FINAL MITIGATION PLAN

January 2019

KEY MILL MITIGATION SITE

Surry County, NC
NCDEQ Contract No. 7180
DMS ID No. 100025

Yadkin River Basin
HUC 03040101

USACE Action ID No. SAW-2017-01504
RFP #: 16-006993

PREPARED FOR:

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

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

REPLY TO
ATTENTION OF:

CESAW-RG/Browning January 7, 2019

MEMORANDUM FOR RECORD

SUBJECT: Key Mill Mitigation Site - NCIRT Comments during 30-day Mitigation Plan Review

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

NCDMS Project Name: Key Mill Site, Surry County, NC

USACE AID#: SAW-2017-01504

NCDMS #: 100025

30-Day Comment Deadline: December 15, 2018

Mac Haupt, NCDWR:

1. Section 5.3- If WEI states that the new channel will raise groundwater and therefore provide a net increase in wetlands, WEI will need to install a couple of groundwater gauges to document this assertion. As always, DWR expects there to be an equivalent or increase in wetland function due to the proposed project.
2. DWR also would like to echo the comments made by DMS (page 27-28 from DMS letter) regarding the usage of log sills only for the steeper gradient tributaries.
3. Table 20- DWR recommends inspecting the crest gauges/stream gauges at least quarterly rather than semi-annually.
4. Design sheet 2.6- Is WEI filling in the wetland noted because of the construction of the new channel? Also, at sta 154+00 the new channel will represent a 5.5 foot cut approximately 30 feet away from the largest wetland. WEI may want to gauge the area of the wetland nearest to the channel construction to document that it will maintain wetland hydrology.
5. Design sheet 2.7- was this an existing crossing or an added crossing?
6. Design sheet 2.8- It appears that at sta 163+00 there is a 3 foot drop after the log sill. DWR is very concerned with the possible undercutting and probable failure of this structure, please advise how WEI will address this situation. Same comment for sta 165+60 on Design Sheet 2.9.
7. Design sheets 2.15 and 2.17- DWR notes the considerable grading that will be going on in these areas. Does WEI have plans for stockpiling top soil to alleviate the problem of vegetation growth in these areas?
8. A note on documenting wetland function both maintaining current level and/or increasing function. DWR recommends taking a close look at how the wetland function level can be maintained. While reviewing the project, DWR was investigating certain project areas where there may be opportunity for wetland restoration, enhancement, or creation. Unfortunately, many of the areas searched (lower UT1, lower UT3, lower UT2 and Reach 3 of Bull Creek) and would seem to be the best candidates for some uplift, have a lot of cut involved with the proposed construction path of the stream channel.

Kim Browning, USACE:

1. Section 8.1.1—If B channels are planned, please add a statement regarding the Entrenchment Ratio (ER) must be above 1.4 for all measured riffle cross-sections on a given reach. This should be reflected in Table 19, as well.
2. Even though there are no wetland credits being sought, and existing wetlands are fairly small, the restoration of reach 3 of Bull Creek appears to run through Wetland A. There will be permanent impacts to this wetland during construction, but it is anticipated that overall wetland function will improve from increased hydrology in this area. It's recommended that a veg plot be placed in this area.
3. Section 8.2—Vegetation Success Criteria: Please add a vigor statement for years five and seven, and update Table 19 accordingly.
4. It's noted that there are three sections of channel where the minimum 30-foot buffer is not met. These areas should be clearly marked on the plan view.
5. A stormwater BMP is mentioned in the narrative. Please provide a brief narrative of any maintenance required for the BMP, if any. Also, please label this area on the conceptual plan map.
6. Appendix 8, Maintenance Plan: If cattle are going to be present on site and have use of the crossings, maintenance of these crossings should be addressed.
7. Some concern about the lower end of UT2 where it flattens out. It appears a flow gauge is planned for this area to document flow.

Kim Browning
Mitigation Specialist
Regulatory Division

January 25, 2019

Mr. Matthew Reid
NCDENR - Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, North Carolina 28801

RE: **Response to Mitigation Plan Comments**
Key Mill Mitigation Site, Surry County
Yadkin River Basin: 03040101
DEQ Contract No. 7180
DMS ID No. 100025

Dear Mr. Reid,

We have reviewed the comments on the Draft Mitigation Plan for the above-referenced project dated January 7, 2019 and have revised the Mitigation Plan and construction plan set based on these comments. Wildlands is submitting the revised documents with this letter as an interim electronic deliverable for DMS review. Below are responses to each of your comments.

MITIGATION PLAN COMMENTS AND RESPONSES

Mac Haupt, NCDWR

1. Section 5.3 - If WEI states that the new channel will raise groundwater and therefore provide a net increase in wetlands, WEI will need to install a couple of groundwater gauges to document this assertion. As always, DWR expects there to be an equivalent or increase in wetland function due to the proposed project.

Section 5.3 was revised to clarify the overall hydrologic uplift expectation. This section states that there is a potential of a net gain of wetland function as construction of the new channel will likely result in increased groundwater elevations within the floodplain.

2. DWR also would like to echo the comments made by DMS (page 27-28 from DMS letter) regarding the usage of log sills only for the steeper gradient tributaries.

Construction plans were revised to incorporate boulder sills downstream of steep rifles (4% or greater slope) and in locations where the drop over the tail of riffle (the difference in elevation between the tail of riffle and next downstream head of riffle) exceeds half a foot. Boulders have been implemented along the intermittent reaches (i.e., UT2 and UT3A). Log grade control will be adequate where consistent base flow is present (i.e., perennial channels).

