(GEOID12B).

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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 GRADING PLAN & PROFILE
STA 4+50 TO 9+00

DRAWING NO.: 25

P:\2019\196-626.00\41-CADD\Dwg\C031196626C01-PLAN_PROFILE_UT3.dwg[25 UT3 SEC 1 GRADING PLAN & PROFILE STA 4+50 TO 9+00] LS(2/3/2020 - cgmaking) - LP: 2/3/2020 8:32 AM

## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
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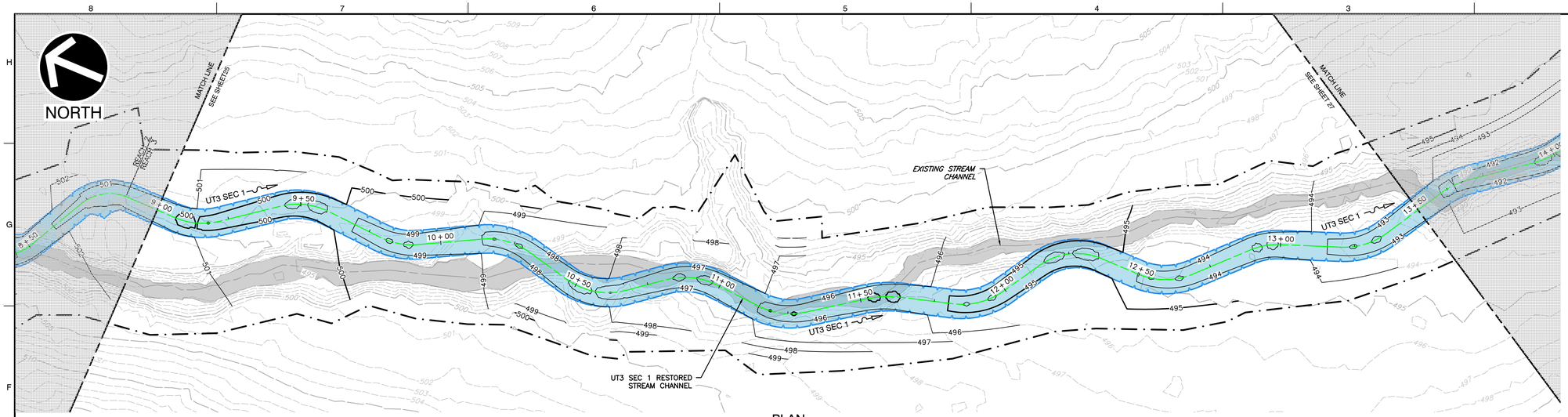
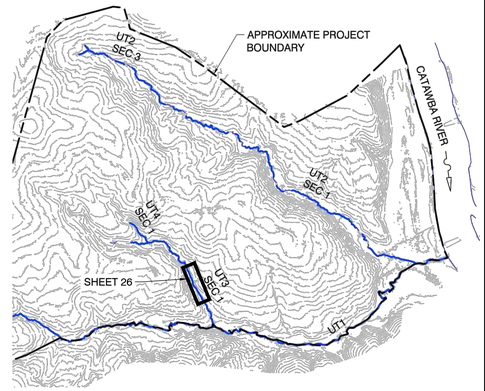



PLAN

SCALE IN FEET

0 20 40

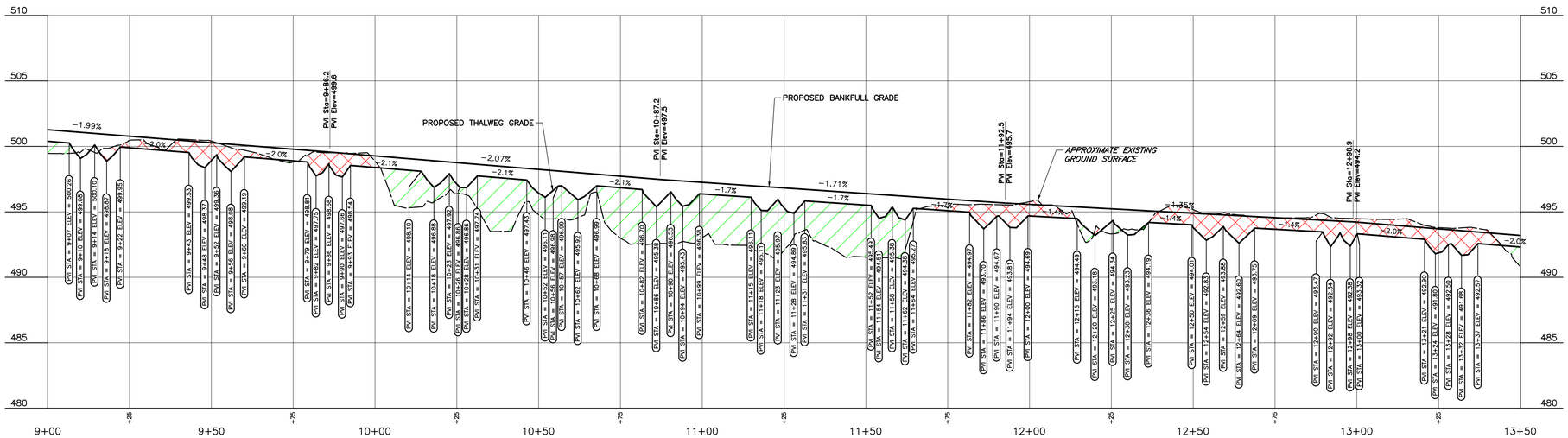



KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

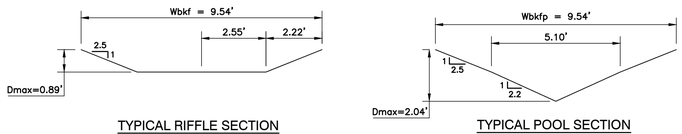



PROPOSED UT3 SEC 1 PROFILE

HORIZONTAL SCALE IN FEET 0 20 40

VERTICAL SCALE IN FEET 0 5 10

4X VERTICAL EXAGGERATION




TYPICAL RIFFLE SECTION

TYPICAL POOL SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT3 SEC 1 REACH 3 BANKFULL TYPICAL STREAM SECTIONS

N.T.S.

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL
- PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)
- PROPOSED ACCESS ROAD

### REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 GRADING PLAN & PROFILE
STA 9+00 TO 13+50

DRAWING NO.: 26

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-PLAN_PROFILE_UT3.dwg\26 UT3 SEC 1 GRADING PLAN & PROFILE STA 9+00 TO 13+50\ LS:(2/3/2020 - cgrieblng) - LP: 2/3/2020 9:32 AM

## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
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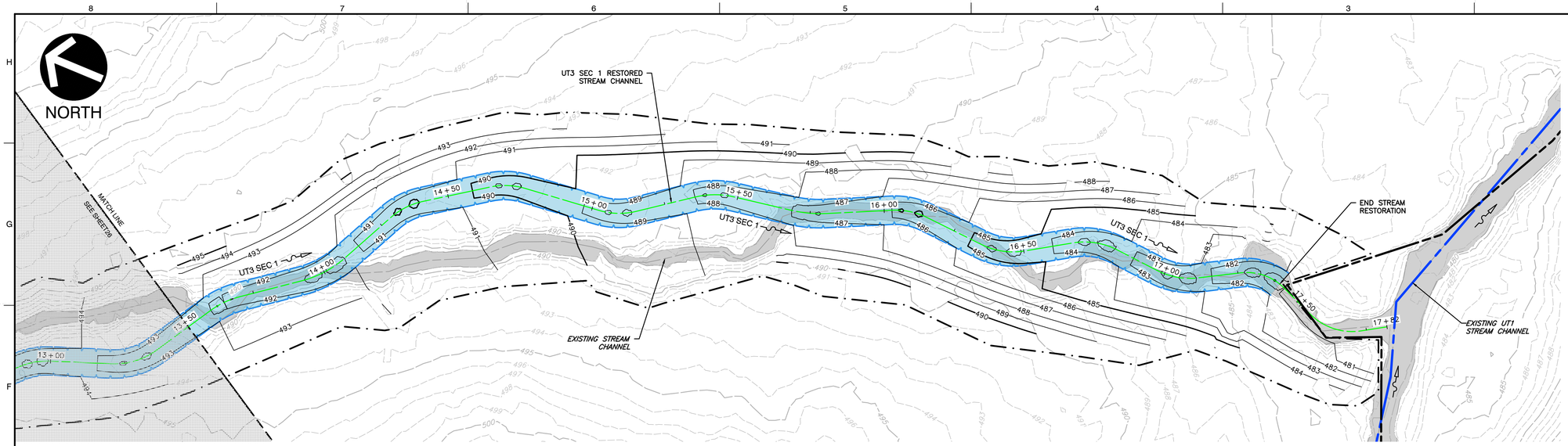
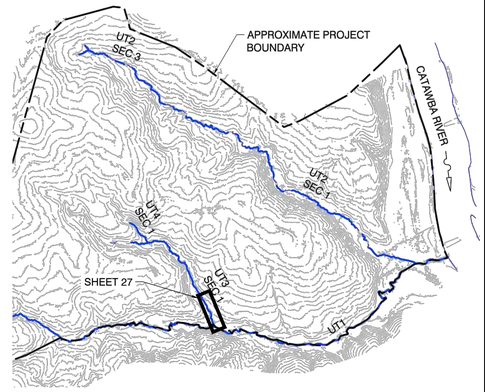



PLAN

SCALE IN FEET

0 20 40

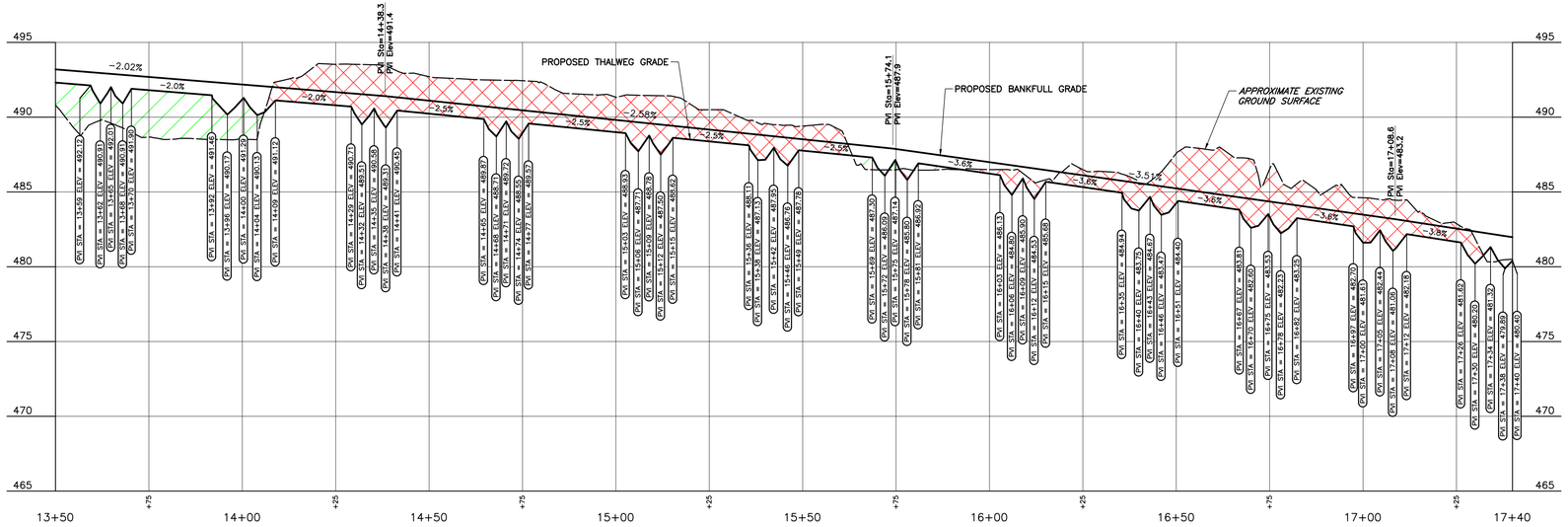



KEYMAP

SCALE IN FEET

0 1000 2000

NORTH




PROPOSED UT3 SEC 1 PROFILE

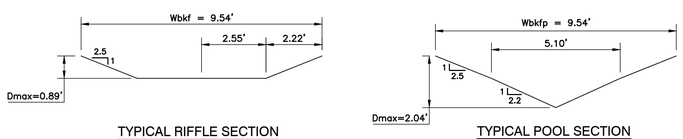
HORIZONTAL SCALE IN FEET 0 20 40

VERTICAL SCALE IN FEET 0 5 10

4X VERTICAL EXAGGERATION

LEGEND

- 850 EXISTING INDEX CONTOUR
- 849 EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 PROPOSED INDEX CONTOUR
- 842 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)




TYPICAL RIFFLE SECTION

TYPICAL POOL SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT3 SEC 1 REACH 3 BANKFULL TYPICAL STREAM SECTIONS

N.T.S.

### REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

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*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

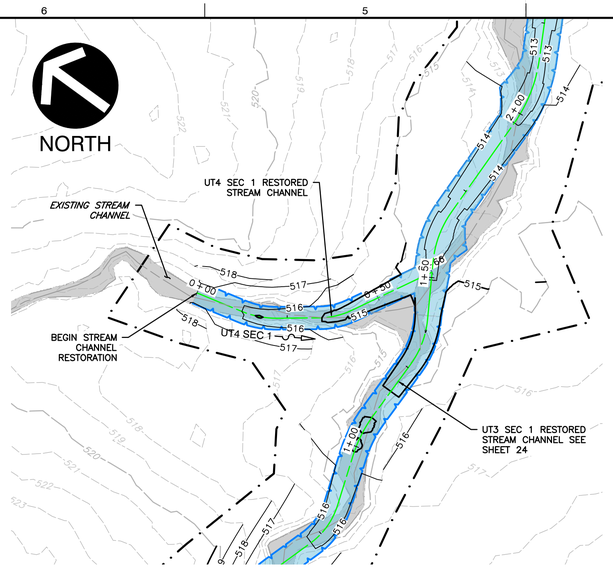
| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 GRADING PLAN & PROFILE
STA 13+50 TO 17+82

DRAWING NO.: 27

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-PLAN_PROFILE_UT3.dwg\27 UT3 SEC 1 GRADING PLAN & PROFILE STA 13+50 TO 17+82\ LS:(2/3/2020 - cgrieblog) - LP: 2/3/2020 9:33 AM

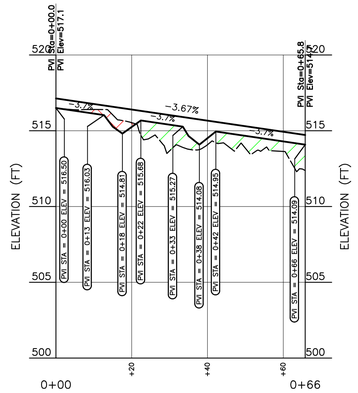
| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |




PLAN

SCALE IN FEET

0 20 40




PROPOSED UT4 SEC 1 PROFILE

HORIZONTAL SCALE IN FEET 0 20 40

VERTICAL SCALE IN FEET 0 5 10

4X VERTICAL EXAGGERATION



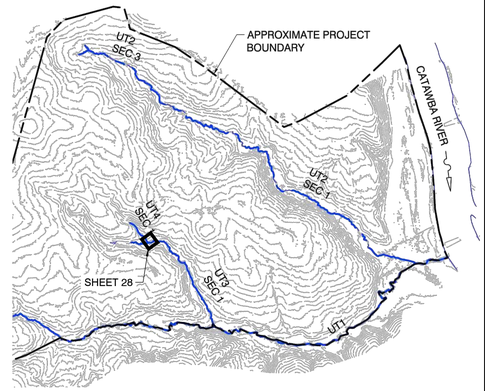

TYPICAL RIFFLE SECTION

TYPICAL POOL SECTION

Abkf = BANKFULL AREA
Wbkf = BANKFULL WIDTH
Dmax=MAXIMUM BANKFULL DEPTH
Dbkf =MEAN BANKFULL DEPTH

UT4 SEC 1 BANKFULL TYPICAL STREAM SECTIONS

N.T.S.




KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 EXISTING INDEX CONTOUR
- 849 EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 PROPOSED INDEX CONTOUR
- 842 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED COMPACTED FILL (PROFILE)
- PROPOSED EXCAVATION (PROFILE)

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE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Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
www.cecinc.com


# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT4 SEC 1 GRADING PLAN & PROFILE

DRAWING NO.: 28

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-PLAN_PROFILE_UT3.dwg|28 UT4 SEC 1 GRADING PLAN & PROFILE| LS:(2/3/2020 - cgrieding) - LP: 2/3/2020 9:33 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
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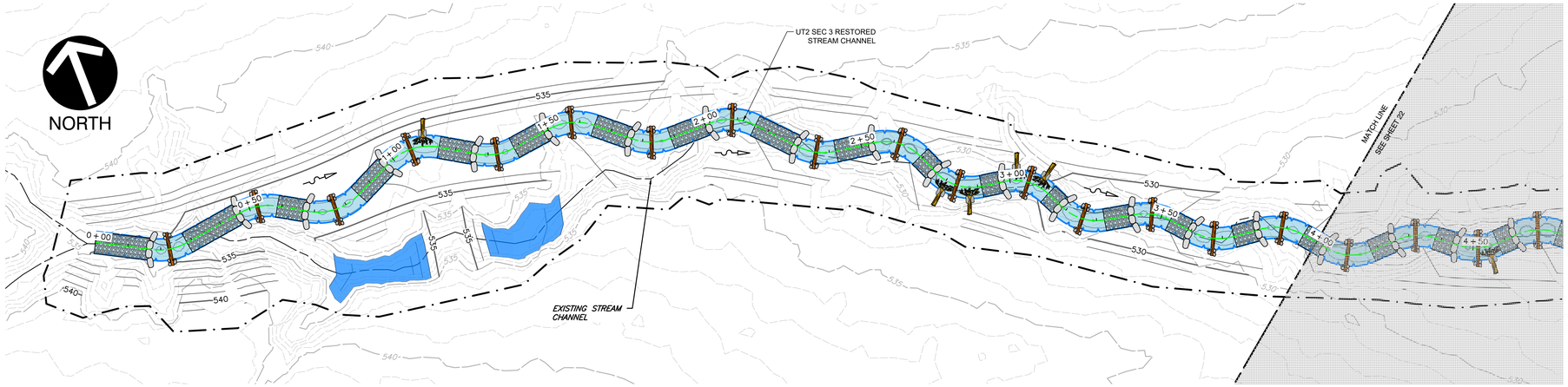
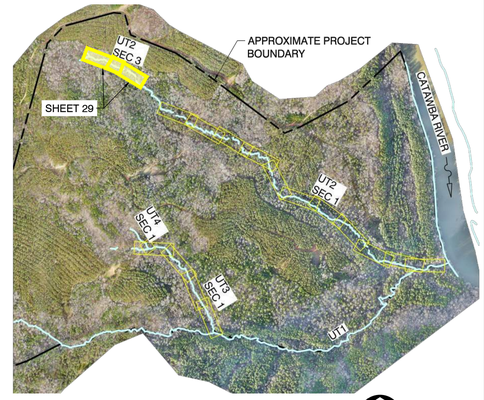
| 2 | 02/26/2020 | ISSUED FOR CONSTRUCTION |
| | | |
| | | |




KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 842 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- DIRECTION OF SURFACE FLOW

STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME |
|---|---|
| | 2/62 ROCK CONSTRUCTED RIFFLE |
| | 6/64 ROOT WAD |
| | 9/66 DOUBLE DROP BOULDER LOG STEP POOL |

SCALE IN FEET

0 20 40

*HAND SIGNATURE ON FILE

## REFERENCE

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4. VERTICAL DATUM IS NAVD88 (GEOID12B).