3. Table 20 - DWR recommends inspecting the crest gauges/stream gauges at least quarterly rather than semiannually.

Table 20 was updated to reflect a quarterly frequency for gauge inspection.

4. Design sheet 2.6 - Is WEI filling in the wetland noted because of the construction of the new channel? Also, at sta 154+00 the new channel will represent a 5.5 foot cut approximately 30 feet away from the largest wetland. WEI may want to gauge the area of the wetland nearest to the channel construction to document that it will maintain wetland hydrology.

This existing feature is an abandoned stream feature functioning as a wetland within the existing floodplain. Stream and floodplain grading is required to restore the degraded channel and to reconnect the channel with its historic floodplain. The restoration activities are expected to promote more frequent floodplain inundation and groundwater recharge in this area.

The proposed channel requires an approximate 5.5-foot cut based on the existing grade in the current floodplain. The proposed riffle elevation at station 155+00 is approximately three feet higher than the existing channel thalweg. The relocation of the channel and proposed grading is not anticipated to have an adverse effect on the existing wetland complex.

5. Design sheet 2.7 - was this an existing crossing or an added crossing?

The landowner currently crosses the stream via a ford at this location. The crossing will be improved and stabilized via the proposed crossing and culvert.

6. Design sheet 2.8 - it appears that at sta 163+00 there is a 3 foot drop after the log sill. DWR is very concerned with the possible undercutting and probable failure of this structure, please advise how WEI will address this situation. Same comment for sta 165+60 on Design Sheet 2.9.

Bull Creek is perennial stream that maintains baseflow year-round. The head of riffle creates a backwater over the designated pool feature. The drop over the tail of riffle to the expected water surface elevation is half a foot, calculated as the difference in the tail of riffle elevation and the next downstream head of riffle elevation. The pool is excavated allowing the plunging water to dissipate energy. This change in elevation between the tail and head of riffle maintains the pool, via the scouring effect of water.

7. Design sheet 2.15 and 2.17 - DWR notes the considerable grading that will be going on in these areas. Does WEI have plans for stockpiling top soil to alleviate the problem of vegetation growth in these areas?

The contractor is required to stockpile and re-use top soil at the direction of the engineer of record per the construction specifications.

8. A note on documenting wetland function both maintaining current level and/or increasing function. DWR recommends taking a close look at how the wetland function level can be maintained. While reviewing the project, DWR was investigating certain project areas where there may be opportunity for wetland restoration, enhancement, or creation. Unfortunately, many of the areas searched (lower UT1, lower UT3, lower UT2 and Reach 3 of Bull Creek) and would seem to be the best candidates for some uplift, have a lot of cut involved with the proposed construction path of the stream channel.

Stream restoration activities proposed at the site are intended to restore the degraded channels and to reconnect them with their historic floodplains. The proposed design at the site includes a combination of Priority I and II stream restoration activities, both of

which are expected to result in improvements to overall floodplain hydrology. Additionally, the restoration activities are expected to promote more frequent flood flows within the floodplains further promoting floodplain hydrology and groundwater recharge.

The project does not include a wetland mitigation component. The existing report generally speaks to the stream activities and the expected hydrological uplift. Revisions within the report specific to this general comment are listed below as they pertain to Section 5.3.

Kim Browning, USACE

1. Section 8.1.1 - If B channels are planned, please add a statement regarding the Entrenchment Ratio (ER) must be above 1.4 for all measured riffle cross-sections on a given reach. This should be reflected in Table 19, as well.

The following text has been added to Section 8.1.1: For restored B channel types the entrenchment ratio shall be above 1.4 for all measured riffle cross-sections. As illustrated below Table 19 was updated to reference ER metrics.

Goal	***Objective***	***Performance Standard***	***Monitoring Metric***
Improve stream channel stability.	*Restore stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.*	*Bank height ratios stay below 1.2. Visual assessments indicate progression towards stability. Entrenchment ratios should be >1.4 for restored B channels and ≥2.2 for C/E channels.*	*Cross-section monitoring and visual assessment.*

2. Even though there are no wetland credits being sought, and existing wetlands are fairly small, the restoration of reach 3 of Bull Creek appears to run through Wetland A. There will be permanent impacts to this wetland during construction, but it is anticipated that overall wetland function will improve from increased hydrology in this area. It's recommended that a veg plot be placed in this area.

A vegetation plot is proposed within proximity to this area. An additional photo point was added at this location for additional documentation. Figure 9 (Proposed Monitoring Plan) illustrates the location of the proposed monitoring features and existing wetlands at the Site.

3. Section 8.2 – Vegetation Success Criteria: please add a vigor statement for years five and seven, and update Table 19 accordingly.

The following text was incorporated into section 8.2 and Table 19:

Additionally, trees in each plot must average 7 feet in height by MY5 and 10 feet by MY7.

4. It's noted that there are three sections of channel where the minimum 30-foot buffer is not met. These areas should be clearly marked on the plan view.

A figure is enclosed that illustrates areas in which the proposed stream buffer is less than 30-feet wide. Based on the current design, less than 3.5% of the proposed stream mitigation length has a buffer less than required width. These areas are also shown on plan sheets 3.1 – 3.8.

5. A stormwater BMP is mentioned in the narrative. Please provide a brief narrative of any maintenance required for the BMP, if any. Also, please label this area on the conceptual plan map.

Maintenance activities associated with the BMP are detailed in Appendix 8, as illustrated below. The location of the proposed BMP is illustrated on Figure 6.

BMP	*Routine BMP maintenance may include removal of accumulated sediment from the bottom of the BMP. Stone and boulders may require adjustment to prevent scour. Wildlands will evaluate and determine whether sediment removal is necessary based on observations of the constructed sediment storage volume and volume remaining in subsequent monitoring years.*

6. Appendix 8, Maintenance Plan: If cattle are going to be present on site and have use of the crossings, maintenance of these crossings should be addressed.

Maintenance of the crossings is now detailed in Appendix 8, as illustrate below.

Stream Crossings	*Stream crossings shall be maintained to ensure stability and functionality when livestock are present. Routine maintenance and repair activities may include additional matting, gravel, and seeding for ford crossings. Maintenance and repair for culvert crossings used for livestock should be minimal but may require additional gravel and seeding to minimize runoff to the adjacent waterbody. Cattle exclusion fencing and gates where applicable shall be regularly inspected and maintained as needed.*

7. Some concern about the lower end of UT2 where it flattens out. It appears a flow gauge is planned for this area to document flow.

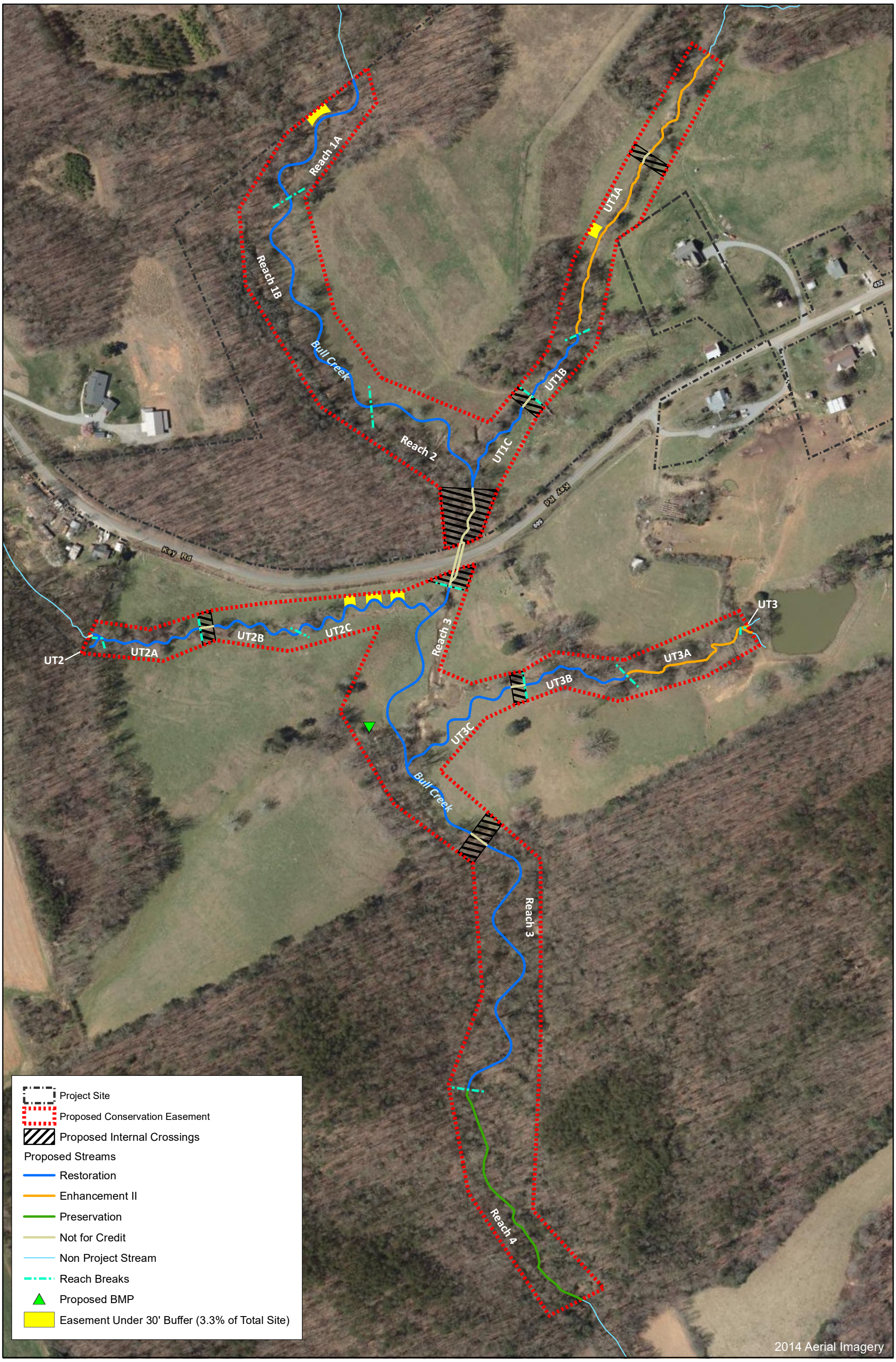
The designated stream/crest gage will be used to document bankfull events. This stream is a perennial, spring driven system, and baseflow is expected within the restored channel during years with normal precipitation. No changes were made to the document.

We sincerely appreciate the thorough review of the mitigation plan. The comments above have been incorporated into this revised electronic submittal. Please let me us know when the document is considered final.