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

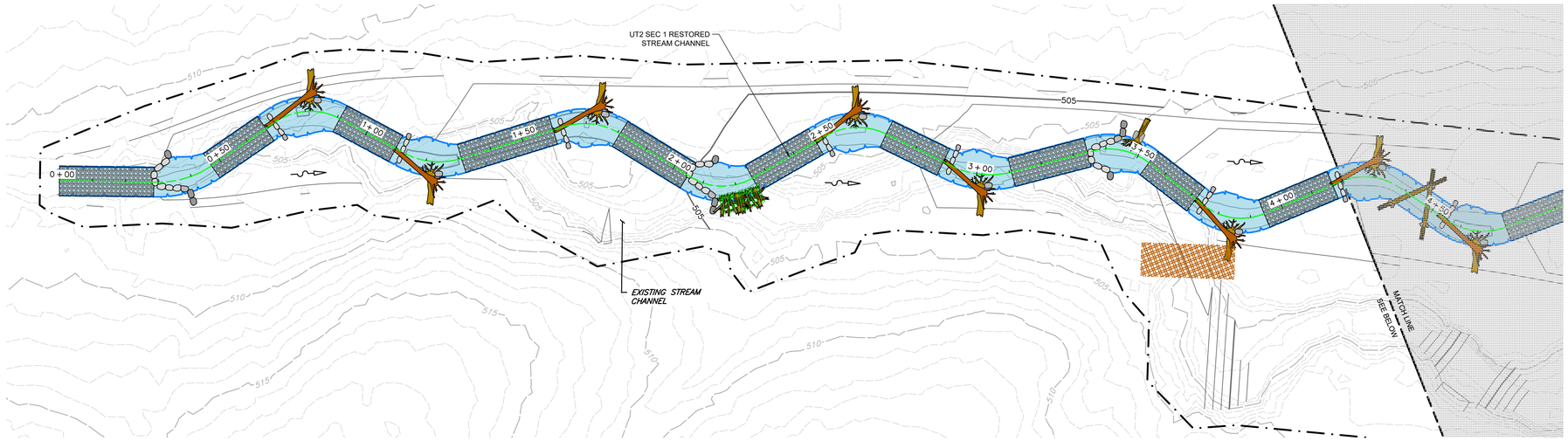
STRUCTURES PLAN UT2 SEC 3 STA 0+00 TO 7+46

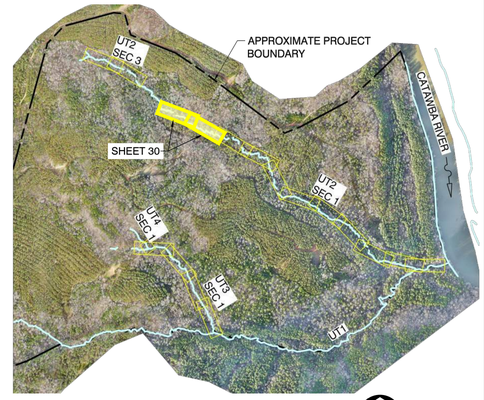
DRAWING NO.: 29

P:\2019\196-626.0041-CAD\Dwg\CD1\196626CD1-STRUCTURES_UT2-1 - (1).dwg[29 STRUCTURES PLAN UT2 SEC 3 STA 0+00 TO 7+46] LS(4/6/2020 - cgriebling) - LP: 4/6/2020 11:44 AM

## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 01/31/2020 | ISSUED FOR PERMITS |
| 2 | 02/28/2020 | ISSUED FOR CONSTRUCTION |



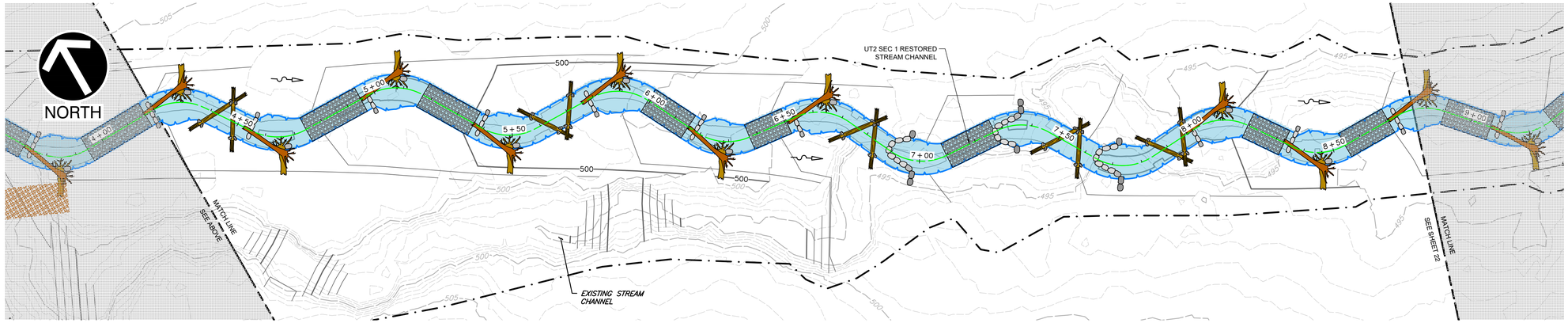




KEYMAP

SCALE IN FEET

0 1000 2000

NORTH




LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- DIRECTION OF SURFACE FLOW

SCALE IN FEET

0 20 40

*HAND SIGNATURE ON FILE

### STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME | MAP SYMBOL | STRUCTURE NAME |
|---|---|---|---|
| | 1/62 LOG VANE, ROCK J-HOOK AND ROOT WAD | | 6/64 ROOT WAD |
| | 2/62 ROCK CONSTRUCTED RIFFLE | | 8/65 IMPERVIOUS STREAM CHANNEL PLUG |
| | 3/63 LOG RIFFLE | | 9/66 DOUBLE DROP BOULDER LOG STEP POOL |
| | 5/64 BOULDER VANE AND J-HOOK | | |

### REFERENCE

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3. HORIZONTAL DATUM IS NAD83 SC STATE PLANE, INTERNATIONAL FOOT (2011).
4. VERTICAL DATUM IS NAVD88 (GEOID12B).

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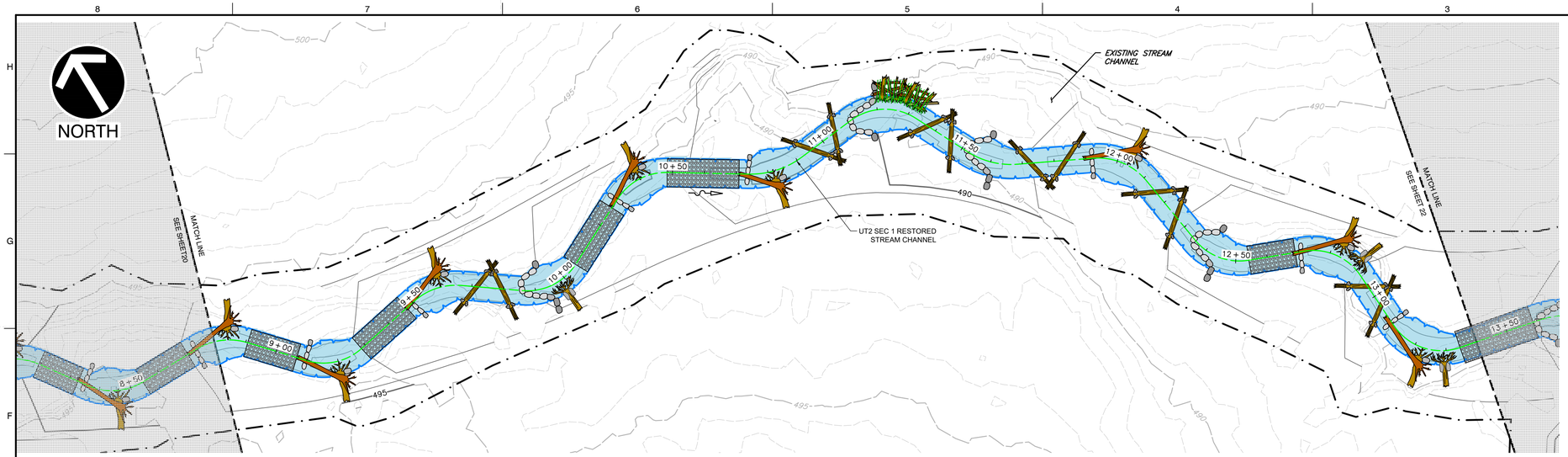
# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

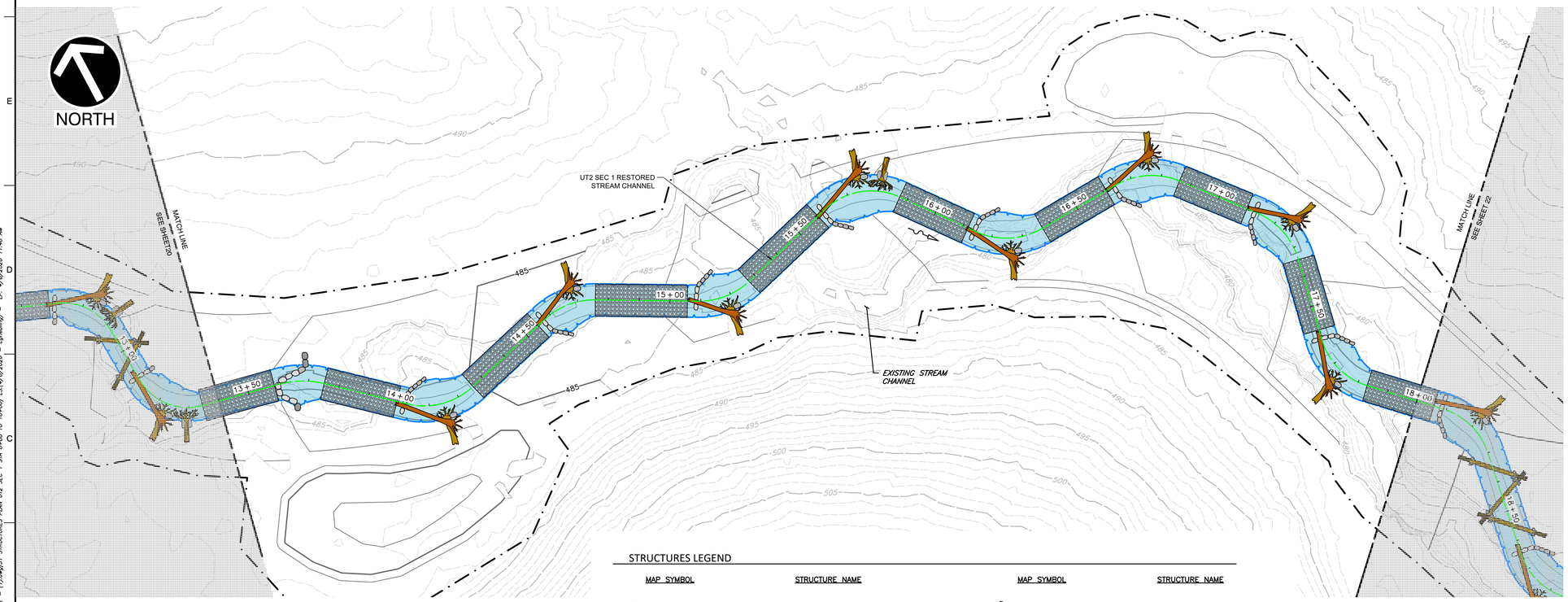
| DRAWN BY: EGK/CJG | CHECKED BY: NSO | APPROVED BY: MDG |
|---|---|---|
| DATE: JANUARY 2020 | DWG SCALE: AS NOTED | PROJECT NO: 196-626 |

STRUCTURES PLAN UT2 SEC 1 STA 0+00 TO 8+80

DRAWING NO.: 30

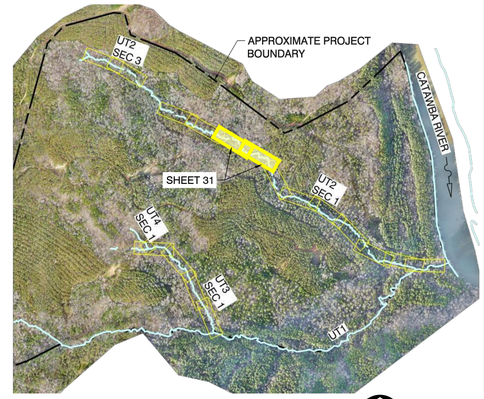
P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-STRUCTURES_UT2-2 - (1).dwg\30 STRUCTURES PLAN UT2 SEC 1 STA 0+00 TO 8+80\ LS:(4/6/2020 - cgriebling) - LP: 4/6/2020 11:48 AM




## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 01/31/2020 | ISSUED FOR PERMITS |
| 2 | 02/28/2020 | ISSUED FOR CONSTRUCTION |
| | | |
| | | |




KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- DIRECTION OF SURFACE FLOW

SCALE IN FEET

0 20 40

*HAND SIGNATURE ON FILE

## STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME | MAP SYMBOL | STRUCTURE NAME |
|---|---|---|---|
| | 1/62 LOG VANE, ROCK J-HOOK AND ROOT WAD | | 5/64 BOULDER VANE AND J-HOOK |
| | 2/62 ROCK CONSTRUCTED RIFFLE | | 6/64 ROOT WAD |
| | 3/63 LOG RIFFLE | | |

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: EGK/CJG | CHECKED BY: NSO | APPROVED BY: MDG |
|---|---|---|
| DATE: JANUARY 2020 | DWG SCALE: AS NOTED | PROJECT NO: 196-626 |

STRUCTURES PLAN UT2 SEC 1 STA 8+80 TO 18+00

DRAWING NO.: 31

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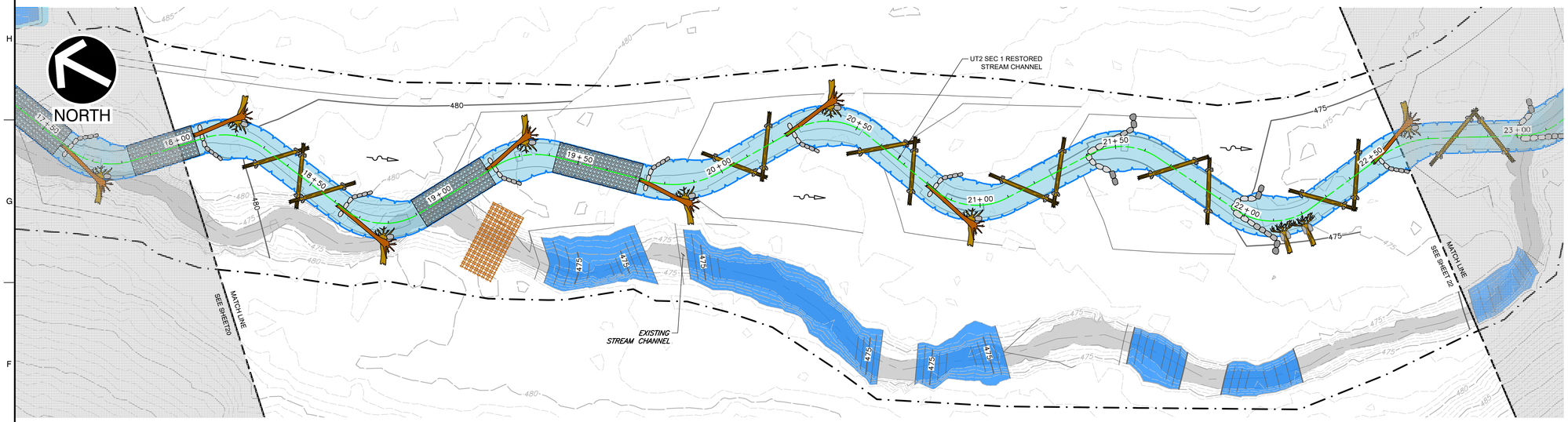
## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 01/31/2020 | ISSUED FOR PERMITS |
| 2 | 02/28/2020 | ISSUED FOR CONSTRUCTION |




PLAN
SCALE IN FEET
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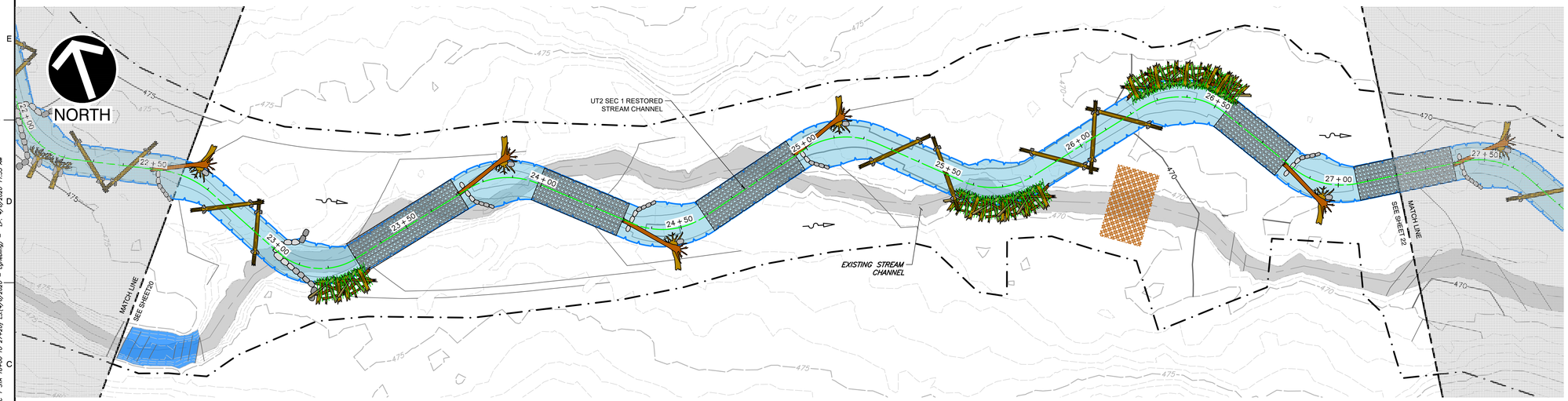
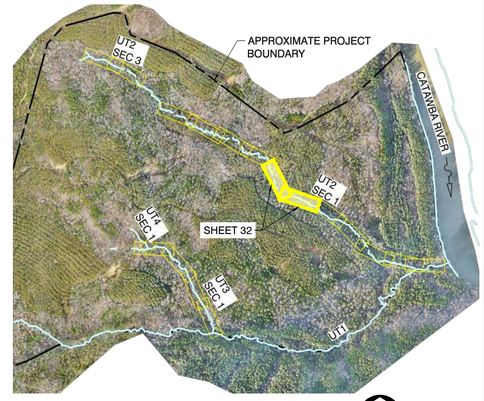



PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- DIRECTION OF SURFACE FLOW

### STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME | MAP SYMBOL | STRUCTURE NAME |
|---|---|---|---|
| | 1/62 LOG VANE, ROCK J-HOOK AND ROOT WAD | | 4/63 TOE WOOD WITH REINFORCED EARTH AND LIVE BRUSH LAYERING |
| | 2/62 ROCK CONSTRUCTED RIFFLE | | 5/64 BOULDER VANE AND J-HOOK |
| | 3/63 LOG RIFFLE | | 8/65 IMPERVIOUS STREAM CHANNEL PLUG |

### REFERENCE

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

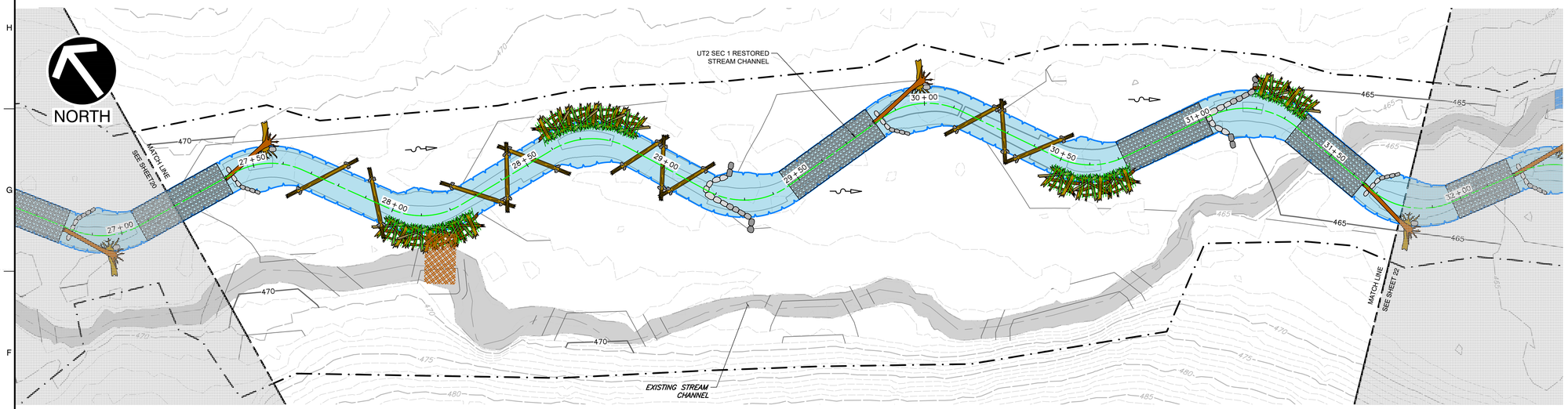
STRUCTURES PLAN UT2 SEC 1 STA 18+00 TO 27+20

DRAWING NO.: 32

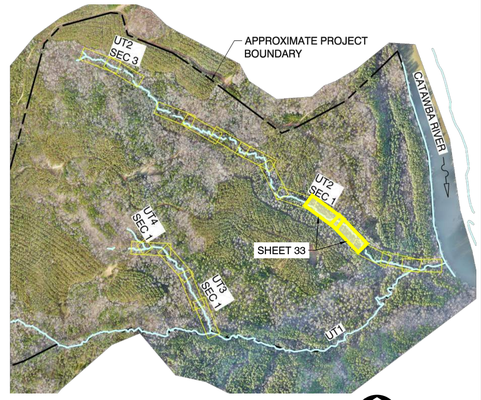
P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-STRUCTURES_UT2-2 - (2).dwg\32 STRUCTURES PLAN UT2 SEC 1 STA 18+00 TO 27+20\ LS:(4/6/2020 - cgriebling) - LP: 4/6/2020 11:53 AM

## SUBMITTAL & REVISION RECORD

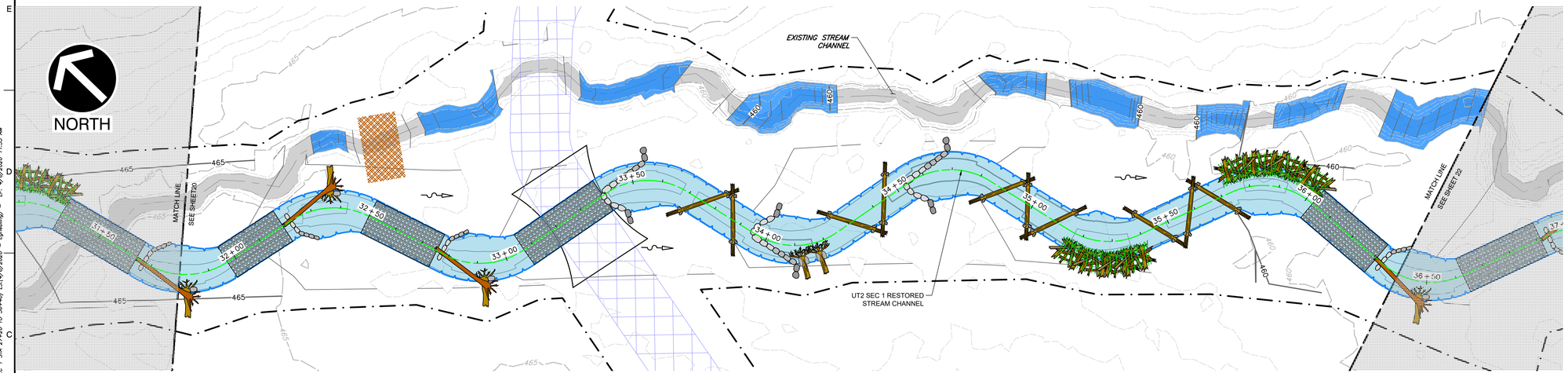
| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 01/31/2020 | ISSUED FOR PERMITS |
| 2 | 02/28/2020 | ISSUED FOR CONSTRUCTION |




PLAN
SCALE IN FEET
0 20 40




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




PLAN
SCALE IN FEET
0 20 40

LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 — PROPOSED INDEX CONTOUR
- 842 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD
- DIRECTION OF SURFACE FLOW

### STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME |
|---|---|
| | 1/62 LOG VANE, ROCK J-HOOK AND ROOT WAD |
| | 2/62 ROCK CONSTRUCTED RIFFLE |
| | 3/63 LOG RIFFLE |
| | 4/63 TOE WOOD WITH REINFORCED EARTH AND LIVE BRUSH LAYERING |
| | 5/64 BOULDER VANE AND J-HOOK |
| | 6/64 ROOT WAD |
| | 8/65 IMPERVIOUS STREAM CHANNEL PLUG |

### REFERENCE

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4. VERTICAL DATUM IS NAVD88 (GEOID12B).