Sincerely,

Aaron S. Earley

Aaron S. Earley, PE, CFM



WILDLANDS ENGINEERING

0 250 500 Feet

Easement Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC

DRAFT MITIGATION PLAN

KEY MILL MITIGATION SITE

Surry County, NC
NCDEQ Contract No. 7180
DMS ID No. 100025

Yadkin River Basin
HUC 03040101

USACE Action ID No. SAW 2017-01504

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203
Phone: (704) 332-7754

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

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

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

Contributing Staff:

Aaron Earley, PE, CFM, *Engineer of Record and Project Manager*
Shawn Wilkerson, *Principal in Charge*
Ian Eckardt, PWS, *Wetland Delineation*
Win Taylor, PWS, *Wetland Delineation and PCN*
Daniel Johnson, MBA, PE, PH *Quality Assurance*
Jeff Keaton, Independent Quality Check
Michael Clark, EI, Design & Construction Documents

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 Introduction

The Key Mill Mitigation Site (Site) is in Surry County approximately 7.2 miles south of the City of Mount Airy and approximately 29 miles northwest of the City of Winston-Salem, NC (Figure 1). The Site is within the NC Division of Mitigation Services (DMS) targeted watershed for the Yadkin River Basin Hydrologic Unit Code (HUC) 03040101110040 and the NC Division of Water Resources (DWR) Sub-basin 03-07-03 and will provide stream mitigation units (SMUs) in the Yadkin River Basin HUC 03040101 (Yadkin 01).

The Site is located on one parcel, bisected by Key Road. The Site is predominantly actively grazed pasture with the downstream extent of the Site forested. Bull Creek is the primary stream which flows southeast through the center of the Site. Five unnamed tributaries (UT1A-C, UT2, UT2A-C, UT3, and UT3A-C) join Bull Creek within the Site limits (Figure 2). Downstream of the Site, Bull Creek continues southeast to join the Ararat River near the Cedar Hill community.

Valleys throughout the Site have moderately steep walls with alluvial bottoms. Valleys narrow and become colluvial towards the upstream extents of UT2, UT2A, UT3, and UT3A. On January 6, 2017, Bull Creek, UT1A-C, UT2A-C, and the majority of UT3A-C were identified as perennial within the project limits. UT2, UT3, and the upstream extent of UT3A within the project limits were identified as intermittent.

This project will improve water quality and ecology through riparian buffer establishment, stream restoration, and exclusion of livestock and farm equipment from aquatic resources. These activities will result in a decrease in nutrient and sediment loads from the project site and improved aquatic and terrestrial habitat onsite. Additionally, this Site connects forested lands upstream and downstream, providing a continuous wooded corridor for wildlife. The Site includes a combination of stream restoration, enhancement level II, and preservation and is expected to generate 6,106 Cool stream mitigation units (SMUs). A stormwater Best Management Practice (BMP) will also be installed to treat concentrated pasture drainage downstream of Key Road, but no direct mitigation credits are proposed for this feature.

Table 1: Project Attribute Table Part 1 – *Key Mill Mitigation Site*

Project Information	
Project Name	Key Mill Mitigation Site
County	Surry
Project Area / Easement Area (acres)	20.81
Project Coordinates (latitude and longitude)	36° 23' 53.80"N | 80° 36' 14.20"W
Planted Acreage (acres of woody stems planted)	16.6

2.0 Watershed Approach and Site Selection

The Site was selected based on its potential to support the objectives and goals of multiple conservation and watershed planning documents, outlined below.

- The Bull Creek watershed is included in the 2009 Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP). The RBRP lists major stressors in the basin as naturally erodible soils, sediment and erosion from land-disturbing activities, and excessive stormwater flow off impervious surfaces. Additionally, the RBRP lists nonexistent or degraded riparian buffers along stream channels are a significant contributing factor to the habitat degradation and water quality impairment noted within the Yadkin River Headwaters.

- The RBRP outlined general goals of restoration of water quality and aquatic habitat on impaired streams in the watershed, and implementation of agricultural BMPs to limit sediment and nutrient input from active farming operations.
- The 2015 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP) notes that habitat loss, excessive sedimentation, and wastewater discharges from urban development and agricultural operations are widespread problems within the Yadkin Pee-Dee River basin. The WAP discusses the importance of habitat conservation and restoration to address current problems affecting species and habitats.

The project will directly and indirectly address stressors identified in the RBRP and the WAP by excluding livestock, stabilizing stream banks, restoring a forested riparian buffer, and preserving existing forested buffers. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to the Ararat River, as well as reconnect instream and terrestrial habitats on the Site. Restoration of the Site is directly in line with recommended management strategies outlined in the RBRP.

3.0 Baseline and Existing Conditions

The Site watershed (Figure 3) is in the southeastern portion of the Yadkin 01 in Surry County, North Carolina. The following sections describe the existing conditions of the Site, watershed, and watershed processes, including disturbance and response.

Table 2: Project Attribute Table Part 2 – *Key Mill Mitigation Site*

Project Watershed Summary Information					
Physiographic Province	Piedmont				
Ecoregion	Northern Inner Piedmont				
River Basin	Yadkin River				
USGS HUC (8 digit, 14 digit)	03040101, 03040101110040				
NCDWR Sub-basin	03-07-03				
Project Drainage Area (acres)	1,146 (Bull Creek – Reach 1A, 1B, &2); 1,293 (Bull Creek – Reach 3 & 4); 102 (UT1A-C); 32 (UT2A-C); 6 (UT2), 45 (UT3 & UT3A--C)				
Project Drainage Area Percentage of Impervious Area	1% (Bull Creek East)				
2011 NLCD Land Use Classification	Bull Creek	UT1A-C	UT2A-C	UT2	UT3/UT3A-C
Forest	58%	70%	32%	55%	22%
Cultivated	33%	21%	49%	45%	74%
Urban	9%	9%	19%	---	4%

3.1 Landscape Characteristics

3.1.1 Physiography and Topography

The Site is in the Smith River Allochthon of the Piedmont physiographic province. The Piedmont Province is characterized by rolling, well rounded hills and long low ridges, with elevations ranging from 300 to 1500 feet above sea level. The Site topography and relief are typical for the region, as illustrated in Figure 4. Bull Creek bisects the Site and several unnamed tributaries are included in the project area.