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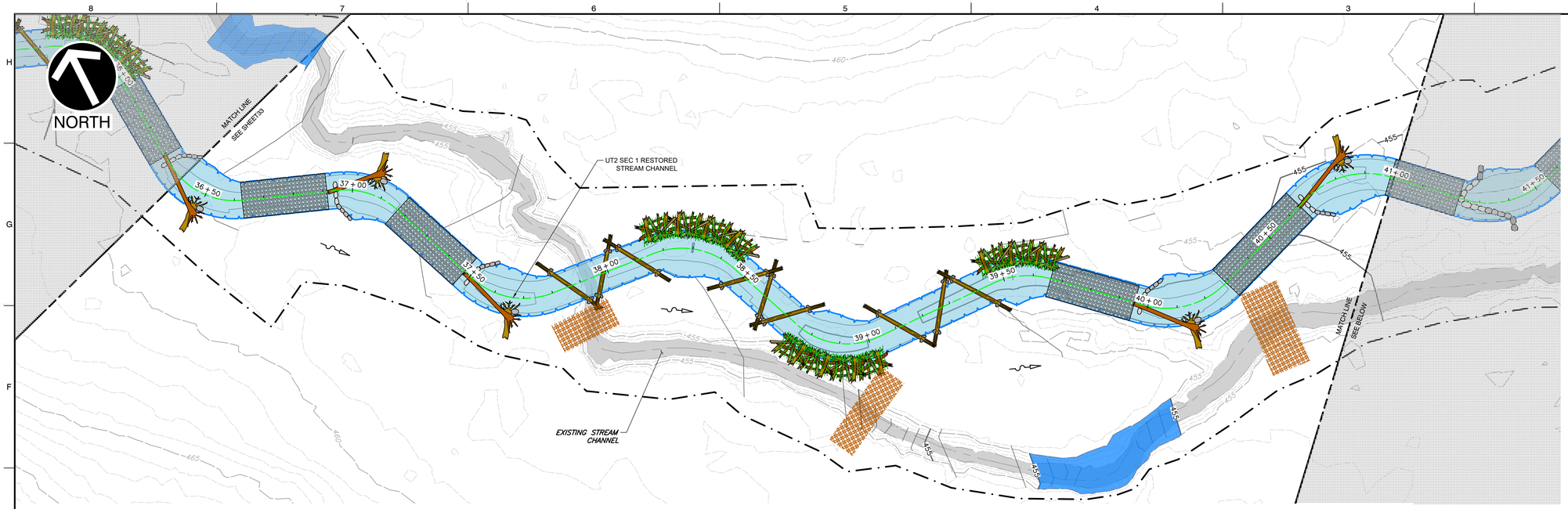
# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

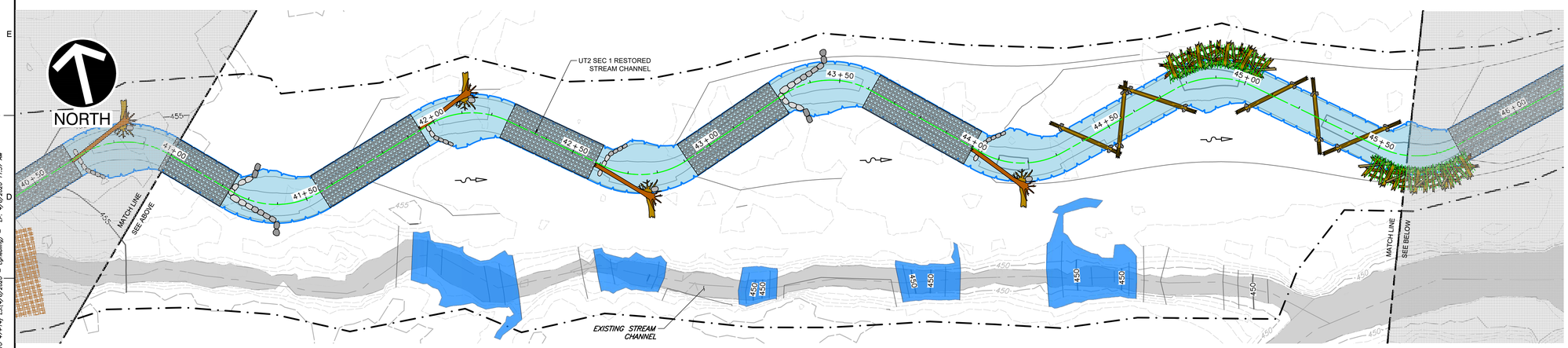
| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

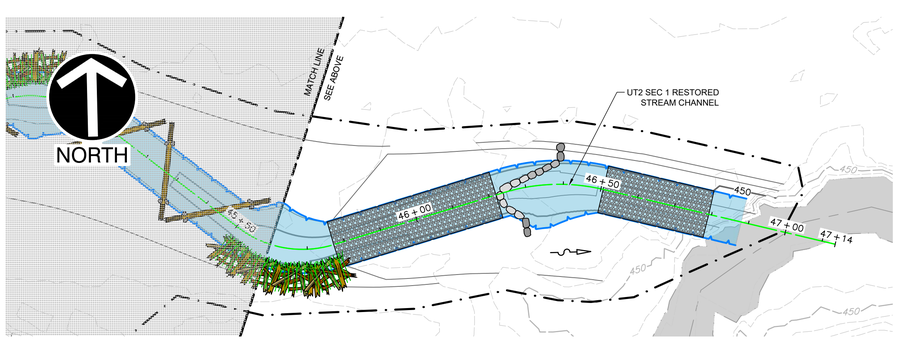
STRUCTURES PLAN UT2 SEC 1 STA 27+20 TO 36+40

DRAWING NO.: 33

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-STRUCTURES_UT2-2 - (2).dwg\33 STRUCTURES PLAN UT2 SEC 1 STA 27+20 TO 36+40\ LS:(4/6/2020 - cgriebling) - LP: 4/6/2020 11:53 AM




## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 01/31/2020 | ISSUED FOR PERMITS |
| 2 | 02/28/2020 | ISSUED FOR CONSTRUCTION |
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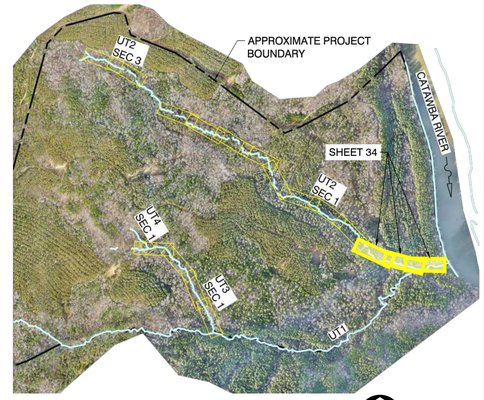



KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

- 850 EXISTING INDEX CONTOUR
- 849 EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- 845 PROPOSED INDEX CONTOUR
- 842 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- DIRECTION OF SURFACE FLOW

## STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME | MAP SYMBOL | STRUCTURE NAME |
|---|---|---|---|
| | 1/62 LOG VANE, ROCK J-HOOK AND ROOT WAD | | 5/64 BOULDER VANE AND J-HOOK |
| | 2/62 ROCK CONSTRUCTED RIFFLE | | 8/65 IMPERVIOUS STREAM CHANNEL PLUG |
| | 3/63 LOG RIFFLE | | |
| | 4/63 TOE WOOD WITH REINFORCED EARTH AND LIVE BRUSH LAYERING | | |

SCALE IN FEET

0 20 40

*HAND SIGNATURE ON FILE

CEC
Civil & Environmental Consultants, Inc.
530 Howell Road · Suite 203 · Greenville, SC 29615
Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
www.cecinc.com

# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: EGK/CJG | CHECKED BY: NSO | APPROVED BY: MDG |
|---|---|---|
| DATE: JANUARY 2020 | DWG SCALE: AS NOTED | PROJECT NO: 196-626 |

STRUCTURES PLAN UT2 SEC 1 STA 36+40 TO 47+14

DRAWING NO.: 34

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

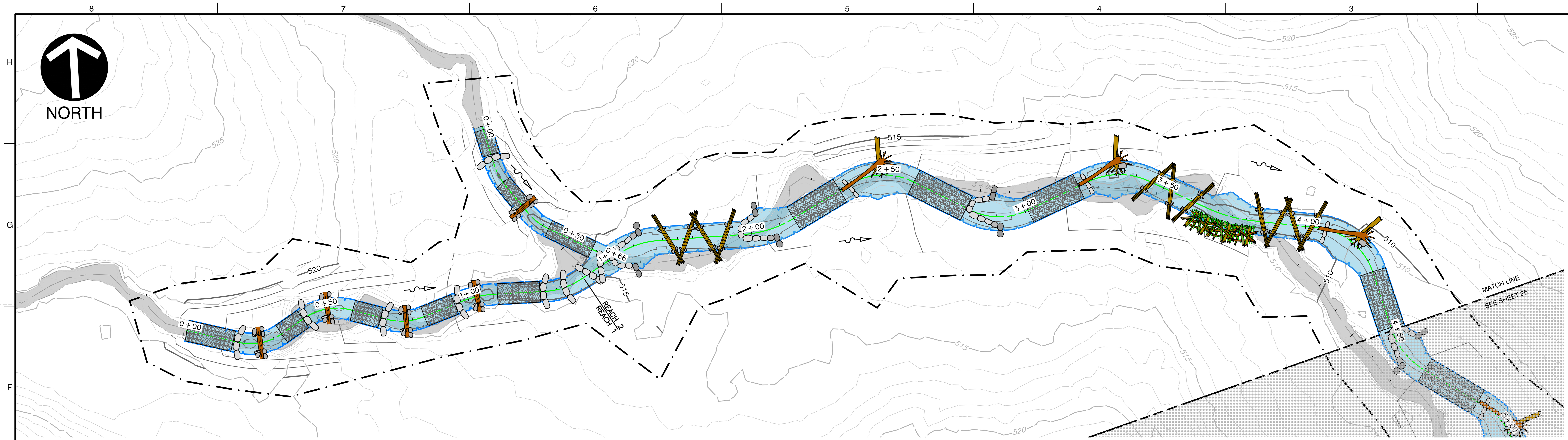
## REFERENCE

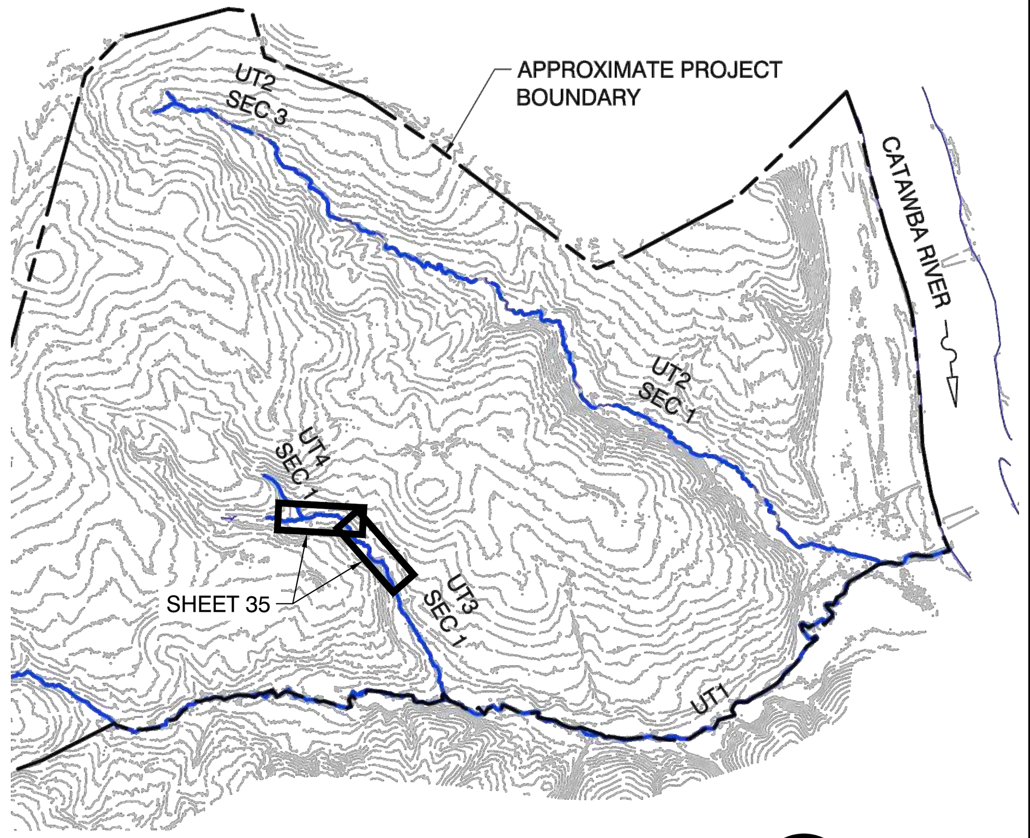
1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS NAD83 SC STATE PLANE, INTERNATIONAL FOOT (2011).
4. VERTICAL DATUM IS NAVD88 (GEOID12B).

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-STRUCTURES_UT2-2 - (3).dwg\34 STRUCTURES PLAN UT2 SEC 1 STA 36+40 TO 47+14\LS(4/6/2020 - cgriebling) - LP: 4/6/2020 11:57 AM

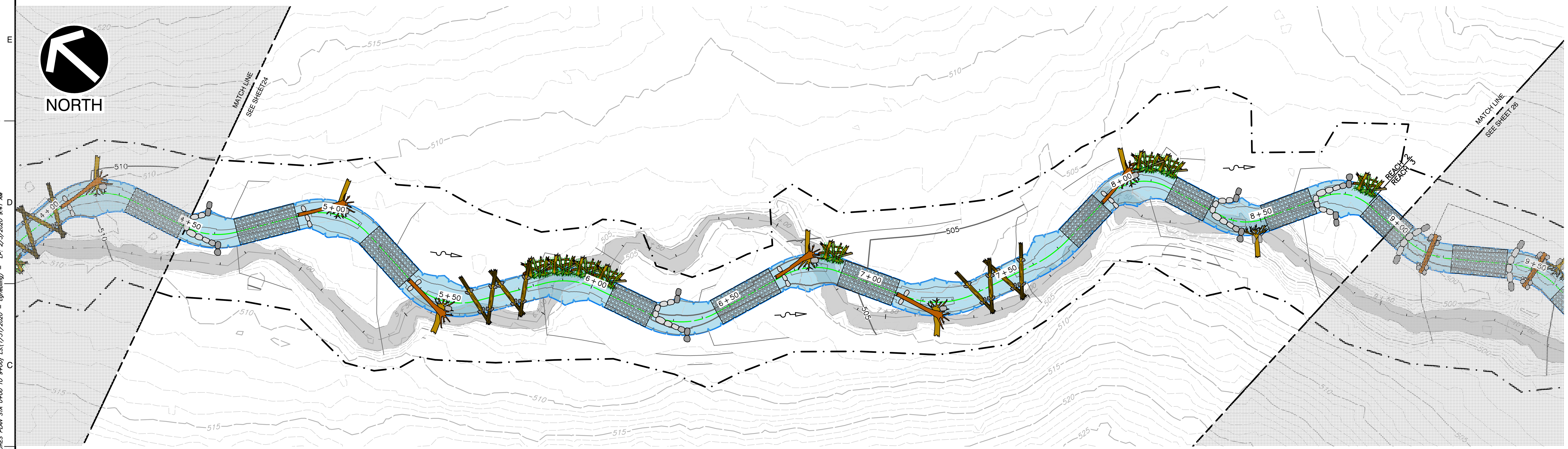
## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| | 01/31/2020 | ISSUED FOR PERMITS |




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH




LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- EXISTING WETLAND
- PROPOSED VERNAL POOL
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED BANKFULL / PROPOSED STREAM CHANNEL
- PROPOSED APPROXIMATE LIMIT OF DISTURBANCE
- DIRECTION OF SURFACE FLOW

SCALE IN FEET
0 20 40

STRUCTURES LEGEND

| MAP SYMBOL | DETAIL | STRUCTURE NAME |
|---|---|---|
| | 1/45 | LOG VANE, ROCK J-HOOK AND ROOT WAD |
| | 2/45 | ROCK CONSTRUCTED RIFFLE |
| | 4/46 | LOG RIFFLE |
| | 5/47 | BOULDER VANE AND J-HOOK |
| | 6/47 | ROOT WAD |
| | 9/49 | DOUBLE DROP BOULDER LOG STEP POOL |

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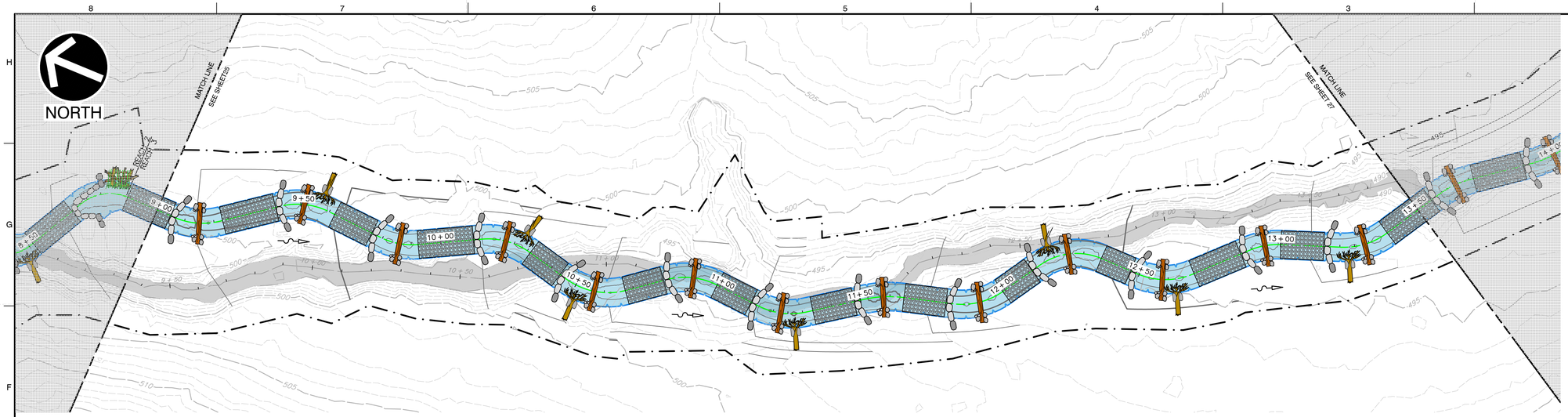
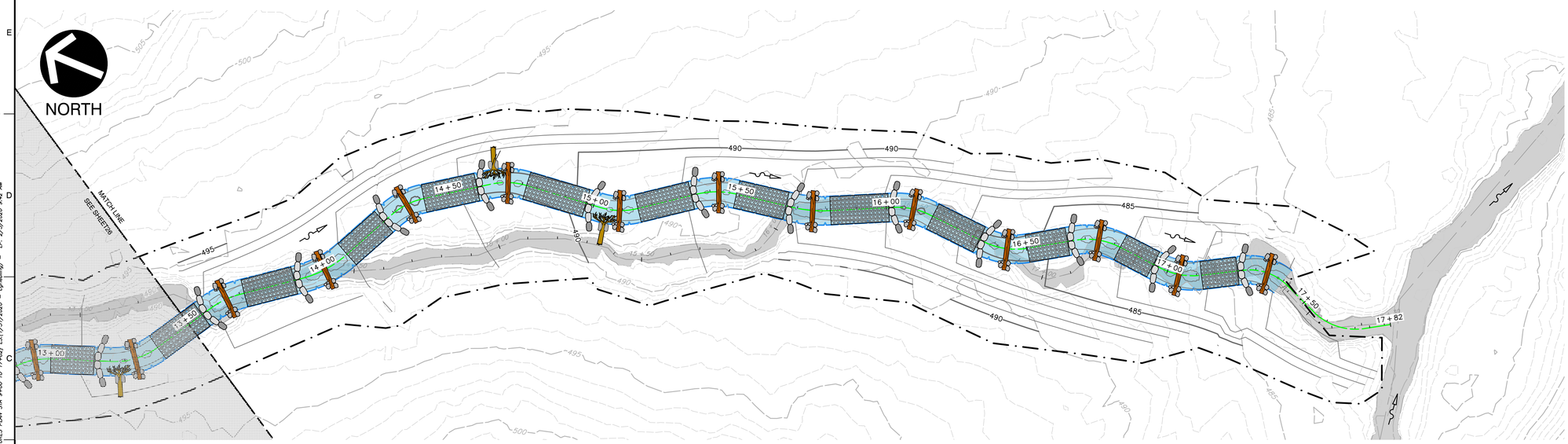
# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: EGK/CJG | CHECKED BY: NSO | APPROVED BY: MDG |
|---|---|---|
| DATE: JANUARY 2020 | DWG SCALE: AS NOTED | PROJECT NO: 196-626 |