3.1.2 Geology and Soils

The Smith River Allochthon is composed of metamorphic rocks and bound by thrust faults. The North Carolina Geological Survey (NCGS) maps the underlying geology of the Site as Late Proterozoic-Cambrian

(500 to 900 million years in age) banded gneiss (CZbb). The unit is described as interlayered with calc-silicate rock, metaconglomerate, amphibolite, sillimanite-mica schist, and granitic rock (NCGS, 2016). Instances of exposed bedrock along project channels are mapped in the plan sheets.

The proposed project is mapped by the Web Soil Survey for Surry County (USDA-NRCS, 2018). Project area soils are described below in Table 3 and illustrated on Figure 5.

Table 3: Project Soil Types – *Key Mill Mitigation Site*

Soil Name	Description
Arkaqua loam, 0 to 2 percent slopes, frequently flooded	These soils are located on floodplains of foothill valleys with nearly level slopes of 0-2%. They are very deep soils and somewhat poorly drained. The profile consists of a loam surface layer and clay loam subsoil.
Colvard and Suches soils, 0 to 3 percent slopes, occasionally flooded	Composition is about 49% Colvard, 39% Suches, and 12% dissimilar inclusions. Colvard soils are very deep and well drained with a fine sandy loam surface layer and fine sandy loam underlying material. Suches soils are very deep and well drained with a loam surface layer and clay loam subsoil. These soils are located on floodplains of foothill valleys with nearly level slopes of 0-3%.
Fairview sandy clay loam, 15 to 25 percent slopes, moderately eroded	These soils are located on ridges and low hills in the Piedmont uplands. The profile consists of a sandy clay loam surface layer and clay to loam subsoil. They are very deep soils that are well drained with slopes of 15-25%.
Fairview-Scott Knob complex, 25 to 45 percent slopes	This series consists of about 60% Fairview, 28% Scott Knob, and 12% dissimilar inclusions. These soils are located on ridges and low hills on Piedmont uplands with 25-45% slopes. Fairview soils are very deep and well drained with a fine sandy loam surface layer and clay to loam subsoil. Scott Knob soils are moderately deep and well drained with fine sandy loam on the surface and sandy clay loam subsoil.

3.2 Land Use/Land Cover

Land use and land cover, both past and present, were investigated throughout the Site and the watershed using historical aerials from 1966-2016 (Appendix 1) and a watershed reconnaissance survey. Since 1966, aerial imagery suggests that the Site has primarily been used for agriculture. Lands upstream and downstream of the Site are predominantly forested though there are some areas of agricultural lands and small residential areas within the watershed, along Siloam road. The rural location of the project and small percentage of impervious areas (residential development and roads relative to forested and cultivated) suggest a stable watershed.

Key Road bisects Bull Creek within the project area. Between 1966 and 1976, Key Road was realigned. The new alignment shifted Key Road to the west, increasing the amount of agricultural land on the eastern side of Key Road. Row crops are visible on the 1993 aerial photo in the project area west of the road. Presently, most of the property is used for cattle grazing and hay production.

Within the project, the property owner's ancestors constructed a mill and dam upstream of Key Road. It has since been breached, though portions of the foundation and stone and timber structural features remain.

3.3 Existing Vegetation

Bull Creek Reach 1A, 1B, and 2 contain a diverse riparian forest on the right hillslope. Catawba rhododendron (*Rhododendron catawbiense*) is heavily present, along with a mature canopy of various stages of oak species, such as post oak (*Quercus stellate*), white oak (*Quercus alba*), and northern red oak (*Quercus rubra*). Other mature hardwoods include American beech (*Fagus grandifolia*), umbrella

magnolia (*Magnolia tripetala*), red maple (*Acer rubrum*), and tulip poplar (*Liriodendron tulipifera*). The understory consists of flowering dogwood (*Cornus flordia*), American witch hazel (*Hamamelis virginiana*), American hornbeam (*Carpinus caroliniana*), mountain laurel (*Kalmia latifolia*), and young sassafras (*Sassafras albidum*). The left floodplain of Bull Creek Reach 1B and 2 contains a pasture beyond the narrow riparian buffer that contains black locust (*Robinia pseudoacacia*), large sycamore (*Platanus occidentalis*), and Chinese privet (*Ligustrum sinense*). The herbaceous cover contains goldenrod (*Solidago sp*.), deer tongue grass (*Dichanthelium clandestinum*), multiflora rose (*Rosa multiflora*), sawtooth blackberry (*Rubus argutus*), various asters (*Symphyotrichum* spp.), Japanese honeysuckle (*Lonicera japonica),* yellow crownbeard (*Verbesina occidentalis*), and pasture fescue (*Festuca sp*.). Below the Bull Creek and UT1 confluence, tree of heaven (*Ailanthus altissima*) and Chinese privet exist.

The upstream portion of Bull Creek Reach 3 does not contain any canopy coverage but there is large mature Chinese privet on the right floodplain just below the culvert. This section of stream is primarily surrounded by pasture that contains fescue, multiflora rose, soft rush (*Juncus effussus*), dogfennel (*Eupatorium capillifolium*), smartweed (*Polygonum sp.*), jimson weed (*Datura stramonium*), and spiny amaranth (*Amaranthus spinosus*). Further up the left floodplain is a small Harlequin glory bower (*Clerodendrum trichotomum*) population. Species composition within the downstream extent of Reach 3 and Reach 4 is similar to the intact forest along Reach 1 and 2. The understory within the forested restoration Reach 3 is heavily inundated with Chinese privet and Japanese honeysuckle.