UT3 SEC 1 STRUCTURES PLAN STA 0+00 TO 9+00

DRAWING NO.: 35




## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
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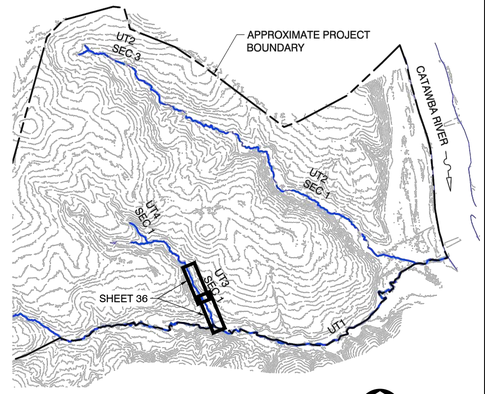


KEYMAP

SCALE IN FEET

0 1000 2000

NORTH

LEGEND

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SCALE IN FEET

0 20 40

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STRUCTURES LEGEND

| MAP SYMBOL | STRUCTURE NAME |
|---|---|
| | 2/45 ROCK CONSTRUCTED RIFFLE |
| | 6/47 ROOT WAD |
| | 9/49 DOUBLE DROP BOULDER LOG STEP POOL |

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
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| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 STRUCTURES PLAN STA 9+00 TO 17+82

DRAWING NO.: 36

P:\2019\196-626.0004\-CADD\Dwg\EC01\196626EC01-STRUCTURES_UT3.dwg\36 UT3 SEC 1 STRUCTURES PLAN STA 9+00 TO 17+82\ LS:(1/31/2020 - cgrinbling) - LP: 2/3/2020 9:42 AM

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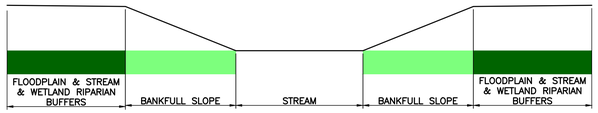
| | | |
| | | |

PLANTING LEGEND

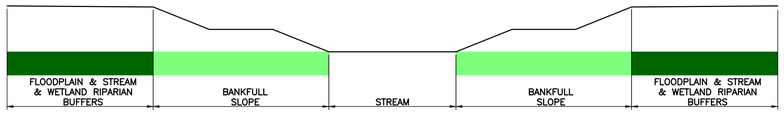
- PROPOSED BANKFULL SLOPE PLANTING
- PROPOSED FLOODPLAINS PLANTING & PROPOSED STREAM & WETLAND RIPARIAN BUFFER PLANTING
- PROPOSED STREAM RIPARIAN BUFFER ENHANCEMENT PLANTING
- PROPOSED STREAM RIPARIAN BUFFER PRESERVATION
- PROPOSED SHALLOW WETLAND PLANTING
- PROPOSED DEEP WETLAND PLANTING
- MITIGATION EASEMENT BOUNDARY

RIPARIAN PLANTING SPECIFICATIONS FOR LANDSFORD TRACT - UT2, UT3, & UT5

| Planting Zone | Scientific Name | Common Name | Type | Percentage | Planting Density | | | Planting Units (Acres) | Total Number |
|---|---|---|---|---|---|---|---|---|---|
| Bankfull Slope | *Cephalanthus occidentalis* | Buttonbush | live stake | 25% | 4,840 | 3'x3' | per acre | 1.08 | 436 |
| | *Cornus amomum* | Silky Dogwood | live stake | 25% | | | | | 436 |
| | *Salix nigra* | Black Willow | live stake | 25% | | | | | 436 |
| | *Salix sericea* | Silky Willow | live stake | 25% | | | | | 436 |
| | *Alnus serrulata* | Tag Alder | bare root | 15% | 450 | 10'x10' | | | 73 |
| | *Betula nigra* | River Birch | bare root | 20% | | | | | 97 |
| | *Cornus amomum* | Silky Dogwood | bare root | 10% | | | | | 49 |
| | *Physocarpus opulifolius* | Ninebark | bare root | 10% | | | | | 49 |
| | *Platanus occidentalis* | Eastern Sycamore | bare root | 20% | | | | | 97 |
| | *Populus deltoides* | Eastern Cottonwood | bare root | 15% | | | | | 73 |
| | *Sambucus nigra* | Elderberry | bare root | 10% | | | | | 49 |
| | Mellow Marsh Farm Wetland Shade Seed Mix | | seed (lbs) | 100% | 25 | | per acre | | 27 |
| Floodplains and Stream and Wetland Riparian Buffers | *Amelanchier arborea* | Downy Serviceberry | bare root | 5% | 450 | 10'x10' | per acre | 3.32 | 75 |
| | *Carya ovata* | Shagbark Hickory | bare root | 10% | | | | | 149 |
| | *Carpinus caroliniana* | Ironwood | bare root | 5% | | | | | 75 |
| | *Celtis laevigata* | Sugarberry | bare root | 5% | | | | | 75 |
| | *Corylus americana* | Hazelnut | bare root | 5% | | | | | 75 |
| | *Euonymus americanus* | Strawberry Bush | bare root | 5% | | | | | 75 |
| | *Ilex opaca* | American Holly | bare root | 5% | | | | | 75 |
| | *Liriodendron tulipifera* | Yellow Poplar | bare root | 5% | | | | | 75 |
| | *Nyssa sylvatica* | Blackgum | bare root | 10% | | | | | 149 |
| | *Quercus bicolor* | Swamp White Oak | bare root | 10% | | | | | 149 |
| | *Quercus nigra* | Water Oak | bare root | 10% | | | | | 149 |
| | *Quercus phellos* | Willow Oak | bare root | 10% | | | | | 149 |
| | *Quercus shumardii* | Swamp Red Oak | bare root | 10% | | | | | 149 |
| | *Viburnum dentatum* | Arrowwood | bare root | 5% | | | | | 75 |
| | Mellow Marsh Farm Riparian Buffer Seed Mix | | seed (lbs) | 100% | 25 | | per acre | | 83 |
| Stream Riparian Buffers | *Acer rubrum* | Red Maple | bare root | 10% | 450 | 10'x10' | per acre | 30.27979 | 1,363 |
| | *Amelanchier arborea* | Downy Serviceberry | bare root | 5% | | | | | 681 |
| | *Diospyros virgiana* | Persimmon | bare root | 5% | | | | | 681 |
| | *Carpinus caroliniana* | Ironwood | bare root | 10% | | | | | 1,363 |
| | *Cercis canadensis* | Eastern Redbud | bare root | 5% | | | | | 681 |
| | *Corylus americana* | Hazelnut | bare root | 5% | | | | | 681 |
| | *Liriodendron tulipifera* | Yellow Poplar | bare root | 10% | | | | | 1,363 |
| | *Nyssa sylvatica* | Black Gum | bare root | 10% | | | | | 1,363 |
| | *Pinus virginiana* | Virginia Pine | tubeling | 5% | | | | | 681 |
| | *Quercus alba* | White Oak | bare root | 10% | | | | | 1,363 |
| | *Quercus falcata* | Southern Red Oak | bare root | 10% | | | | | 1,363 |
| | *Quercus rubra* | Northern Red Oak | bare root | 10% | | | | | 1,363 |
| | *Viburnum dentatum* | Arrowwood | bare root | 5% | | | | | 681 |
| Temporary Vegetative Cover for Disturbed Areas | Temporary Cover Seed: | | | | | | | | |
| | Scientific Name | Common Name | Planting Dates | | Rates (lbs/acre) | | | Planting Area (acres) | No. lbs |
| | *Secale cereale* | Winter rye | Aug 15-Feb 28 | | 85 | | per acre | 34.67979 | 2,948 |
| | *Avena sative* | Oats | Apr 1-Jun 15 | | 50 | | | | 1,734 |
| | *Echinochloa muricata* | American Barnyard Grass | May 15-Aug 15 | | 15 | | | | 520 |




**TYPICAL HIGH-GRADIENT PLANTING SECTION**
N.T.S.




**TYPICAL LOW-GRADIENT PLANTING SECTION**
N.T.S.

PLANTING NOTES:

1. PLANT MATERIALS WILL BE FROM PLANT STOCK NATIVE OR ADAPTED TO THE EASTERN BROADLEAF FOREST PROVINCE, AS DEFINED BY THE USDA FOREST SERVICE, AND USDA PLANT HARDINESS ZONE 7.
2. PLANT HANDING AND INSTALLATION SHOULD BE PERFORMED BY A CONTRACTOR WITH EXPERIENCE IN LANDSCAPING, PLANT PROPAGATION, PLANTING WETLAND MITIGATION SITES, REFORESTATION, AND/OR ECOLOGICAL RESTORATION WORK.
3. PERMANENT SEEDING AND WOODY PLANTING WILL BE PERFORMED FROM NOVEMBER 1 THROUGH MAY 1.
4. PLANTS WILL BE INSTALLED WITHIN EACH PLANTING ZONE THE SPECIFIED NUMBER OF WOODY PLANTS WILL BE ESTABLISHED PER ACRE OF PLANTING AREA. SPECIES SHOULD BE PLANTED IN AREAS OF APPROPRIATE SOIL MOISTURE, BUT OTHERWISE IN A RANDOM FASHION INTERMIXING TREES AND SHRUBS.
5. CONDITION OF PLANT MATERIALS:
   a. PLANT MATERIALS WILL BE HEALTHY AND FREE OF DISEASE, PESTS, MECHANICAL INJURY AND STRESS. PLANTS WITH LEAVES AND SHOOTS WILL APPEAR HEALTHY, WITH NO LEAF SPOTS, LEAF DISCOLORATIONS, CHOROSIS, LEAF WILTING OR CURLING, OR EVIDENCE OF INSECT INFESTATION. PLANTS WILL EXHIBIT NORMAL PHYSICAL AND GROWTH CHARACTERISTICS TYPICAL OF THE SPECIES.
   b. CONTAINER-GROWN PLANTS WILL BE FULLY ROOTED IN THE SOIL POTTING MEDIUM WITHOUT SPIRALING PRIMARY WOODY ROOTS.
   c. UPON RECEIPT AND FOLLOWING INSPECTION, PLANT MATERIALS SHOULD BE IMMEDIATELY INSTALLED IN THE DISTURBED AREA. IF PLANT MATERIALS CANNOT BE INSTALLED IMMEDIATELY AFTER DELIVERY, THEY WILL BE STORED APPROPRIATELY FOR NOT LONGER THAN 3 DAYS. SEED SHOULD BE STORED IN A COOL, DRY, SHELTERED LOCATION. CONTAINER-GROWN PLANTS WILL BE STORED OUT OF DIRECT EXPOSURE TO WIND AND SUN AND WILL BE WATERED PERIODICALLY TO MAINTAIN SOIL MOISTURE.
6. PROPER SEED MIX USE WILL DEPEND ON ENVIRONMENTAL CHARACTERISTICS AT THE INTENDED SITE. PERMANENT SEED MIXES CAN BE SOWN IN CONJUNCTION WITH APPROPRIATE SEASONAL COVER CROP SEED IF SITE CONDITIONS WARRANT. PRIOR TO SEEDING, SEED MIXES SHOULD BE MIXED WITH A MINIMUM OF AN EQUAL VOLUME OF APPROPRIATE INERT CARRIER (CLEAN SAND, SAWDUST, OAT GROATS, ETC.) TO PROVIDE MORE UNIFORM SEED DISTRIBUTION. WETLAND SEED MIXES WILL BE BROADCAST ON MOIST SOIL WITH HAND-HELD SEED SPREADERS UPLAND WARM SEASON GRASS SEED MIX WILL BE DRILLED INTO A FIRM SEED BED TO A DEPTH OF 1/2-INCH USING A NATIVE GRASS SEED DRILL. MULCH UPLAND BUFFERS WITH CLEAN STRAW (AT 140 POUNDS PER 1,000 SQUARE FEET) FOLLOWING TEMPORARY AND FINAL SEEDING.
7. CONTAINER-GROWN WOODY AND HERBACEOUS WETLAND PLANTS WILL BE INSTALLED IN MOIST SOIL USING APPROPRIATE HAND TOOLS (SPADE, DIBBLE, AUGER, ETC.). INDIVIDUAL PLANTS WILL BE FERTILIZED ONCE, AT THE TIME OF PLANTING, BY MIXING THE FOLLOWING QUANTITY OF 19-6-12 OSMOCOTE (14 TO 16-MONTH RELEASE) FERTILIZER IN EACH PLANTING HOLE:
   a. 1 OUNCE FOR BARE ROOT TREES AND SHRUBS
   b. 2.0 OUNCES FOR TUBELING OR 1 GALLON WOODY PLANTS
   c. 6.0 OUNCES FOR 5 GALLON WOODY PLANTS
   d. 10.0 OUNCES FOR RELOCATED TREES/10 GALLON TREES/BALL & BURLAP TREES

PLANTING SPECIFICATIONS FOR FORESTED WETLANDS

| Plant Community | Plant Species | | Type | Percentage | Planting Density (units/acre) | Total | |
|---|---|---|---|---|---|---|---|
| | Scientific Name | Common Name | | | | Area (acres) | Quantity (# units) |
| Bottomland Hardwood Swamp | *Alnus serrulata* | Smooth Alder | 1 gallon | 10% | 450 | 0.12 | 6 |
| | *Acer saccharinum* | Silver Maple | 1 gallon | 10% | | | 6 |
| | *Cephalanthus occidentalis* | Buttonbush | 1 gallon | 10% | | | 6 |
| | *Fraxinus pennsylvanica* | Green Ash | 1 gallon | 10% | | | 6 |
| | *Quercus bicolor* | Swamp White Oak | 1 gallon | 15% | | | 9 |
| | *Quercus lyrata* | Overcup Oak | 1 gallon | 15% | | | 9 |
| | *Quercus michauxii* | Swamp Chestnut Oak | 1 gallon | 15% | | | 9 |
| | *Quercus shumardii* | Swamp Red Oak | 1 gallon | 15% | | | 9 |
| | Mellow Marsh Farm Wetland Shade Seed Mix | | seed (lbs) | 100% | 20 | | 3 |
| Transional Forested Wetland | *Acer rubrum* | Red maple | bare root | 10% | 450 | 0.05 | 3 |
| | *Celtis laevigata* | Sugarberry | bare root | 15% | | | 4 |
| | *Cornus amomum* | Silky Dogwood | bare root | 20% | | | 5 |
| | *Populus deltoides* | Eastern Cottonwood | bare root | 10% | | | 3 |
| | *Quercus nigra* | Water Oak | bare root | 15% | | | 4 |
| | *Quercus phellos* | Willow Oak | bare root | 15% | | | 4 |
| | *Quercus shumardii* | Swamp Red Oak | bare root | 15% | | | 4 |
| | Mellow Marsh Farm Wetland Seed Mix | | seed (lbs) | 100% | 20 | | 2 |

Mellow Marsh Farm Riparian Buffer Mix

| Species | Common Name | Percent |
|---|---|---|
| *Agrostis perennans* | Autumn bentgrass | 15 |
| *Andropogon gerardii* | Big bluestem | 10 |
| *Coreopsis lanceolata* | Lanceleaf coreopsis | 10 |
| *Elymus virginicus* | Virginia wildrye | 20 |
| *Juncus effusus* | Soft rush | 5 |
| *Panicum virgatum* | Switchgrass | 15 |
| *Rudbeckia hirta* | Blackeyed susan | 10 |
| *Schizachyrium scoparium* | Little bluestem | 5 |
| *Sorghastrum nutans* | Indian grass | 5 |
| *Tripsacum dactyloides* | Eastern gamagrass | 5 |
| Total | | 100 |

Mellow Marsh Farm Wetland Mix

| Species | Common Name | Percent |
|---|---|---|
| *Bidens aristosa* | Showy tickseed | 7 |
| *Carex vulpinoidea* | Fox sedge | 12 |
| *Dichanthelium clandestinum* | Deertongue | 8 |
| *Elymus virginicus* | Virginia wildrye | 20 |
| *Juncus effusus* | Soft rush | 4 |
| *Panicum dichotomiflorum* | Smooth panicgrass | 14 |
| *Panicum rigidulum* | Redtop panicgrass | 8 |
| *Panicum virgatum* | Switchgrass | 23 |
| *Polygonum pensylvanicum* | Pennsylvania smartweed | 2 |
| *Sparganium americanum* | Eastern bur reed | 2 |
| Total | | 100 |

Mellow Marsh Farm Wetland Shade Mix

| Species | Common Name | Percent |
|---|---|---|
| *Carex lurida* | Lurid sedge | 5 |
| *Carex vulpinoidea* | Fox sedge | 12 |
| *Desmodium canadense* | Showy tick trefoil | 5 |
| *Dichanthelium clandestinum* | Deer tongue | 20 |
| *Elymus riparius* | Riverbank wildrye | 20 |
| *Elymus virginicus* | Virginia wildrye | 20 |
| *Iris versicolor* | Blue flag | 2 |
| *Schizachyrium scoparium* | Little bluestem | 12 |
| *Scirpus cyperinus* | Woolgrass | 2 |
| *Sparganium americanum* | Eastern bur reed | 2 |
| Total | | 100 |

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PLANTING NOTES

DRAWING NO.: 37

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| SUBMITTAL & REVISION RECORD | | |
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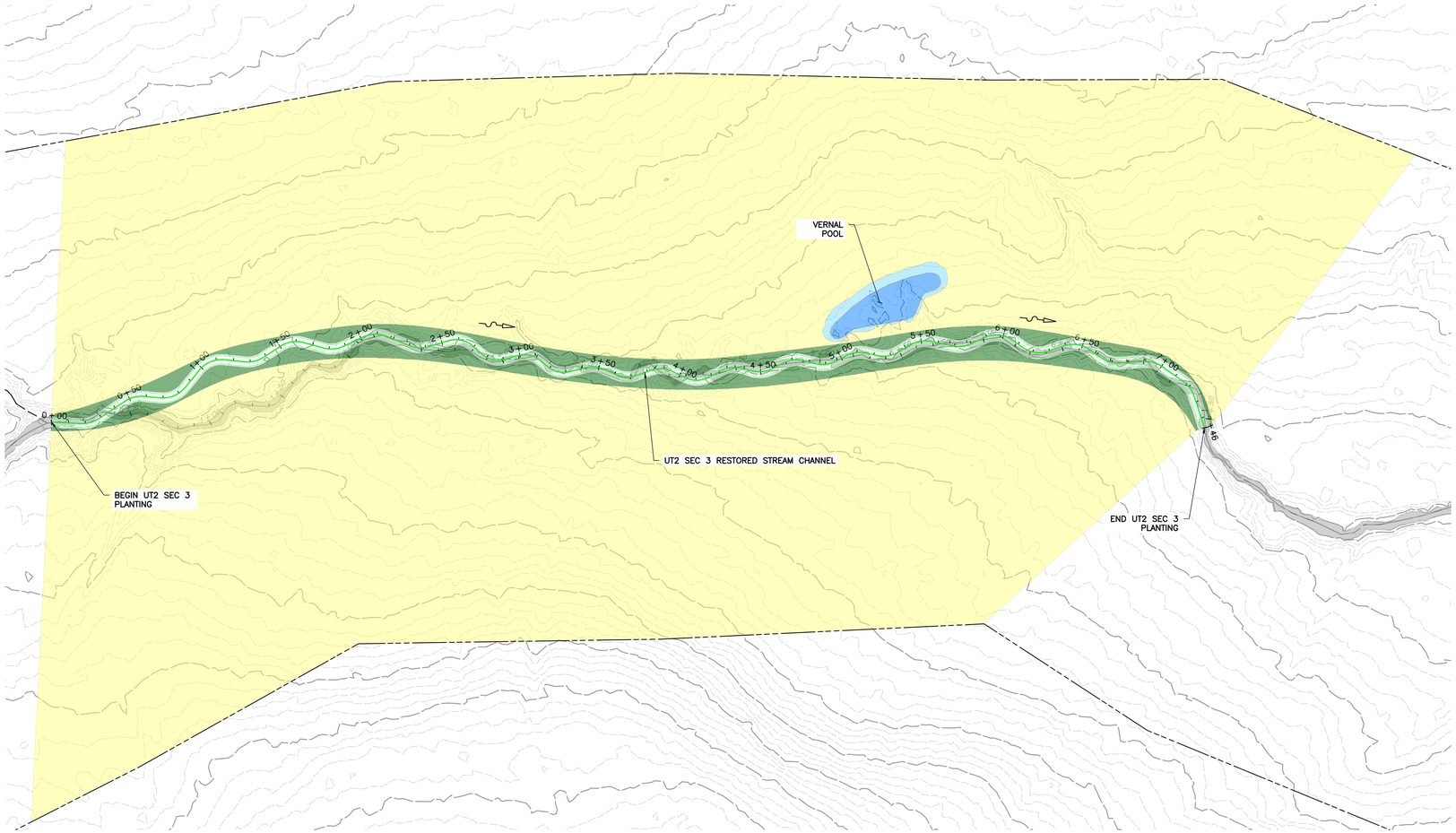
LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY

PLANTING LEGEND

- PROPOSED BANKFULL SLOPE PLANTING
- PROPOSED FLOODPLAINS PLANTING & PROPOSED STREAM & WETLAND RIPARIAN BUFFER PLANTING
- PROPOSED STREAM RIPARIAN BUFFER ENHANCEMENT PLANTING
- PROPOSED STREAM RIPARIAN BUFFER PRESERVATION
- PROPOSED SHALLOW WETLAND PLANTING
- PROPOSED DEEP WETLAND PLANTING
- MITIGATION EASEMENT BOUNDARY




NORTH

SCALE IN FEET

0 40 80

**REFERENCE**

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

SUBMITTED FOR PERMITS
NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


Civil & Environmental Consultants, Inc.
530 Howell Road · Suite 203 · Greenville, SC 29615
Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135
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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 3 PLANTING PLAN

DRAWING NO.: 38

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LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY

PLANTING LEGEND

- PROPOSED BANKFULL SLOPE PLANTING
- PROPOSED FLOODPLAINS PLANTING & PROPOSED STREAM & WETLAND RIPARIAN BUFFER PLANTING
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- PROPOSED STREAM RIPARIAN BUFFER PRESERVATION
- PROPOSED SHALLOW WETLAND PLANTING
- PROPOSED DEEP WETLAND PLANTING
- MITIGATION EASEMENT BOUNDARY

## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
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| | 01/31/2020 | ISSUED FOR PERMITS |
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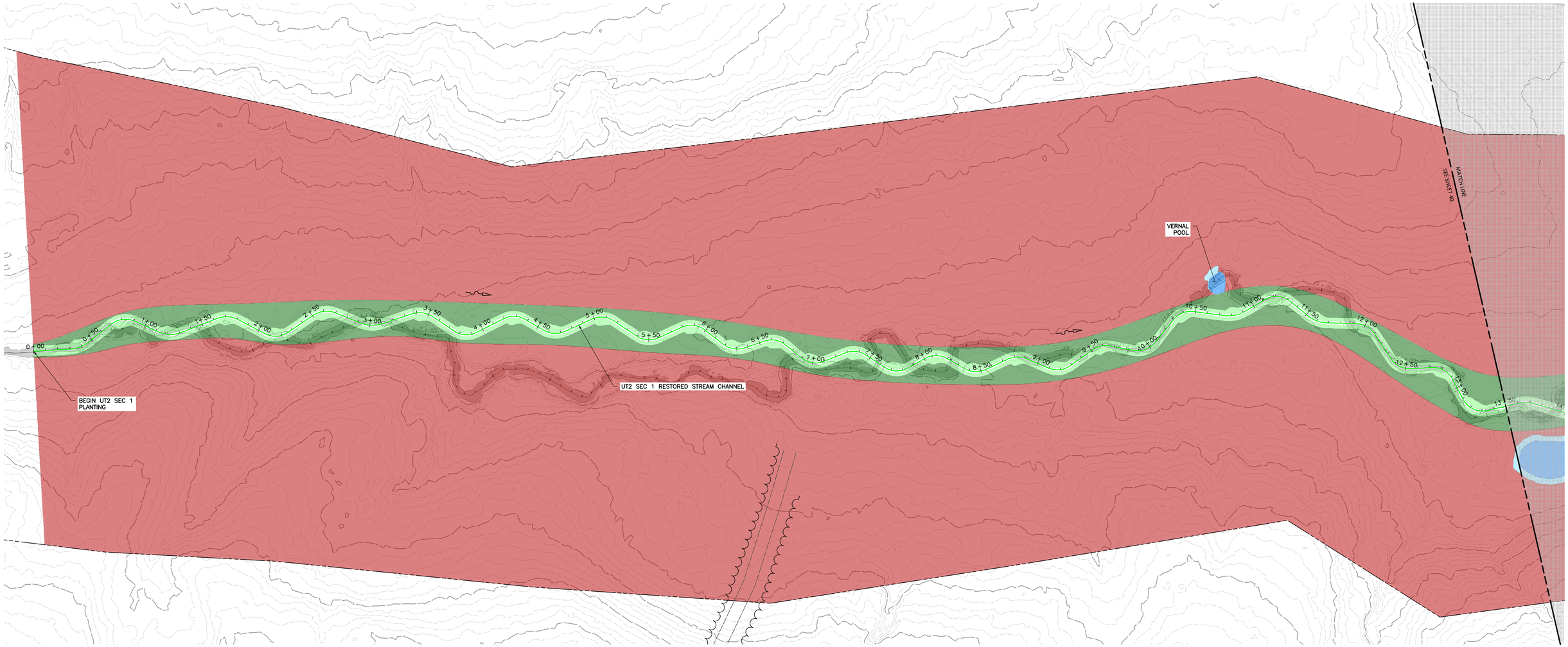


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NORTH

SCALE IN FEET

0 40 80


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 PLANTING PLAN

DRAWING NO.: 39

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

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## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
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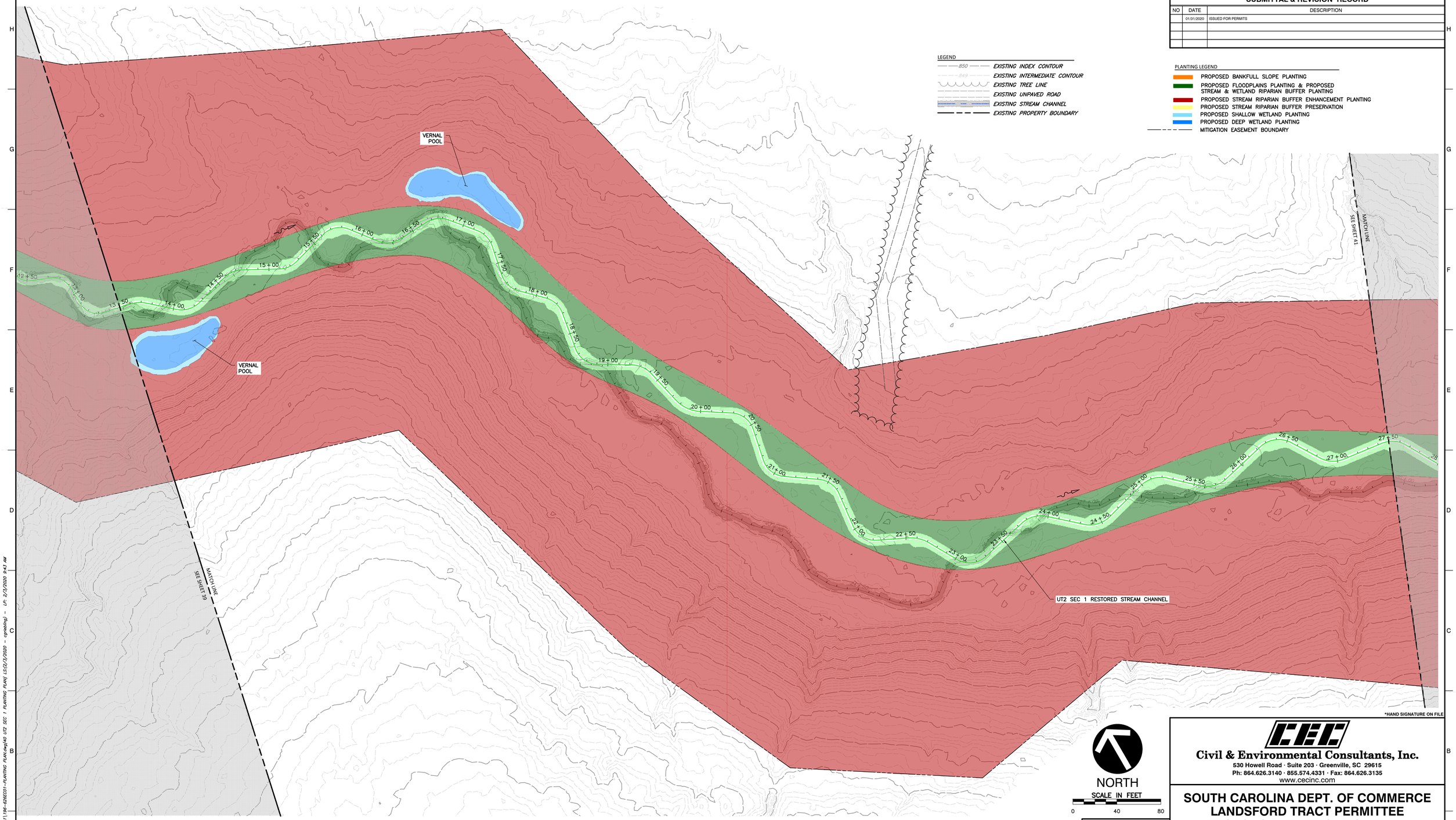


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# SOUTH CAROLINA DEPT. OF COMMERCE
# LANDSFORD TRACT PERMITTEE
# RESPONSIBLE MITIGATION PLAN
# CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 PLANTING PLAN

DRAWING NO.: 40

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

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## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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## SUBMITTAL & REVISION RECORD

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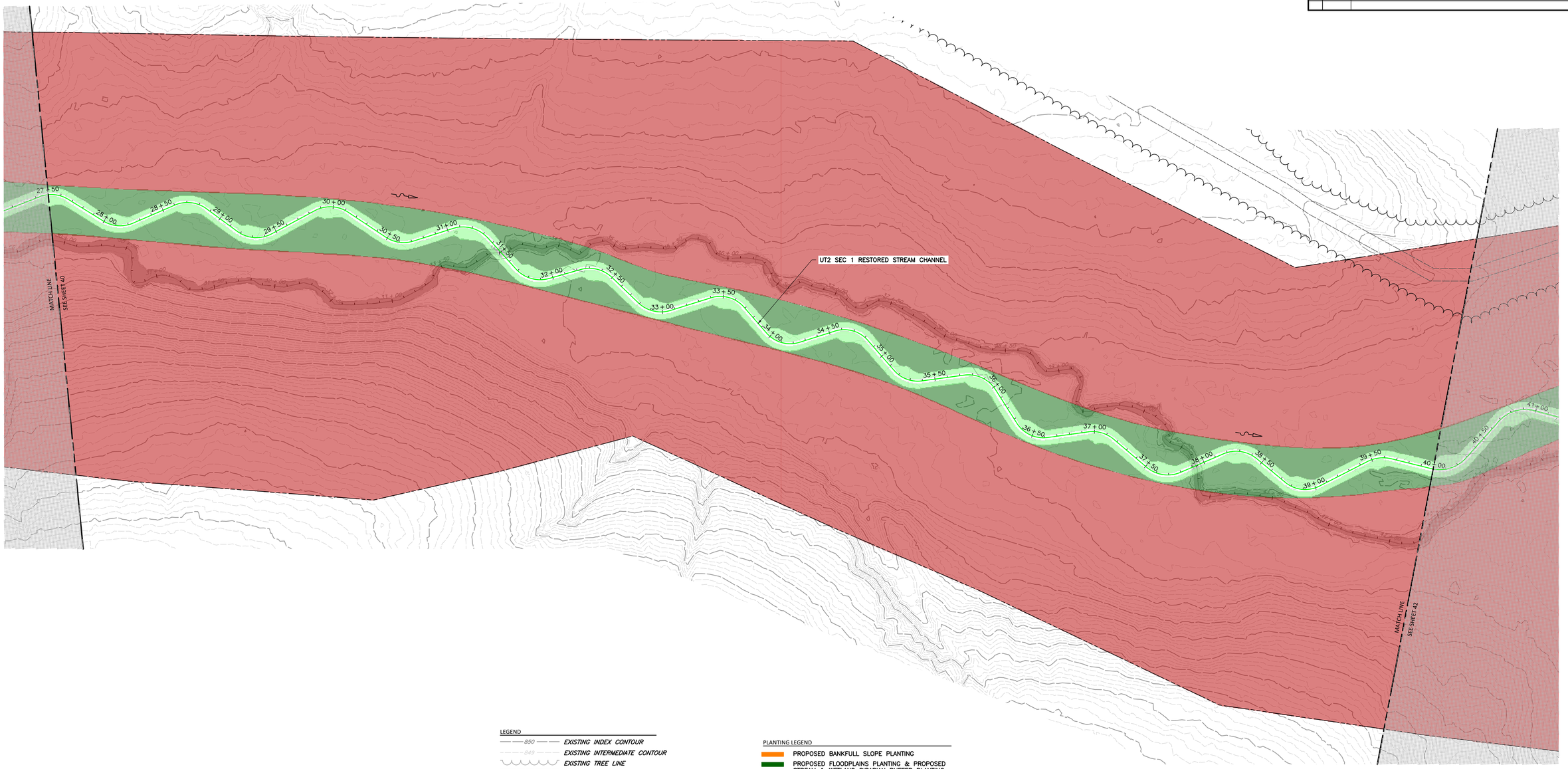


LEGEND

- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
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PLANTING LEGEND

- PROPOSED BANKFULL SLOPE PLANTING
- PROPOSED FLOODPLAINS PLANTING & PROPOSED STREAM & WETLAND RIPARIAN BUFFER PLANTING
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- MITIGATION EASEMENT BOUNDARY

NORTH

SCALE IN FEET

0 40 80

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 PLANTING PLAN

DRAWING NO.: 41

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

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## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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4. VERTICAL DATUM IS NAVD88(GEOID12B).

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| SUBMITTAL & REVISION RECORD | | |
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| NO | DATE | DESCRIPTION |
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PLANTING LEGEND

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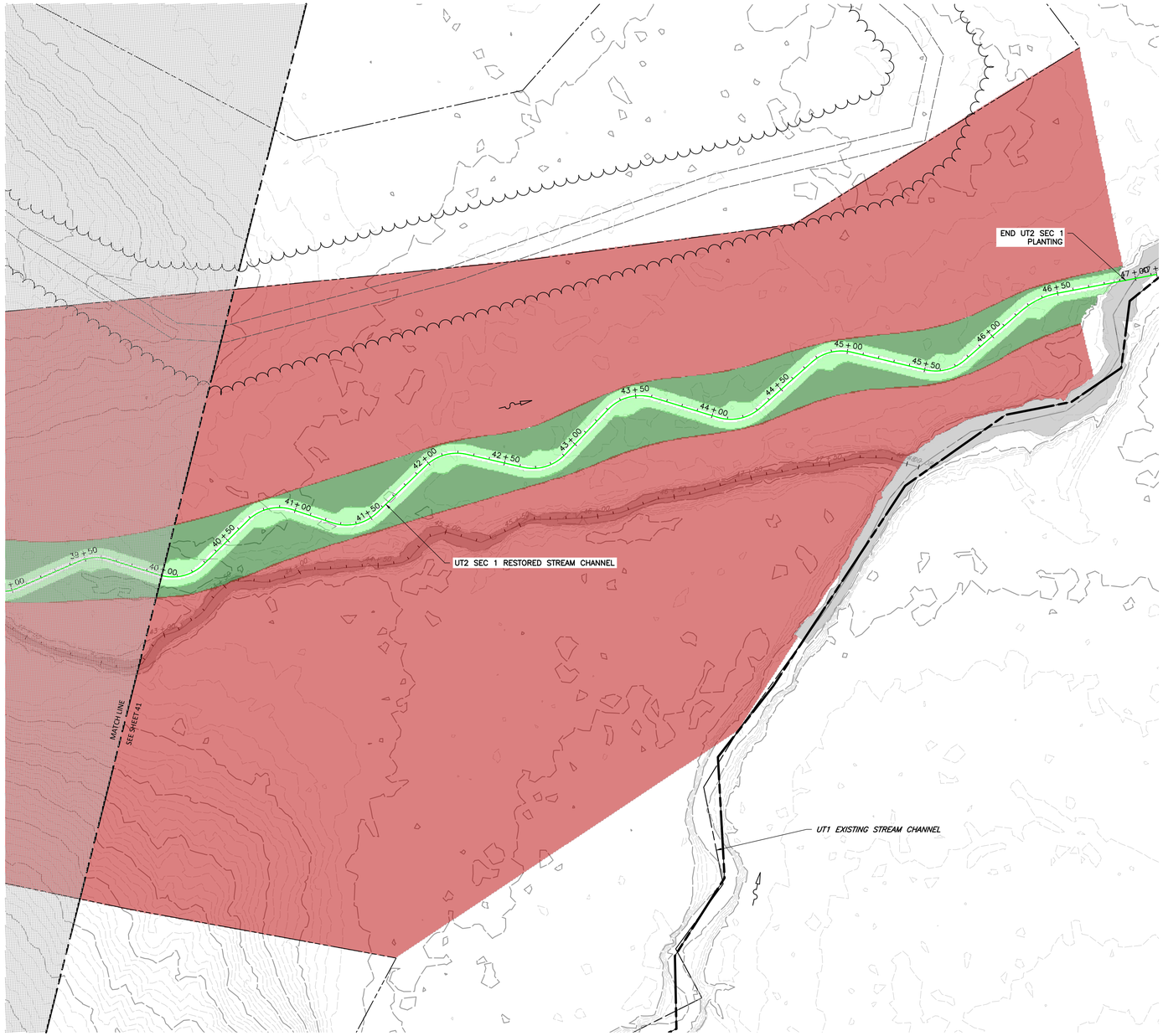


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT2 SEC 1 PLANTING PLAN

DRAWING NO.: 42

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

SUBMITTED FOR PERMITS NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

**REFERENCE**

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4. VERTICAL DATUM IS NAVD88(GEOID12B).

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## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
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LEGEND

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PLANTING LEGEND

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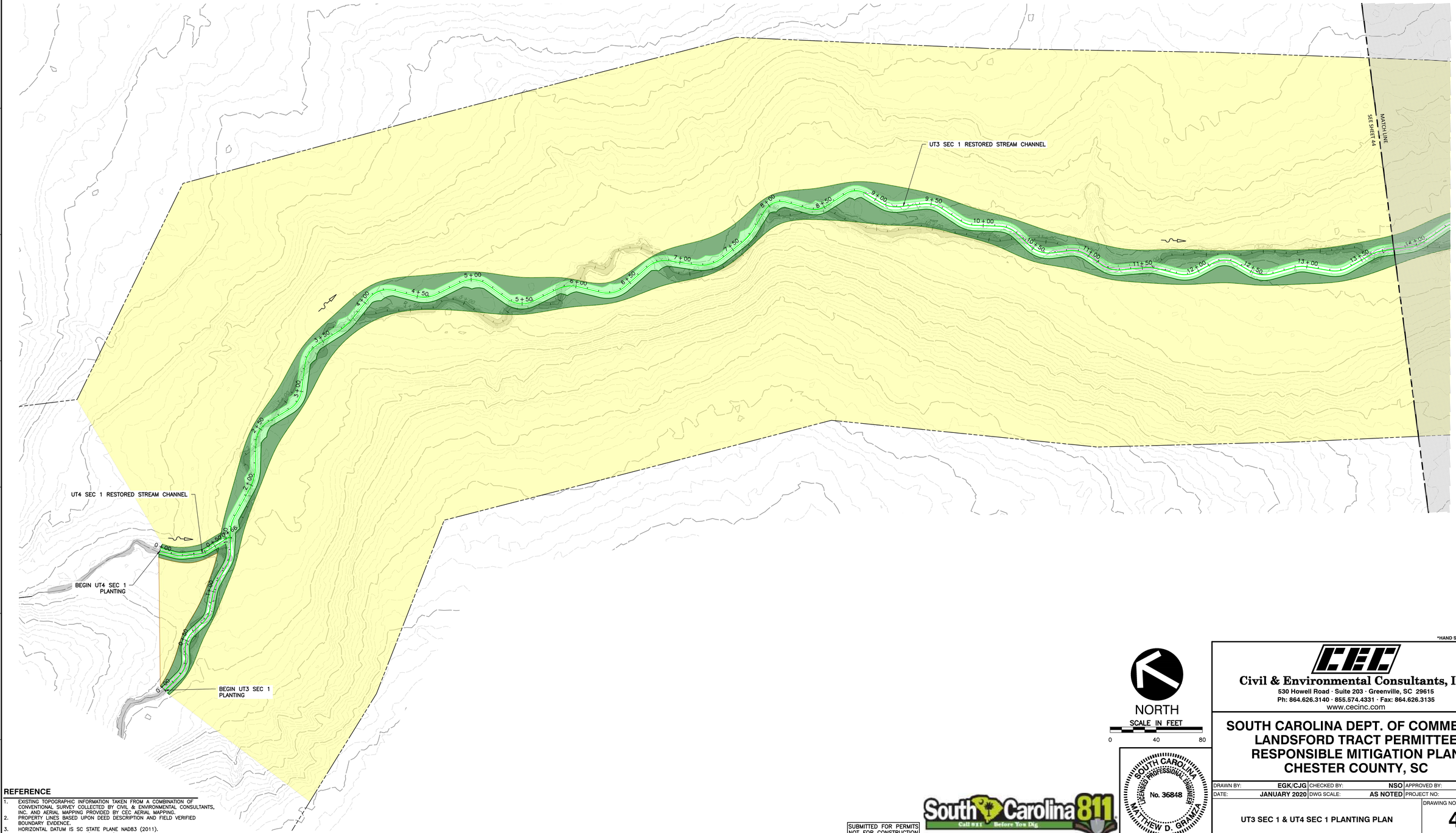


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

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|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 & UT4 SEC 1 PLANTING PLAN

DRAWING NO.: 43

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

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## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
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4. VERTICAL DATUM IS NAVD88(GEOID12B).

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## SUBMITTAL & REVISION RECORD

| NO | DATE | DESCRIPTION |
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| | 01/31/2020 | ISSUED FOR PERMITS |
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LEGEND

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PLANTING LEGEND

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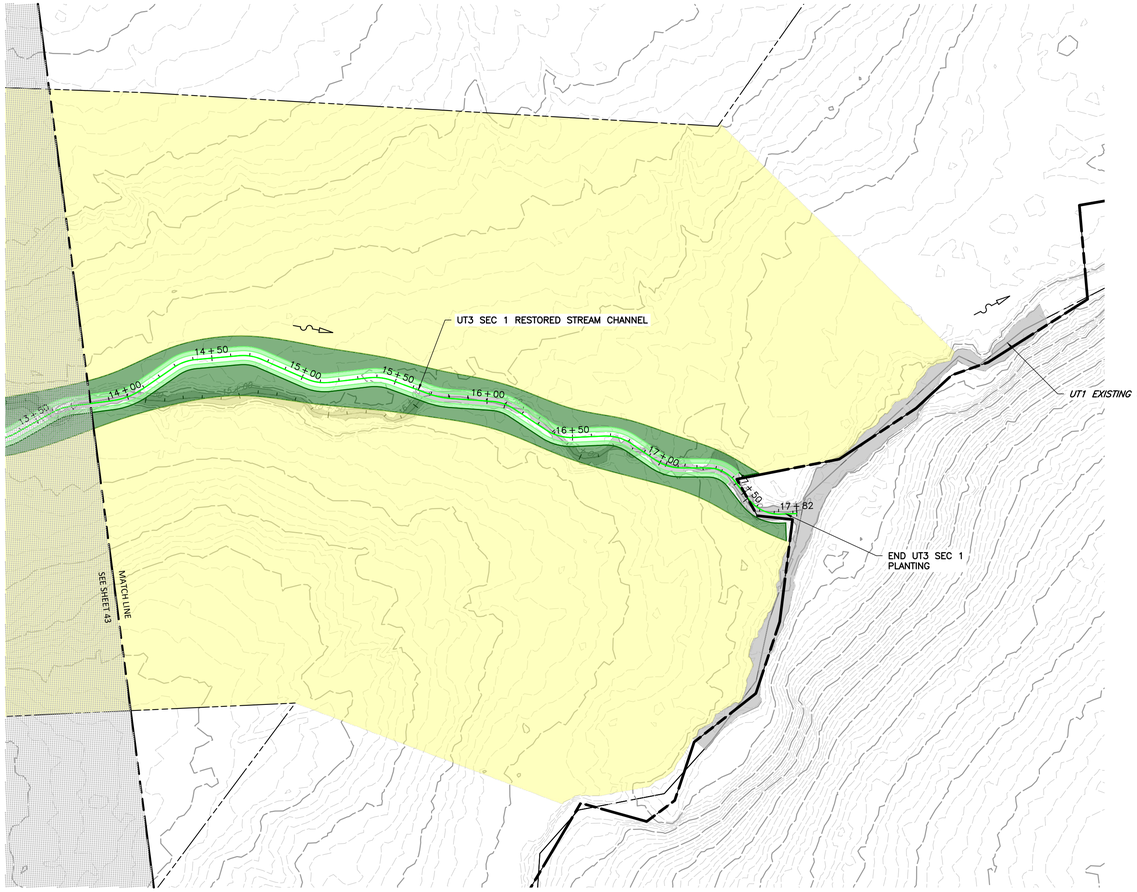


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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

UT3 SEC 1 PLANTING PLAN

DRAWING NO.: 44

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

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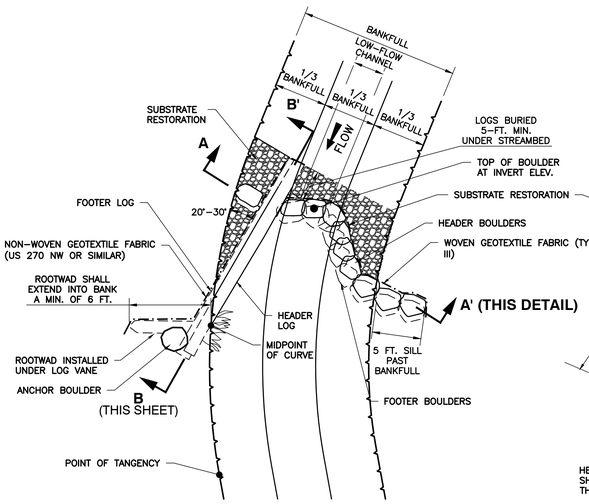


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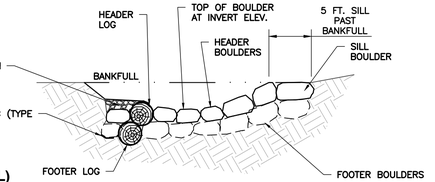
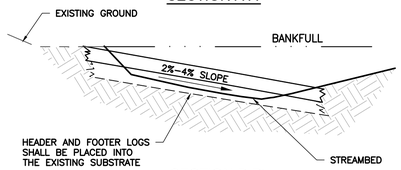



SECTION A-A'

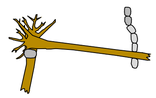



SECTION B-B'

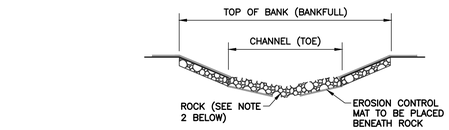
NOTES:

1. A HYDRAULIC EXCAVATOR, WITH A HYDRAULIC THUMB, SHALL BE USED TO PLACE BOULDERS AND LOGS.
2. LOGS SHALL BE RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED AND EXTENDED INTO THE BANK 6-FT.
3. LOG VANE SHALL EXTEND FROM THE BOTTOM OF THE BED ELEVATION TO THE HEAD OF THE VANE AT A MIN. DEPTH OF 1/2 BANKFULL ELEVATION. THE LOG VANE ARM HAS A SLOPE OF 2%-4%. HEADER AND FOOTER LOGS SHALL BE TIED SECURELY INTO THE BANK IN SUCH A WAY THAT ELIMINATES THE POSSIBILITY OF STREAM FLOW DIVERTING AROUND THEM.
4. NON-WOVEN GEOTEXTILE FABRIC (US 270NW OR SIMILAR) SHALL BE INSTALLED ON THE UPSTREAM SIDE OF THE STRUCTURE 1/4 DIAMETER LENGTH FROM THE TOP OF THE LOG. THE NAILS SHALL BE NO GREATER THAN 12 INCHES ON CENTER. THE WOVEN GEOTEXTILE FABRIC SHALL BE BURIED IN THE BOTTOM OF THE CHANNEL AND SHALL BE PLACED THE ENTIRE LENGTH OF STRUCTURE.
5. BOULDERS SHALL BE PLACED ON TOP OF HEADER LOG FOR ANCHORING. 1/3 OF THE WAY ACROSS THE CHANNEL FROM THE OUTSIDE BANK. THE HEADER ROCK SHALL BE PLACED AT THE CHANNEL INVERT ELEVATION. HEADER BOULDERS TO BE PLACED TOGETHER WITH GAPS CHOKED AND CHINKED WITH SMALLER ROCKS TO PREVENT PIPING.
6. WOVEN GEOTEXTILE FABRIC (TYPE III) SHALL BE INSTALLED ON THE UPSTREAM SIDE OF THE ROCK J-HOOK 1/4-INCH FROM THE TOP OF THE ROCK. THE NON-WOVEN GEOTEXTILE FABRIC SHALL BE BURIED IN THE BOTTOM OF THE CHANNEL AND SHALL BE PLACED THE ENTIRE LENGTH OF STRUCTURE.
7. ROOT WAD SHALL BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK.
8. BACKFILL WITH SELECT MATERIAL SPECIFIED IN THE SUBSTRATE RESTORATION DETAIL.
9. SOIL SHALL BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG WHILE CREATING A SMALL POCKET BETWEEN THE HEADER LOG AND THE OUTSIDE BANK.
10. ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ON-SITE CONSTRUCTION OBSERVER.
11. ITEMS IN THIS DETAIL ARE A GRAPHICAL ILLUSTRATION AND DO NOT SPECIFY THE ACTUAL QUANTITY OF MATERIALS (I.E. LOGS, BOULDERS, STONE, ETC.) TO BE USED FOR CONSTRUCTION.

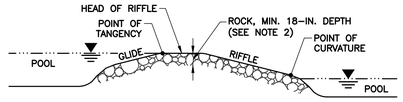
PLAN SYMBOL



(1/45) **LOG VANE, ROCK J-HOOK AND ROOT WAD**
NOT TO SCALE



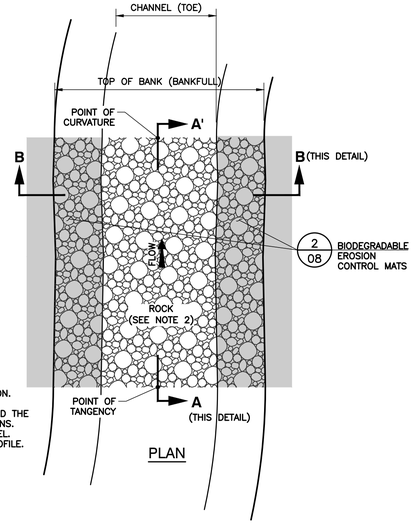

SECTION B-B'




SECTION A-A'

NOTES:

1. DIG A TRENCH BELOW THE BED FOR THE INVERT INSTALLATION.
2. REFER TO THE QUANTITIES SHEETS FOR EACH REACH TO FIND THE CONSTRUCTED RIFFLE GRADING AND ROCK SIZE SPECIFICATIONS. FILL THE TRENCH TO THE INVERT ELEVATION OF THE CHANNEL.
3. RIFFLE SLOPE IS SPECIFIED ON THE GRADING PLAN AND PROFILE.




PLAN

PLAN SYMBOL



(2/45) **ROCK CONSTRUCTED RIFFLE**
NOT TO SCALE

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**SUBMITTAL & REVISION RECORD**

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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

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| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

IN-STREAM STRUCTURE DETAILS

DRAWING NO.: 45

P:\2019\196-626.0041-CAD\Dwg\ECD\196-626ECD1-IN-STREAM PHOTODETAILS_1.dwg(45 IN-STREAM STRUCTURE DETAILS) LS(1/31/2020 - cgreeling) - LP: 2/3/2020 8:45 AM

| SUBMITTAL & REVISION RECORD | | |
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| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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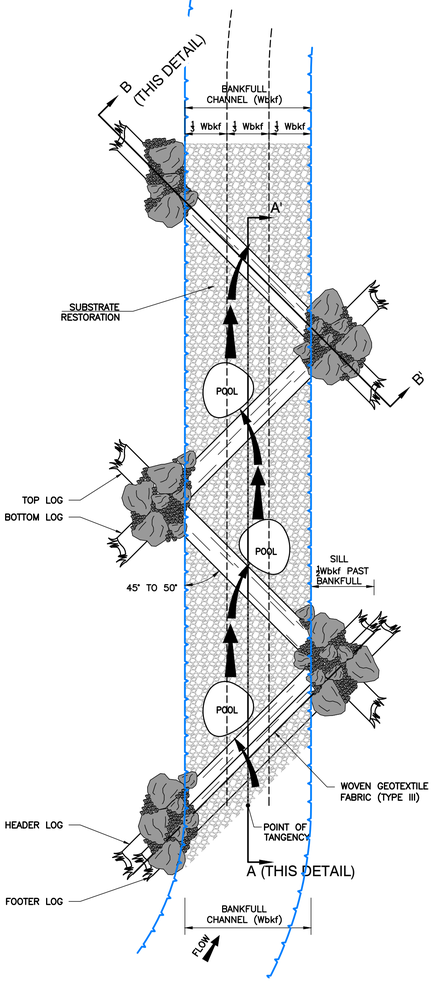
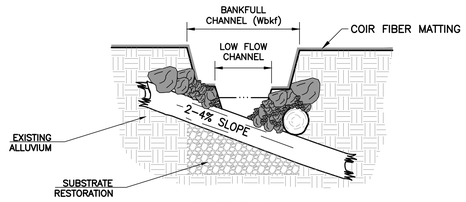
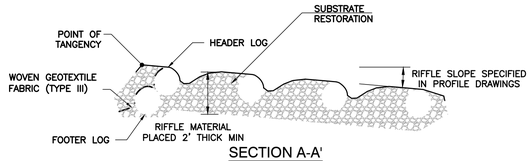



SECTION B-B'

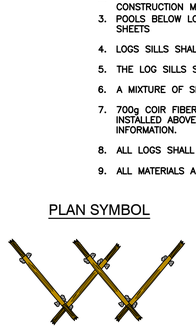



SECTION A-A'

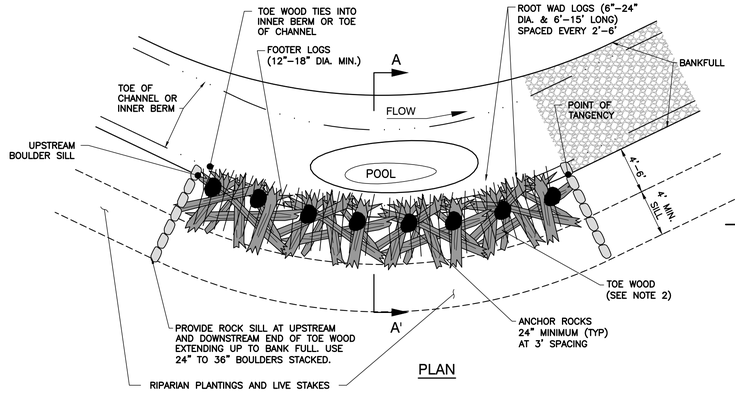
NOTES:

1. PLACE WOVEN GEOTEXTILE FABRIC (TYPE III) ON THE UPSTREAM SIDE OF THE MOST UPSTREAM LOG SILL IN THE CONSTRUCTED RIFFLE.
2. BOULDERS WITH 2' MINIMUM DIAMETER SHALL BE USED TO ANCHOR LOGS UNLESS DIRECTED BY ON-SITE CONSTRUCTION MANAGER.
3. POOLS BELOW LOGS SHALL BE NOT EXTEND BELOW ½ LOG DIAMETERS BELOW GRADE SPECIFIED ON PROFILE SHEETS
4. LOGS SILLS SHALL OVERLAP AND ANCHOR THE LOG SILL DIRECTLY UPSTREAM.
5. THE LOG SILLS SHALL ALL BE DESIGNED TO BE SUBMERGED OR COVERED AT LOW FLOWS.
6. A MIXTURE OF SELECT MATERIAL WILL BE USED IN THE RIFFLES TO CHINK GAPS IN THE ANCHOR BOULDERS.
7. 700g COIR FIBER ECB MATTING SHALL BE USED IN BANKFULL FLOW CHANNEL. THE MATTING SHALL BE INSTALLED ABOVE THE INNER-BERM STAGE. SEE TYPICAL CROSS-SECTION DATA FOR INNER-BERM INFORMATION.
8. ALL LOGS SHALL BE RELATIVELY STRAIGHT.
9. ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

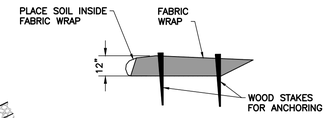
PLAN SYMBOL



3/46 **LOG RIFFLE**
NOT TO SCALE



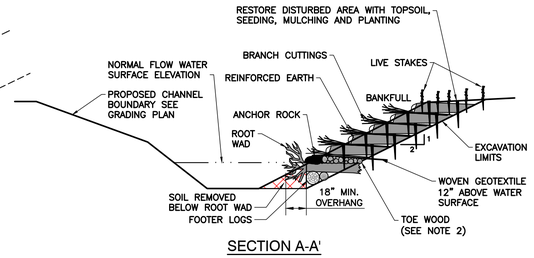

PLAN




REINFORCED EARTH

NOTE:
STAKES MAY BE MADE BY SAWING A 2x4 DIAGONALLY IN HALF.

WOOD STAKE




SECTION A-A'

NOTES:

1. IF AN APPROVED ON-SITE SOURCE IS AVAILABLE, SOD MAT LAYERS MAY BE USED INSTEAD OF REINFORCED EARTH. SOD MATS MAY ALSO BE OBTAINED FROM CLEARING AND EXCAVATION WORK ASSOCIATED WITH THE PROJECT. THE NUMBER OF LAYERS OF REINFORCED EARTH OR SOD MATS MAY VARY WITH THE BANK HEIGHT.
2. TOE WOOD CONSISTS OF A MIX OF LOGS, BRANCHES, BRUSH, AND OTHER WOODY VEGETATION INSTALLED AT VARIOUS ANGLES, BUT NOT PARALLEL TO THE FLOW. LAYER THE WOOD WITH LARGER MATERIAL ON THE BOTTOM AND A MAT OF BRANCHES AS THE TOP LAYER. ANGLE ROOT WADS SLIGHTLY UPSTREAM INTO THE FLOW.
3. THE TOP LAYER OF TOE WOOD SHALL BE AT THE ESTABLISHED NORMAL FLOW ELEVATION.
4. FILL BETWEEN ROOT WADS WITH A MIX OF WOODY DEBRIS PER NOTE 2.
5. LAYER REINFORCED EARTH AND CUTTINGS TO BANKFULL.

PLAN SYMBOL

4/46 **TOE WOOD WITH REINFORCED EARTH AND LIVE BRUSH LAYERING**
NOT TO SCALE

SUBMITTED FOR PERMITS
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South Carolina 811 Call 811 Before You Dig

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


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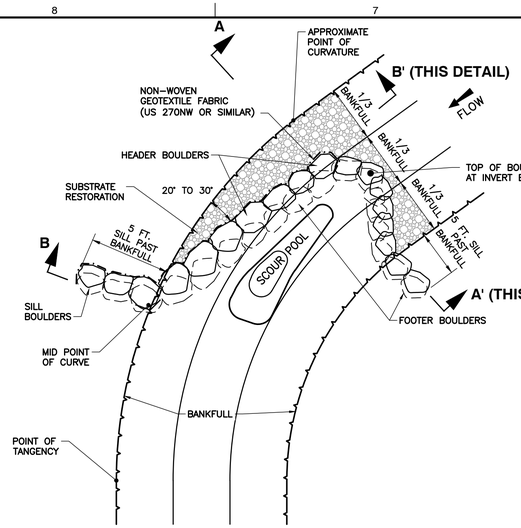
# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

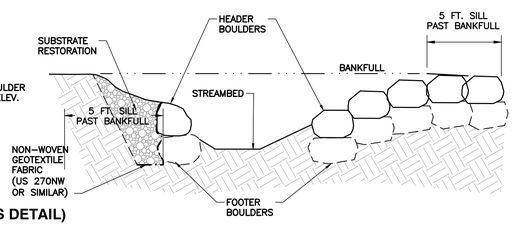
IN-STREAM STRUCTURE DETAILS

DRAWING NO.: 46

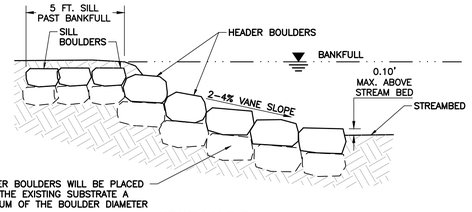
P:\2019\196-626.0004\-CAD\Dwg\ECD\196-626ECD1-IN-STREAM PHOTODETAILS_1.dwg[46 IN-STREAM STRUCTURE DETAILS] 1/31/2020 - cgreeling - LP: 2/3/2020 8:46 AM




PLAN VIEW




SECTION A-A'

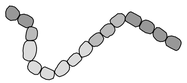



SECTION B-B'

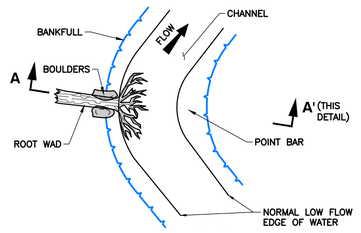
NOTES:

1. ALL BOULDERS SHALL BE A MINIMUM DIAMETER OF 3 FT.
2. GAPS BETWEEN BOULDERS SHALL BE MINIMIZED BY FITTING BOULDERS TOGETHER, AND PLUGGING WITH SELECT MATERIAL AND LINED WITH FILTER FABRIC. THE CONTRACTOR WILL BE REQUIRED TO FIT BOULDERS TIGHTLY.
3. DIMENSIONS AND SLOPES MAYBE ADJUSTED TO FIT BY THE ENGINEER.
4. A DOUBLE FOOTER BOULDER SHALL BE UTILIZED IN SAND BED MATERIAL.
5. VANE ARM SHALL TIE INTO THE BANK HALFWAY BETWEEN THE CHANNEL INVERT AND BANKFULL ELEVATIONS. THE ARM SHALL RISE AT 2%-4% FROM THE CHANNEL INVERT AT AN ANGLE OF 20-30 DEG FROM THE ADJACENT TANGENT LINE.
6. NON-WOVEN GEOTEXTILE FILTER FABRIC (US 270NW OR SIMILAR) SHALL BE PLACED ON THE UPSTREAM SIDE OF THE VANE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH BOULDER GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER BOULDER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
7. ALL MATERIALS ARE TO BE APPROVED BY THE ENGINEER OR THE ENGINEER'S ON-SITE CONSTRUCTION OBSERVER.