UT1A has limited canopy coverage consisting of tag alder (*Alnus serrulata*), the invasive Mimosa (*Albizia julibrissin*), the invasive Bradford pear (*Pyrus calleryana*), river birch (*Betula nigra*), and black walnut (*Juglans nigra*). Canopy within UT1B & C consists of tulip poplar and red maple with the understory dominated by mature Chinese privet.

While the UT2 reaches begin within an intact forested area, the majority of this reach is open pasture with limited canopy coverage from green ash (*Fraxinus pennsylvanica*) and red maple. The limited understory is dominated by Eastern red cedar (Juniperus virginiana) and Chinese privet. Herbaceous plants include soft rush, sedge (*Carex* sp.), and pasture fescue.

The upstream extent of the UT3 reaches contain a mature canopy of white oak, northern red oak, sourwood (Oxydendrum arboretum), tulip poplar, pignut hickory (*Carya glabra*), shortleaf pine (*Pinus echinate*) and red maple. The understory is sparse and open with occasional Eastern red cedar, flowering dogwood, and Chinese privet. Very few herbaceous species are present and primarily consist of sporadic yellow crownbeard and Japanese stilt grass (*Microstegium vimineum*). Reaches UT3B & C are primarily surrounded by open pasture.

3.4 Project Resources

Wildlands investigated on-site jurisdictional Waters of the United States (US) within the proposed project area. Potential jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and the subsequent Eastern Mountain and Piedmont Regional Supplement. Streams were classified using North Carolina Department of Water Resources (NCDWR) Classification Forms. Wetland determination forms representative of on-site jurisdictional areas as well as non-jurisdictional upland areas are included in Appendix 2.

The results of the on-site investigation include six jurisdictional stream channels [Bull Creek (Reach 1A, 1B, 2, 3, & 4), UT1A-C, UT2, UT2A-C, UT3, and UT3A-C] and six wetlands (A-F). The wetland delineation was confirmed on Site by USACE staff on July 25, 2018. These jurisdictional features are discussed below by their location within the Site and are illustrated in Figure 2. NCDWR stream identification forms are in

Appendix 3. Table 4 provides a summary of water resources within the project limits. Reach specific cross-sections and geomorphic summaries are provided in Appendix 4.

Bull Creek

Bull Creek includes five reaches (1A, 1B, 2, 3, and 4). Prior to entering the Site, Bull Creek flows through a mature forest and the stream appears to be transporting the sediment supplied (i.e., sediment deposition is not apparent immediately upstream of the project boundary). Incision and bank erosion and failure was observed as Bull Creek enters the Site and documented along a majority (greater than 50%) of the designated restoration reaches of Bull Creek. Sediment deposition in the form of mid-channel bars and shallow pools is apparent throughout the restoration reaches due to localized bank erosion within the project area. Active scour and undercutting jeopardize the stability of the trees present on the top of bank.

Incised and Eroding (Bull Creek Reach 1B)

Reach 1A enters the Site from the west as a perennial stream. The valley at the upstream extent is confined but gently sloping, 1.0%. Bull Creek Reach 1B begins several hundred feet below the upstream extent of the project where the valley becomes wider, the stream becomes confined along the right valley toe, and the left floodplain land use transitions to open, actively grazed pasture. In this area, there is an old barbed wire fence that previously prohibited cattle access to the stream. The fence has not been maintained allowing cattle full access to Bull Creek as evidenced by a path along the left top of bank with regular trails down to Bull Creek. Valley slopes increase going downstream with a slope of 2.7% along Bull Creek Reach 2. Bank height ratios range from 3.7 to 4.1 with width to depth ratios of 14.1 to 16.8, indicating severe incision. Bull Creek has cut down to the bedrock layer and bedrock seams are exposed along the stream bed at regular intervals within these upper reaches. Riffles are present along the bedrock seams and pools are shallow and created by backwater as opposed to scour. Bedrock exposure is also common along the right toe of slope due to the location of the creek along the right valley toe. Bank erosion along these reaches consistently alternates between the left and right bank. Bed material along this reach consists of gravel, cobble, small boulders, and fines from bank erosion. Riffle cross-sections (XS1 and XS3) from these reaches classify the stream as a Rosgen F3.

Just upstream of Key Road, the concrete footers and stacked stone remnants of an old mill dam remain along the creek banks as well as timbers in the creek. The dam was hand stacked by a Key family ancestor. To avoid impacting this historical structure and to not restrict future activities associated with this structure, no restoration activities will occur within this reach. However, this area will be fenced to exclude livestock from accessing the stream except during times in which cattle are moved between pastures. The stream flows under Key Road crossing through two 60-inch corrugated metal pipes.

Downstream of Key Road, Bull Creek Reach 3 flows through the center of an open pasture with active cattle access. The banks of this reach are extensively trampled by cattle. Bank erosion is persistent, and in many areas, the banks have slumped due to rotational failure. The valley is wider and gently sloping, <1.0%. Reach 3 bank heights are lower, but the stream remains somewhat incised with bank height ratios ranging from 1.9 to 2.8 and width to depth ratios of 8.5 to 22.5. The stream has historically moved around the floodplain, evidenced by two abandoned stream channels that are present in the left floodplain. Depositional features including mid-channel bars are present within this reach and the riffles

are short and pools are shallow, filled with fine deposits. The stream continues in this condition to a fence line which separates the pasture from the downstream wooded area. Bull Creek Reach 3 within the woods remains incised and bank erosion is prevalent along the left toe of slope due to the location of the creek along the left valley toe. Riffle cross-sections (XS4, XS5, XS7, and XS8) from this reach classify the stream as a Rosgen F3/G3c.

Bull Creek Reach 4 within the downstream extent of the Site begins as the stream meanders back to the central floodplain valley. Reach 4 is entirely forested with stable banks and appropriate geomorphology.

UT1


Incised Channel (UT1B)

UT1A originates as a perennial stream outside of the conservation easement. Upstream of the Site, above Loblolly Lane, the stream is in good condition with stable banks, excellent pattern and bedform, and abundant habitat. UT1A enters the Site under a fence separating forest from cattle pasture. This reach contains limited riparian buffers, areas of bank erosion, and a grass road is present in the left floodplain. An existing 24" reinforced concrete pipe culvert crossing is present approximately 100 LF downstream of the Site boundary. A sediment bar upstream of the culvert crossing suggests that the culvert is clogged and serves as a sediment transport barrier in its current condition. Additionally, the culvert is perched downstream of the crossing. The grass farm road crosses the culvert and parallels UT1A on the right floodplain through the field before turning upslope.

Downstream of UT1A, the stream becomes incised as it transitions to reach UT1B and UT1C. The valley slope along UT1B is 2.4% and increases to 3.7% as it transitions to UT1C. Bank height ratios range from 5.0 to 7.9 with width depth ratios of 7.3 to 8.1. The right floodplain is wide and flat, but the channel follows the left valley toe. The stream's location in the valley and the presence of an old spoil berm along the right bank indicate historic relocation of the channel. Cattle have full access to the channel and the banks are trampled and unstable. An additional damaged culvert crossing is located within this lower reach. Riffle cross-sections (XS14 and XS15) from these reaches classify the stream as a Rosgen G4c and G4.

UT2


Incised & Eroding Channel (UT2B)

The UT2 project reach includes four reaches (UT2, UT2A, UT2B, and UT2C). These systems originate within a wooded area immediately upstream from the property boundary. A sporadic, single line of mature trees are located along the top of banks which provides some shade to the stream, but many of these trees are in poor health. Except for the upper extent of UT2 and UT2A, cattle have full access to the entire length of these reaches as it flows through open pasture. The erosive effects of cattle access are evident.

UT2 originates within the wooded area at an old spring box. UT2 is intermittent from its origin to its

confluence with UT2A within the pasture. The valley along UT2 is confined and steeply sloping, 6.4%. UT2A begins at the property boundary and is a perennial system. As UT2A crosses into the pasture, the stream becomes incised and eroded. The valley is moderately confined with a slope of 2.9%. UT2B begins at a proposed stream culvert crossing location and has a valley slope similar to UT2A (3.1%). The valley widens as transitions downstream towards Bull Creek and the valley slope decreases to 1.9%. Riffle and pool morphology are limited and the bedform is impaired by fines generated from the bank erosion. Riffle cross-sections (XS12 and XS13) on reach UT2C classify the stream as a G5 stream type. Bank height ratios ranged from 1.4 to 1.9 with width to depth ratios ranging from 3.7 to 4.8.

UT3

UT3 stream reaches originate just downstream from a farm pond which is fenced to prevent cattle access. UT3 and UT3A comprise two separate channels which flow from the pond. UT3 and UT3A are intermittent before transitioning to perennial flow on reach UT3A. The upstream reaches (UT3, UT3A, and UT3B) have a valley that is more V-shaped and steeper slopes (3.6%), before transitioning to UT3C (1.6% valley slope) within the wide, flat floodplain of Bull Creek. The V-shaped valley along UT3 and UT3A is partially wooded before transitioning to pasture within the downstream extent. Cattle have access throughout the entire stream reach. UT3 and UT3A exhibit normal pattern with some development of benches despite areas of bank erosion and extensive impacts from cattle access. Within the V-shaped valley, UT3B is deeply incised with extensive bank erosions resulting from vertical unstable banks. Within Bull Creek's floodplain, UT3C is deeply incised. As UT3C approaches Bull Creek, the existing incised channel is adjacent to an abandoned channel meander bend. Riffle cross-section (XS14 and XS15) data collected on this reach indicates bank height ratios of 2.7 to 3.8 and a width to depth ratios of 5.4 to 7.8. These reaches most closely classify as a Rosgen G5c and G5 stream types.

Eroding Channel (UT3B)

Wetlands

There are six wetlands (A – F) located within the project area which are best classified as seeps and bottomland hardwood forest wetland types. The features exhibit saturated soils and soils with low chroma matrix. Vegetation within the majority of the wetlands is significantly impaired due to livestock grazing and mowing. Wetlands A and B are depressional areas which are abandoned stream channel areas adjacent to Bull Creek and UT3. Wetland C is a depressional area within the floodplain of Bull Creek. Wetlands D, E, and F are small seeps that originate from the hillslope along UT1. Wetland activities are not proposed for this project.