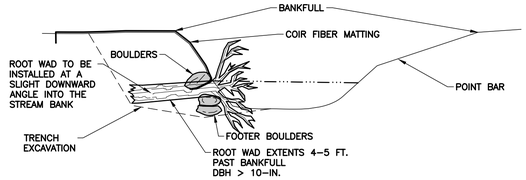
PLAN SYMBOL



5/47 **BOULDER VANE AND J-HOOK**
NOT TO SCALE




PLAN




SECTION A-A'

NOTES:

1. EXCAVATE A TRENCH FOR THE LOG PORTION OF THE ROOT WAD AND FOOTER BOULDERS. THE FOOTER BOULDERS SHOULD BE INSTALLED UNDERNEATH THE ROOT WAD IN A TRENCH EXCAVATED PERPENDICULAR TO THE BANK AND FAR ENOUGH BELOW THE STREAM BED TO ACCOMMODATE THE FOOTER BOULDERS AND ROOT WAD LOG.
2. BOULDERS SHOULD BE PLACED ON EACH SIDE OF THE ROOT WAD TO PIN IT IN PLACE. THE BOULDERS SHOULD BE APPROXIMATELY 1.5-FT. X 1.5-FT. X 1.5-FT.
3. THE TOP OF THE ROOT WAD SHOULD BE AT THE SAME ELEVATION AS THE HEAD OF THE DOWNSTREAM RIFFLE.
4. PLACE A BOULDER ON TOP OF THE LOG AND BACKFILL ON TOP OF THE ROOT WAD AND BOULDERS TO BANKFULL.

PLAN SYMBOL

6/47 **ROOT WAD**
NOT TO SCALE

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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THE FOLLOWING SPECIFICATION IS DESIGNED TO REPLACE AND RESTORE COARSE (GRAVEL, COBBLE, AND BOULDER) SUBSTRATE TO THE STREAM CHANNEL IN CASES WHERE COARSE SUBSTRATES ARE ABSENT FOLLOWING CHANNEL EXCAVATION. THE PURPOSE OF THIS RESTORATION MEASURE IS TO PROVIDE NATURAL SUBSTRATE AND EROSION AND SCOUR PROTECTION IN THE CHANNEL.

1. SUBSTRATES COMPRISED PREDOMINANTLY OF GRAVEL (0.08-2.5 INCHES), COBBLE (2.5-10.1 INCHES) AND/OR BOULDER (10.1-80 INCHES), ALSO REFERRED TO IN THIS SPECIFICATION AS COARSE SUBSTRATE OR ALLUVIUM, THAT ARE REMOVED FROM THE STREAM DURING CHANNEL EXCAVATION WILL BE TEMPORARILY STOCKPILED IN A NON-WETLAND/AQUATIC SITE FOR POSSIBLE REPLACEMENT IN THE CHANNEL.
2. IMMEDIATELY FOLLOWING CHANNEL EXCAVATION, PERFORM AND RECORD THE RESULTS OF A PEBBLE COUNT (HARRELSON ET AL. 1994) IN THE EXCAVATED CHANNEL TO DETERMINE THE PERCENT COMPOSITION OF SILT/CLAY, SAND, GRAVEL, COBBLE, BOULDER, AND BEDROCK SIZE CLASSES.
3. IF THE IN-PLACE STREAM SUBSTRATE IS COMPRISED OF GREATER THAN 70% GRAVEL, COBBLE, AND/OR BOULDER, AND MEDIAN PARTICLE DIAMETER GREATER THAN 4.5 INCHES THE STREAM SUBSTRATE WILL BE DEEMED ACCEPTABLE AS IS AND SUBSTRATE REPLACEMENT WILL NOT BE PERFORMED.
4. IF THE IN-PLACE STREAM SUBSTRATE IS COMPRISED OF LESS THAN 70% GRAVEL, COBBLE, AND/OR BOULDER, OR THE MEDIAN PARTICLE DIAMETER IS LESS THAN 4.5 INCHES THE CHANNEL WILL BE OVER-EXCAVATED TO A DEPTH OF 12 TO 18 INCHES AND BACKFILLED WITH COARSE SUBSTRATE TO MEET THE >70% COARSE MATERIAL WITH MEDIAN DIAMETER GRATER THAN 4.5 INCHES, AS VERIFIED BY A PEBBLE COUNT.
5. COARSE ALLUVIUM EXCAVATED FROM THE CHANNEL AND TEMPORARILY STOCKPILED IS THE PREFERRED MATERIAL TO USE FOR SUBSTRATE REPLACEMENT.
6. IF THE QUANTITY OF EXCAVATED COARSE ALLUVIUM IS INSUFFICIENT OR CONTAINS TOO HIGH A PERCENTAGE OF FINES (SAND, SILT, AND CLAY), THEN THE FOLLOWING MIXTURE OF MATERIALS CAN BE USED AS SUBSTRATE:
   A. CLEAN, NON-ACID FORMING ROUNDED NATURAL ROCK AND STONE, SUCH AS RIVER GRAVEL, LIMESTONE OR SANDSTONE;
   B. USE AND MIX THE SPECIFIED QUANTITIES (% BY WEIGHT) OF THE FOLLOWING AASHTO SIZE CLASSES OF ROCK AND STONE:

| AASHTO # | GRADED ROCK SIZE (IN.) MIN. | $D_{50}$ | MAX. | QUANTITY (BY WEIGHT) |
|---|---|---|---|---|
| # 3 | 0.5 | 1.5 | 2.5 | 15% |
| # 1 | 0.75 | 2.5 | 4 | 25% |
| R-3 | 3 | 4.5 | 6 | 35% |
| R-4 | 4 | 8 | 12 | 25% |

PEBBLE COUNT REFERENCE: HARRELSON, CHERYL C; RAWLINS, C. L.; POTYONDY, JOHN P. 1994. STREAM CHANNEL REFERENCE SITES: AN ILLUSTRATED GUIDE TO FIELD TECHNIQUE. GEN. TECH. REP. RM-245. FORT COLLINS, CO: U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE, ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION. 61 P. HTTP://216.48.37.142/PUBS/20753.

7/47 **SUBSTRATE RESTORATION**
NOT TO SCALE

SUBMITTED FOR PERMITS
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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

*HAND SIGNATURE ON FILE


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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

IN-STREAM STRUCTURE DETAILS

DRAWING NO.: 47

P:\2019\196-626.0004\-CAD\Dwg\CD11\196-626E01-IN-STREAM PHOTODETAILS_1.dwg*47 IN-STREAM STRUCTURE DETAILS [2/13/2020 - cgmabing] - LP: 2/13/2020 9:46 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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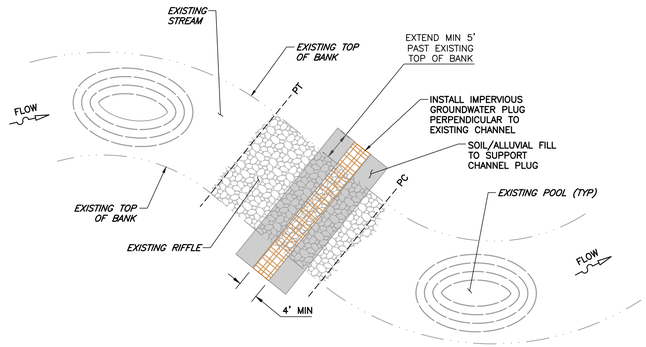
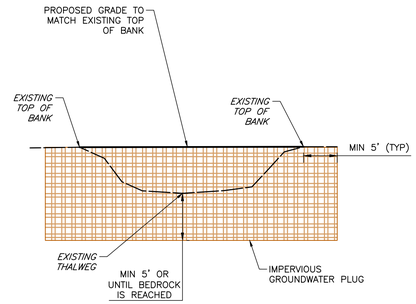
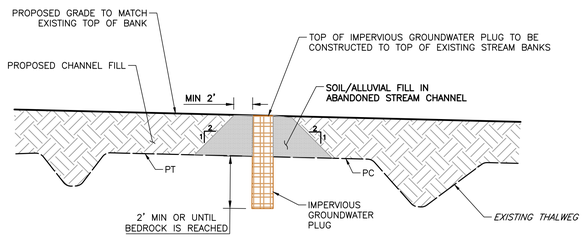



PLAN VIEW

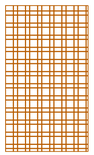



SECTION VIEW




PROFILE VIEW

PLAN SYMBOL



8/48 **IMPERVIOUS STREAM CHANNEL PLUG**
NOT TO SCALE

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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
No. 36848
MATTHEW D. GRAMZA

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# SOUTH CAROLINA DEPT. OF COMMERCE
# LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN
# CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

IN-STREAM STRUCTURE DETAILS

DRAWING NO.: 48

P:\2019\196-626.00041-CAD\Dwg\EC01\196-626EC01-IN-STREAM PHOTODETAILS_1.dwg[48 IN-STREAM STRUCTURE DETAILS] LS(1/31/2020 - cgmabing) - LP: 2/3/2020 9:46 AM

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
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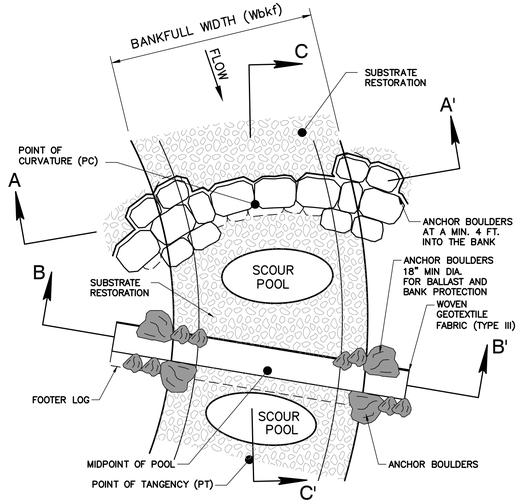
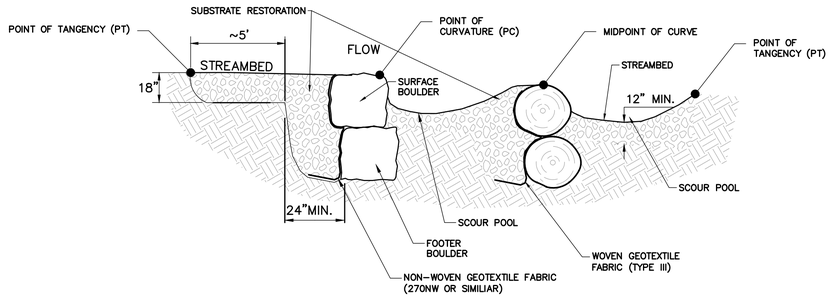
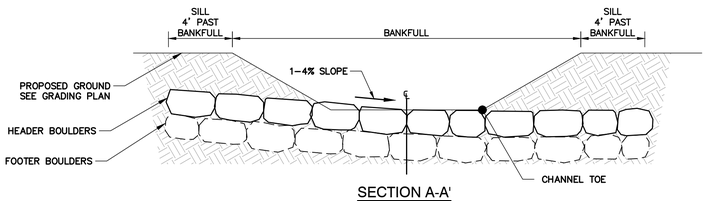
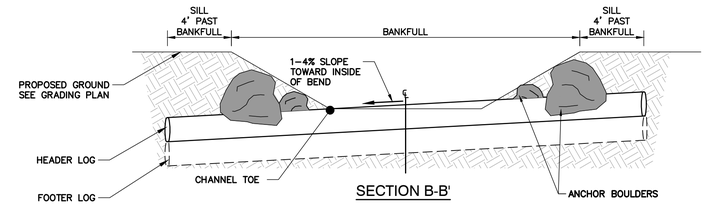



SECTION C-C'




SECTION A-A'

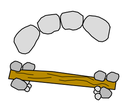



SECTION B-B'

NOTES:

1. THIS DETAIL CAN BE USED FOR CONSTRUCTING A DOUBLE DROP POOL WITH ONE BOULDER STEP AND ONE LOG STEP. DOUBLE DROP POOLS ARE MOST COMMONLY SPECIFIED FOR ROSGEN B STREAMS WITH 2% TO 4% CHANNEL SLOPE. THIS STRUCTURE DETAIL IS VALID ONLY FOR SMALL STREAMS ($W_{BKF}$<10'), LARGER STREAMS ($W_{BKF}$>10') HAVE SEPARATE DETAIL.
2. LOG OR BOULDER STEP CAN BE OMITTED AT DISCRETION OF CEC ENGINEER.
3. BOULDER STEPS SHALL BE CONSTRUCTED WITH 1 ROW OF FOOTER BOULDERS AND 1 ROW OF HEADER BOULDERS. LOG STEPS SHALL BE CONSTRUCTED WITH 1 FOOTER LOG AND 1 HEADER LOG.
4. PLACE HEADER BOULDERS/LOG 0.2' UPSTREAM ON TOP OF THE FOOTER BOULDERS/LOG.
5. PLACE 18" MIN. DIAMETER ANCHOR BOULDERS ON THE UPSTREAM AND DOWNSTREAM OF THE HEADER LOG ON THE LEFT AND RIGHT BANK SIDES. PLACE SELECT COARSE MATERIAL AROUND ANCHOR BOULDERS TO CHINK GAPS BETWEEN BOULDERS AND LOGS. BOULDERS SHALL BE PLACED TO BALLAST LOG STEP AND PREVENT MOVEMENT OF THE LOG STEP.
6. MAXIMUM DROP BETWEEN STEPS SHALL BE 6". MAXIMUM DROP BETWEEN LOG STEP AND PT SHALL BE 6".
7. NON-WOVEN GEOTEXTILE FABRIC (270NW OR SIMILAR) SHALL EXTEND FROM THE BOTTOM OF THE FOOTER BOULDERS TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
8. WOVEN GEOTEXTILE FABRIC (TYPE III) SHALL BE NAILED TO THE UPSTREAM SIDE OF THE LOG STEP 1/4 DIAMETER FROM THE TOP OF THE LOG. CENTER TO CENTER NAIL SPACING SHALL NOT EXCEED 12". THE WOVEN GEOTEXTILE FABRIC SHALL BE BURIED TO THE BOTTOM OF THE FOOTER LOG AND SHALL BE PLACED THE ENTIRE LENGTH OF THE LOG STEP.
9. STEPS SHALL ALIGN PERPENDICULAR TO THE CHANNEL BANKS AND POINT TOWARDS CENTER OF RADIUS OF STREAM CHANNEL CURVE.
10. PLACE BOULDER AND LOG STEPS AND BACKFILL WITH MATERIAL SPECIFIED IN SUBSTRATE RESTORATION DETAIL.
11. ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION OBSERVER.

PLAN SYMBOL



9/49 **DOUBLE DROP BOULDER LOG STEP POOL**
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# SOUTH CAROLINA DEPT. OF COMMERCE LANDSFORD TRACT PERMITTEE RESPONSIBLE MITIGATION PLAN CHESTER COUNTY, SC

| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

IN-STREAM STRUCTURE DETAILS

DRAWING NO.: 49

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36848 MATTHEW D. GRAMZA

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NOT FOR CONSTRUCTION

South Carolina 811 Call 811 Before You Dig

P:\2019\196-626.0004\-CADD\Dwg\EC011\196-626EC01-IN-STREAM PHOTODETAILS_1.dwg[49 IN-STREAM STRUCTURE DETAILS] LS(1/1/2020 - cgmalling) - LP: 2/3/2020 9:46 AM

# APPENDIX P

# SEDIMENT CAPACITY CALCULATIONS

**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT1** | | Stream Type: **E 4** | | |
| Location: | **UT1 Mini Regional Curve Reference Cross Section 1** | | Valley Type: | | |
| Observers: | **Robert Stewart** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **79.0** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **47.5** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.476** | $D_{max}$ | Largest particle from bar sample (ft) | **145** | **(mm)** | 304.8 mm/ft |
| **0.019** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **1.09** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s - \gamma/\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **1.66** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: | $\tau^* = 0.0834 (D_{50}/D_{50}^{\wedge})^{-0.872}$ | |
| **1.84** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: | $\tau^* = 0.0384 (D_{max}/D_{50})^{-0.887}$ | |
| **0.02241** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | **2** | |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.93** | **d** | Required bankfull mean depth (ft) | $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | (use $D_{max}$ in ft) | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.016** | **S** | Required bankfull water surface slope (ft/ft) | $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | (use $D_{max}$ in ft) | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **1.292** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **101.8** | CO **183.6** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **1.814** | CO **0.938** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **1.53** | CO **0.79** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope | $d = \frac{\tau}{\gamma S}$ | | |
| Shields **0.0267** | CO **0.0138** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) predicted shear stress, $\gamma$ = 62.4, d = existing depth | $S = \frac{\tau}{\gamma d}$ | $\tau$ = | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT1** | | Stream Type: **E 4** | | |
| Location: | **UT1 Mini Regional Curve Reference Cross Section 1** | | Valley Type: | | |
| Observers: | **Robert Stewart** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **79.0** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **47.5** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.476** | $D_{max}$ | Largest particle from bar sample (ft) | **145** | **(mm)** | 304.8 mm/ft |
| **0.019** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **1.31** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s - \gamma/\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **1.66** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: | $\tau^* = 0.0834 (D_{50}/D_{50}^{\wedge})^{-0.872}$ | |
| **1.84** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: | $\tau^* = 0.0384 (D_{max}/D_{50})^{-0.887}$ | |
| **0.02241** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | **2** | |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.93** | **d** | Required bankfull mean depth (ft) | $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | (use $D_{max}$ in ft) | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.013** | **S** | Required bankfull water surface slope (ft/ft) | $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | (use $D_{max}$ in ft) | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **1.553** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **123.4** | CO **210.2** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **1.814** | CO **0.938** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **1.53** | CO **0.79** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope | $d = \frac{\tau}{\gamma S}$ | | |
| Shields **0.0222** | CO **0.0115** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) predicted shear stress, $\gamma$ = 62.4, d = existing depth | $S = \frac{\tau}{\gamma d}$ | $\tau$ = | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT2** | | Stream Type: **G4c** | | |
| Location: | **UT2 Downstream Impaired Reach** | | Valley Type: | | |
| Observers: | **Nate Ober** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **4.7** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **1.0** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.174** | $D_{max}$ | Largest particle from bar sample (ft) | **53** | **(mm)** | 304.8 mm/ft |
| **0.008** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **1.29** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s$-$\gamma$/$\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **4.73** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 \left( D_{50}/D_{50}^{\wedge} \right)^{-0.872}$ | | |
| **11.21** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 \left( D_{max}/D_{50} \right)^{-0.887}$ | | |
| **0.02151** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | | **1** |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.77** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | | | (use $D_{max}$ in ft) |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.005** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | | | (use $D_{max}$ in ft) |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **0.644** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **49.29** | CO **110** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **0.69** | CO **0.239** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **1.38** | CO **0.48** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope $d = \frac{\tau}{\gamma S}$ | | | |
| Shields **0.0086** | CO **0.0030** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth $S = \frac{\tau}{\gamma d}$ | | | |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT2** | | Stream Type: **G4c** | | |
| Location: | **UT2 Middle Impared Reach** | | Valley Type: | | |
| Observers: | **Robert Stewart** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **59.0** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **22.5** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.653** | $D_{max}$ | Largest particle from bar sample (ft) | **199** | **(mm)** | 304.8 mm/ft |
| **0.016** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **0.96** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s$-$\gamma$/$\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **2.62** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 \left( D_{50}/D_{50}^{\wedge} \right)^{-0.872}$ | | |
| **3.37** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 \left( D_{max}/D_{50} \right)^{-0.887}$ | | |
| **0.01306** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | **2** | |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.88** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | | (use $D_{max}$ in ft) | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.015** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | | (use $D_{max}$ in ft) | |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |

| | | |
|---|---|---|
| **Sediment Competence Using Dimensional Shear Stress** | | |
| **0.958** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d )<br>$\gamma$ = 62.4, d = existing depth, S = existing slope |
| Shields **74.59** | CO **147.3** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** |
| Shields **2.458** | CO **1.442** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** |
| Shields **2.46** | CO **1.44** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $d = \frac{\tau}{\gamma S}$<br>$\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope |
| Shields **0.0410** | CO **0.0241** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $S = \frac{\tau}{\gamma d}$<br>$\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT2** | | Stream Type: **E4/5** | | |
| Location: | **UT2 Middle Reference Reach** | | Valley Type: | | |
| Observers: | **Nate Ober** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **6.2** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **1.0** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.148** | $D_{max}$ | Largest particle from bar sample (ft) | **45** | **(mm)** | 304.8 mm/ft |
| **0.004** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **1.07** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s$-$\gamma$/$\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **6.24** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 ( D_{50}/D_{50}^{\wedge})^{-0.872}$ | | |
| **7.21** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 (D_{max}/D_{50})^{-0.887}$ | | |
| **0.01690** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | **1** | |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **1.03** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | | (use $D_{max}$ in ft) | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.004** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | | (use $D_{max}$ in ft) | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **0.267** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **19.7** | CO **57.57** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **0.59** | CO **0.191** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **2.36** | CO **0.77** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $d = \frac{\tau}{\gamma S}$ $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope | | | |
| Shields **0.0088** | CO **0.0029** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $S = \frac{\tau}{\gamma d}$ $\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth | | | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT2** | | Stream Type: **G4/5c** | | |
| Location: | **UT2 Upstream Impared Reach** | | Valley Type: | | |
| Observers: | **Robert Stewart** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **12.9** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **5.9** | $\hat{D}_{50}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.105** | $D_{max}$ | Largest particle from bar sample (ft) | **32** | **(mm)** | 304.8 mm/ft |
| **0.019** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **0.93** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s$-$\gamma$/$\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **2.18** | $D_{50}/\hat{D}_{50}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 \left( D_{50}/\hat{D}_{50} \right)^{-0.872}$ | | |
| **2.49** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 \left( D_{max}/D_{50} \right)^{-0.887}$ | | |
| **0.01712** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | **2** | |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.16** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | | (use $D_{max}$ in ft) | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.003** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | | (use $D_{max}$ in ft) | |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **1.103** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **86.32** | CO **163.3** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **0.425** | CO **0.12** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **0.36** | CO **0.10** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope $d = \frac{\tau}{\gamma S}$ | | | |
| Shields **0.0073** | CO **0.0021** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth $S = \frac{\tau}{\gamma d}$ | | | |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT3** | | Stream Type: **G4** | | |
| Location: | **UT3 Downstream Impaired Reach** | | Valley Type: | | |
| Observers: | **Robert Stewart** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **86.3** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **54.7** | $\hat{D}_{50}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.814** | $D_{max}$ | Largest particle from bar sample (ft) | **248** | **(mm)** | 304.8 mm/ft |
| **0.023** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **0.79** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s$-$\gamma$/$\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **1.58** | $D_{50}/\hat{D}_{50}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 \left( D_{50}/\hat{D}_{50} \right)^{-0.872}$ | | |
| **2.87** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 \left( D_{max}/D_{50} \right)^{-0.887}$ | | |
| **0.01506** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | | **2** |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.86** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^*(\gamma_s - 1)D_{max}}{S}$ | | | (use $D_{max}$ in ft) |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.026** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^*(\gamma_s - 1)D_{max}}{d}$ | | | (use $D_{max}$ in ft) |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **1.157** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **90.76** | CO **169.2** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **3.036** | CO **1.945** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **2.07** | CO **1.33** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope $d = \frac{\tau}{\gamma S}$ | | | |
| Shields **0.0616** | CO **0.0395** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth $S = \frac{\tau}{\gamma d}$ | | | |
| **Check:** ☐ Stable ☐ Aggrading ☑ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT3** | | Stream Type: **E 4** | | |
| Location: | **UT3 Upstream Reference Reach Riffle 1** | | Valley Type: | | |
| Observers: | **NATE OBER** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **45.0** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **25.0** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.206** | $D_{max}$ | Largest particle from bar sample (ft) | **62.8** | **(mm)** | 304.8 mm/ft |
| **0.01179** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **1.03** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s$-$\gamma$/$\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **1.80** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 \left( D_{50}/D_{50}^{\wedge} \right)^{-0.872}$ | | |
| **1.40** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 \left( D_{max}/D_{50} \right)^{-0.887}$ | | |
| **0.02857** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | **2** | |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.82** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^* (\gamma_s - 1) D_{max}}{S}$ | | (use $D_{max}$ in ft) | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.00943** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^* (\gamma_s - 1) D_{max}}{d}$ | | (use $D_{max}$ in ft) | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **0.758** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **58.4** | CO **124** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **0.813** | CO **0.301** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **1.10** | CO **0.41** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $d = \frac{\tau}{\gamma S}$ $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope | | | |
| Shields **0.0126** | CO **0.0047** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $S = \frac{\tau}{\gamma d}$ $\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth | | | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |

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**Worksheet 3-14.** Sediment competence calculation form to assess bed stability.

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **UT3** | | Stream Type: **E 4** | | |
| Location: | **UT3 Upstream Reference Reach Riffle 2** | | Valley Type: | | |
| Observers: | **NATE OBER** | | Date: **01/12/2020** | | |
| **Enter Required Information for Existing Condition** | | | | | |
| **45.0** | $D_{50}$ | Median particle size of riffle bed material (mm) | | | |
| **25.0** | $D_{50}^{\wedge}$ | Median particle size of bar or sub-pavement sample (mm) | | | |
| **0.206** | $D_{max}$ | Largest particle from bar sample (ft) | **62.8** | **(mm)** | 304.8 mm/ft |
| **0.012** | $S$ | Existing bankfull water surface slope (ft/ft) | | | |
| **0.79** | $d$ | Existing bankfull mean depth (ft) | | | |
| **1.65** | $\gamma_s - \gamma/\gamma$ | Immersed specific gravity of sediment | | | |
| **Select the Appropriate Equation and Calculate Critical Dimensionless Shear Stress** | | | | | |
| **1.80** | $D_{50}/D_{50}^{\wedge}$ | Range: 3 – 7 | Use EQUATION 1: $\tau^* = 0.0834 \left( D_{50}/D_{50}^{\wedge} \right)^{-0.872}$ | | |
| **1.40** | $D_{max}/D_{50}$ | Range: 1.3 – 3.0 | Use EQUATION 2: $\tau^* = 0.0384 \left( D_{max}/D_{50} \right)^{-0.887}$ | | |
| **0.02857** | $\tau^*$ | Bankfull Dimensionless Shear Stress | EQUATION USED: | | **2** |
| **Calculate Bankfull Mean Depth Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.82** | **d** | Required bankfull mean depth (ft) $d = \frac{\tau^* (\gamma_s - 1) D_{max}}{S}$ (use $D_{max}$ in ft) | | | |
| **Calculate Bankfull Water Surface Slope Required for Entrainment of Largest Particle in Bar Sample** | | | | | |
| **0.012** | **S** | Required bankfull water surface slope (ft/ft) $S = \frac{\tau^* (\gamma_s - 1) D_{max}}{d}$ (use $D_{max}$ in ft) | | | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |
| **Sediment Competence Using Dimensional Shear Stress** | | | | | |
| **0.581** | | Bankfull shear stress $\tau = \gamma dS$ (lbs/ft$^2$) (substitute hydraulic radius, R, with mean depth, d ) $\gamma$ = 62.4, d = existing depth, S = existing slope | | | |
| Shields **44.29** | CO **102** | Predicted largest moveable particle size (mm) at bankfull shear stress $\tau$ **(Figure 3-11)** | | | |
| Shields **0.813** | CO **0.301** | Predicted shear stress required to initiate movement of measured $D_{max}$ (mm) **(Figure 3-11)** | | | |
| Shields **1.10** | CO **0.41** | Predicted mean depth required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, S = existing slope $d = \frac{\tau}{\gamma S}$ | | | |
| Shields **0.0165** | CO **0.0061** | Predicted slope required to initiate movement of measured $D_{max}$ (mm) $\tau$ = predicted shear stress, $\gamma$ = 62.4, d = existing depth $S = \frac{\tau}{\gamma d}$ | | | |
| **Check:** ☑ Stable ☐ Aggrading ☐ Degrading | | | | | |

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# APPENDIX Q

# VEGETATIVE QUADRAT DATA AND PHOTOGRAPHS

| | Vegetative Strata | Number | Common Name | *Scientific Name* | DBH (inches) |
|---|---|---|---|---|---|
| QUAD 2 (Preservation) | Tree >2" DBH | 1A | sweetgum | *Liquidambar styraciflua* | 13.9 |
| | | 1B | sweetgum | *Liquidambar styraciflua* | 6.3 |
| | | 2 | red maple | *Acer rubrum* | 6.5 |
| | | 3 | red maple | *Acer rubrum* | 6.0 |
| | | 4 | loblolly pine | *Pinus taeda* | 4.4 |
| | | 5 | red maple | *Acer rubrum* | 3.1 |
| | | 6 | sweetgum | *Liquidambar styraciflua* | 5.3 |
| | | 7A | sweetgum | *Liquidambar styraciflua* | 17.0 |
| | | 7B | sweetgum | *Liquidambar styraciflua* | 16.0 |
| | | 8 | flowering dogwood | *Cornus florida* | 3.8 |
| | | 9 | red maple | *Acer rubrum* | 3.4 |
| | | 10A | sweetgum | *Liquidambar styraciflua* | 12.6 |
| | | 10B | sweetgum | *Liquidambar styraciflua* | 17.6 |
| | | 10C | sweetgum | *Liquidambar styraciflua* | 9.0 |
| | | 10D | sweetgum | *Liquidambar styraciflua* | 16.4 |

| | Vegetative Strata | Number | Common Name | *Scientific Name* | DBH (inches) |
|---|---|---|---|---|---|
| QUAD 3 (Enhancement) | Tree >2" DBH | 1 | tulip poplar | *Liriodendron tulipifera* | 13.4 |
| | | 2 | sweetgum | *Liquidamber styraciflua* | 4.6 |
| | | 3A | tulip poplar | *Liriodendron tulipifera* | 18.3 |
| | | 3B | tulip poplar | *Liriodendron tulipifera* | 16.7 |
| | | 4A | black cherry | *Prunus serotina* | 3.8 |
| | | 4B | black cherry | *Prunus serotina* | 3.9 |
| | | 5 | sweetgum | *Liquidamber styraciflua* | 4.4 |
| | | 6 | sweetgum | *Liquidamber styraciflua* | 3.6 |
| | | 7 | sweetgum | *Liquidamber styraciflua* | 4.4 |
| | | 8 | loblolly pine | *Pinus taeda* | 12.9 |

| | Vegetative Strata | Number | Common Name | *Scientific Name* | DBH (inches) |
|---|---|---|---|---|---|
| QUAD 4 (Enhancement) | Tree >2" DBH | 1 | loblolly pine | *Pinus taeda* | 12.3 |
| | | 2 | loblolly pine | *Pinus taeda* | 10.5 |
| | | 3 | tulip poplar | *Liriodendron tulipifera* | 7.9 |
| | | 4 | oak species | *Quercus sp.* | 2.9 |
| | | 5 | winged elm | *Ulmus alata* | 6.1 |
| | | 6 | loblolly pine | *Pinus taeda* | 17.0 |
| | | 7 | oak species | *Quercus sp.* | 4.4 |
| | | 8 | loblolly pine | *Pinus taeda* | 12.6 |
| | | 9A | tulip poplar | *Liriodendron tulipifera* | 3.1 |
| | | 9B | tulip poplar | *Liriodendron tulipifera* | 2.9 |

| | Vegetative Strata | Number | Common Name | *Scientific Name* | DBH (inches) |
|---|---|---|---|---|---|
| QUAD 7 (Preservation) | Tree >2" DBH | 1 | boxelder | *Acer negundo* | 3.1 |
| | | 2 | boxelder | *Acer negundo* | 3.0 |
| | | 3 | boxelder | *Acer negundo* | 4.8 |
| | | 4 | tulip poplar | *Liriodendron tulipifera* | 16.3 |
| | | 5A | boxelder | *Acer negundo* | 3.1 |
| | | 5B | boxelder | *Acer negundo* | 4.1 |
| | | 6 | sweetgum | *Liquidamber styraciflua* | 5.9 |
| | | 7 | sweetgum | *Liquidamber styraciflua* | 3.3 |
| | | 8 | tulip poplar | *Liriodendron tulipifera* | 19.3 |
| | | 9 | sweetgum | *Liquidamber styraciflua* | 7.4 |
| | | 10 | tulip poplar | *Liriodendron tulipifera* | 19.1 |
| | | 11 | sweetgum | *Liquidamber styraciflua* | 2.9 |
| | | 12 | boxelder | *Acer negundo* | 2.3 |

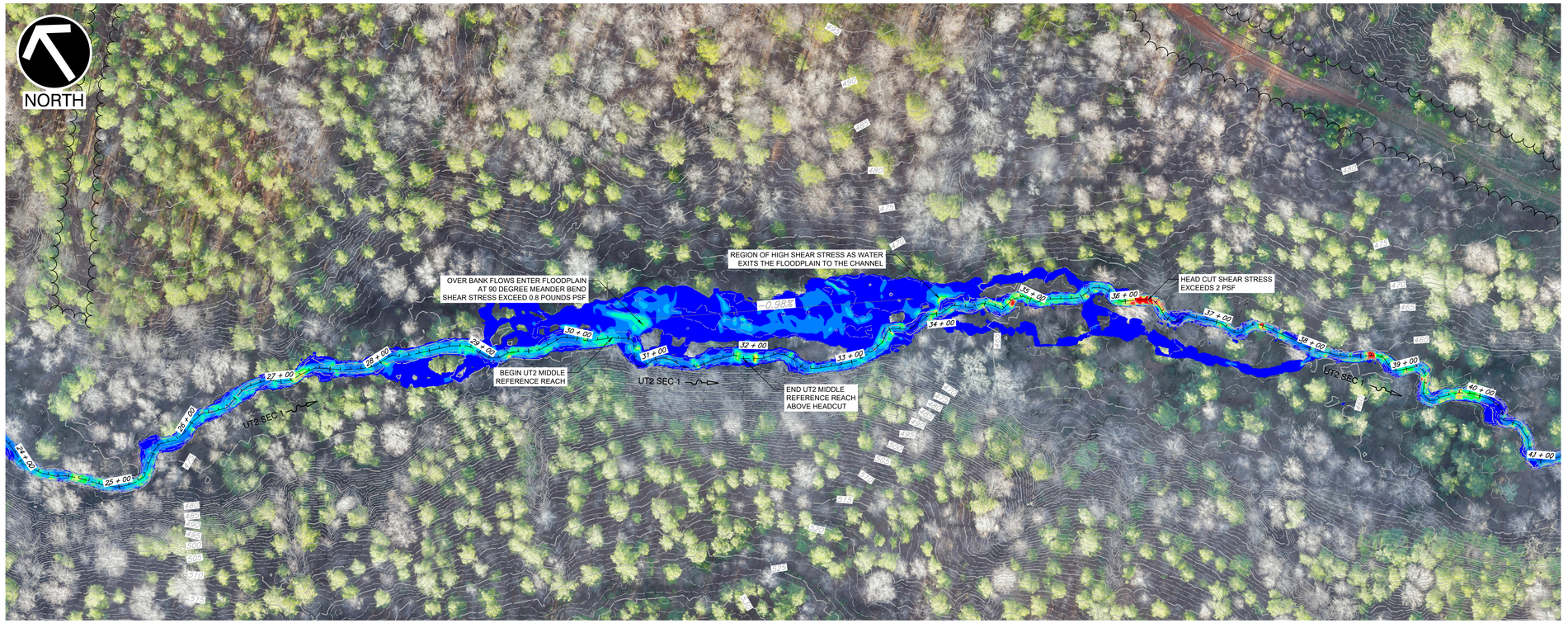
| | Vegetative Strata | Number | Common Name | *Scientific Name* | DBH (inches) |
|---|---|---|---|---|---|
| QUAD 8 (Enhancement) | Tree >2" DBH | 1 | loblolly pine | *Pinus taeda* | 13.4 |
| | | 2 | elm species | *Ulmus sp.* | 4.4 |
| | | 3 | white mulberry | *Morus alba* | 5.0 |
| | | 4 | loblolly pine | *Pinus taeda* | 17.5 |
| | | 5 | loblolly pine | *Pinus taeda* | 16.7 |
| | | 6 | loblolly pine | *Pinus taeda* | 16.2 |
| | | 7 | boxelder | *Acer negundo* | 5.3 |
| | | 8A | boxelder | *Acer negundo* | 2.6 |
| | | 8B | boxelder | *Acer negundo* | 2.6 |
| | | 9 | loblolly pine | *Pinus taeda* | 18.7 |

| | Vegetative Strata | Number | Common Name | *Scientific Name* | DBH (inches) |
|---|---|---|---|---|---|
| QUAD 9 (Enhancement) | Tree >2" DBH | 1A | sweetgum | *Liquidambar styraciflua* | 3.3 |
| | | 1B | sweetgum | *Liquidambar styraciflua* | 2.6 |
| | | 2 | sweetgum | *Liquidambar styraciflua* | 2.5 |
| | | 3 | loblolly pine | *Pinus taeda* | 15.8 |
| | | 4 | sweetgum | *Liquidambar styraciflua* | 3.8 |
| | | 5 | loblolly pine | *Pinus taeda* | 15.0 |
| | | 6 | loblolly pine | *Pinus taeda* | 14.4 |
| | | 7 | sweetgum | *Liquidambar styraciflua* | 2.5 |
| | | 8 | loblolly pine | *Pinus taeda* | 18.0 |
| | | 9 | sweetgum | *Liquidambar styraciflua* | 2.6 |
| | | 10 | sweetgum | *Liquidambar styraciflua* | 5.1 |
| | | 11 | loblolly pine | *Pinus taeda* | 13.6 |

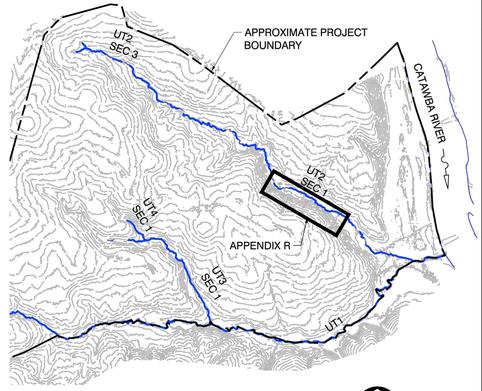
# APPENDIX R

# DETAILED HYDRAULIC MODEL

| SUBMITTAL & REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | 01/31/2020 | ISSUED FOR PERMITS |
| | | |
| | | |
| | | |



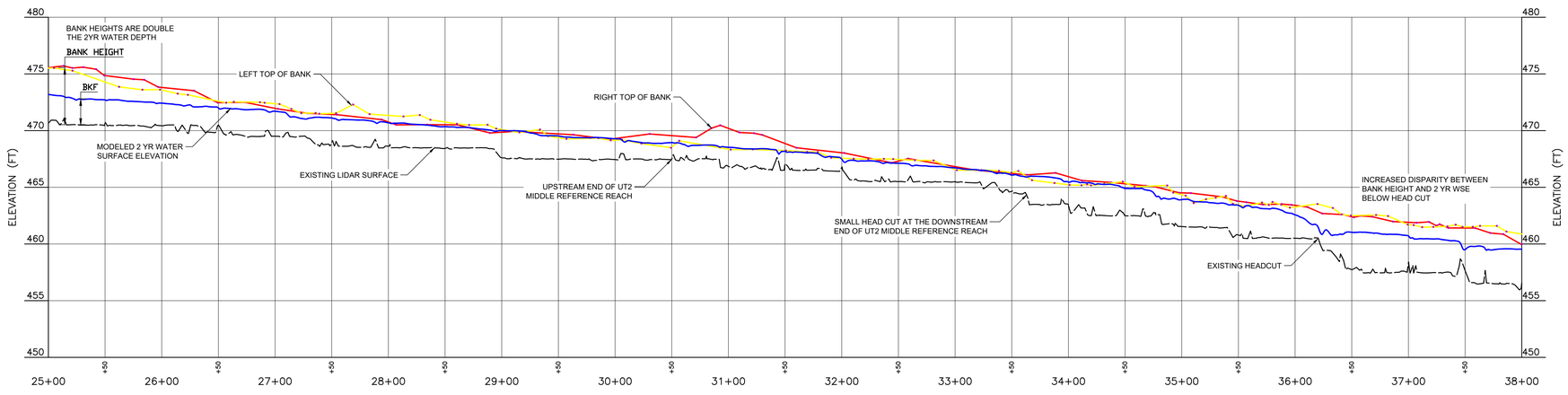

SCALE IN FEET
0 60 120




KEYMAP
SCALE IN FEET
0 1000 2000
NORTH

LEGEND
- 850 — EXISTING INDEX CONTOUR
- 849 — EXISTING INTERMEDIATE CONTOUR
- EXISTING TREE LINE
- EXISTING UNPAVED ROAD
- EXISTING STREAM CHANNEL
- EXISTING PROPERTY BOUNDARY
- DIRECTION OF SURFACE FLOW

SHEAR STRESS
- 0.0 – 0.2 PSF
- 0.2 – 0.4 PSF
- 0.4 – 0.6 PSF
- 0.6 – 0.8 PSF
- 0.8 – 1.0 PSF
- 1.0 – 1.2 PSF
- 1.2 – 1.4 PSF
- 1.4 – 1.6 PSF
- 1.6 – 1.8 PSF
- 1.8 – 2.0 PSF
- 2.0 – 99 PSF




HORIZONTAL
SCALE IN FEET
0 60 120

VERTICAL
SCALE IN FEET
0 6 12

## REFERENCE

1. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM A COMBINATION OF CONVENTIONAL SURVEY COLLECTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND AERIAL MAPPING PROVIDED BY CEC AERIAL MAPPING.
2. PROPERTY LINES BASED UPON DEED DESCRIPTION AND FIELD VERIFIED BOUNDARY EVIDENCE.
3. HORIZONTAL DATUM IS SC STATE PLANE NAD83 (2011).
4. VERTICAL DATUM IS NAVD88(GEOID12B).

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| DRAWN BY: | EGK/CJG | CHECKED BY: | NSO | APPROVED BY: | MDG |
|---|---|---|---|---|---|
| DATE: | JANUARY 2020 | DWG SCALE: | AS NOTED | PROJECT NO: | 196-626 |

APPENDIX R - DETAILED HYDRAULIC MODEL
UT2 SHEAR STRESS DURING 2YR FLOW

DRAWING NO.: R

P:\2019\196-626\~CADD\Dwg\EC01\196626EC01-EXISTING_UT2-SHR2D.dwg[08 UT2 SEC 1 EXISTING CONDITIONS] LS:2/3/2020 - rstewart - LP: 2/3/2020 10:00 AM