Table 4: Project Attribute Table Part 3 – *Key Mill Mitigation Site*

Reach Summary Information						
Parameter		**Bull Creek Reach 1A**	**Bull Creek Reach 1B**	**Bull Creek Reach 2**	**Bull Creek Reach 3**	**Bull Creek Reach 4**
Existing Length of Reach (LF)		435	876	403	2,291	683
Valley Confinement (confined,		Confined to Moderately Confined			Moderately Confined	
Existing Drainage Area (acres)		1,146			1,293	
Perennial, Intermittent, Ephemeral		P	P	P	P	P
NCDWR Water Quality Classification		C	C	C	C	C
Stream Classification[1]	**Existing[1]**	F3	F3	F3	F3/G3c	---
	Proposed	C3	C3	C3b	C3	---
Evolutionary Trend (Simon)[1]		IV/V	IV/V	IV/V	IV/V	VI
FEMA Classification		Outside SFHA				

Parameter		**UT1A**	**UT1B**	**UT1C**
Existing Length of Reach (LF)		866	188	332
Valley Confinement (confined,		Confined		
Existing Drainage Area (acres)		102		
Perennial, Intermittent, Ephemeral		P	P	P
NCDWR Water Quality Classification		C	C	C
Stream Classification[1]	**Existing[1]**	---	G4c	G4
	Proposed	---	B4	B4a
Evolutionary Trend (Simon)[1]		III/IV	III/IV	III/IV
FEMA Classification		Outside SFHA		

Parameter		**UT2**	**UT2A**	**UT2B**	**UT2C**
Existing Length of Reach (LF)		61	349	299	223
Valley Confinement (confined,		Confined		Moderately Confined	
Existing Drainage Area (acres)		6	32		
Perennial, Intermittent, Ephemeral		I	P	P	P
NCDWR Water Quality Classification		C	C	C	C
Stream Classification[1]	**Existing[1]**	G4	G5	G5c	G5
	Proposed	B4	B4	C4b	C4
Evolutionary Trend (Simon)[1]		III/IV	III/IV	III/IV	III/IV
FEMA Classification		Outside SFHA			

Parameter		**UT3**	**UT3A**	**UT3B**	**UT3C**
Existing Length of Reach (LF)		21	249	414	296
Valley Confinement (confined, moderately confined, unconfined)		Confined		Moderately Confined	
Existing Drainage Area (acres)		45			
Perennial, Intermittent, Ephemeral		I	I/P	P	P
NCDWR Water Quality Classification		C	C	C	C
Stream Classification[1]	**Existing[1]**	---	---	G5	G5c
	Proposed	---	---	B4	C4
Evolutionary Trend (Simon)[1]		III/IV	III/IV	III/IV	III/IV
FEMA Classification		Outside SFHA			

1. The Rosgen classification system (Rosgen, 1994) and Simon Channel Evolution Model (Simon, 1989) is for natural streams. These channels have been heavily manipulated by man and therefore may not fit the classification category or channel evolution as described by these models. Results of the classification and model are provided for illustrative purposes only.

Wetland Summary Information						
Parameter	**A**	**B**	**C**	**D**	**E**	**F**
Size of Wetland (acres)[1]	0.028	0.021	0.220	0.002	0.001	0.009
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Riverine					
Mapped Soil Series	Colvard & Suches			Arkaqua		
Drainage Class	Occasionally flooded / well drained			Frequently flooded / somewhat poorly drained		
Soil Hydric Status	No			Yes		
Source of Hydrology	Groundwater & stream baseflow			Groundwater		
Restoration or enhancement method (hydrologic, vegetative, etc.)	N/A					

1. Wetland areas are not proposed for restoration or enhancement credit.

4.0 Functional Uplift Potential

The potential for functional uplift is qualitatively described in this section using terminology from the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology. Neither the Stream Functions Pyramid nor the Quantification Tool are proposed to determine success of the Site.

4.1 Hydrology

As identified in Section 3.2, the watershed is stable and comprised predominately of cultivated lands (agriculture) and forested lands. The hydrology function is affected by land cover throughout the entire watershed and for this reason limited improvements to hydrology are expected and hydrology will not be monitored.

4.1.1 Hydraulics

All the reaches identified for restoration are hydraulically impaired and lack a consistent floodplain connection. Project streams continue to be affected by the historic channelization, confinement against the valley walls, and incision. Reconnecting the streams to the floodplain will reduce in-channel shear stress (for large flow events) and provide the in-stream relief needed to improve the hydraulic function of on-site streams. The water table is expected to rise to meet the restored elevation of baseflow in the stream channel, which may result in pocket wetland formation in the restored valley bottom. These effects of the project amount to significant uplift for the hydraulics function.

4.1.2 Channel Geomorphology

The impaired on-site streams are in in stage III through V of the Simon Channel Evolution Model due to historic impoundment (historic mill dam), channelization, incision, and on-going bank erosion. Numerous reaches are actively eroding and contributing sediment and stressing Bull Creek and downstream receiving waters (2009 Upper Yadkin Pee-dee River Basin Restoration Priorities). Bull Creek and its associated tributaries have isolated sections of well defined pool and riffle sequences and areas with bedform diversity. However, the bedform diversity is predominately poor due to cattle intrusion. Overall, the existing geomorphology function ranges from moderate in areas where bedform diversity has formed despite prior channelization, to very poor due to cattle intrusion.

There is a significant opportunity to improve the geomorphologic function on the Site. The incision and bank erosion will be directly addressed via restoration and enhancement activities. Large woody debris (LWD) will be incorporated into the system via instream structures and bank revetments. A riparian buffer will be planted with native vegetation promoting long-term geomorphic stability and function. Geomorphology is expected to improve significantly and will be monitored via topographic data collection and visual assessments.

4.1.3 Physicochemical

Upon execution of the project, the exclusion of cattle within the Site provides a great potential to improve the physicochemical functioning of the streams. A BMP will be installed at a point of concentrated agricultural input to reduce sediment, nutrient, and fecal coliform inputs from an adjacent farm field. A riparian buffer will be established within the conservation easement, reducing polluted runoff and erosion of nutrient-rich bank sediments and eventually providing stream shading resulting in reduced water temperatures. Water will flow over instream structures, providing reaeration. The stream will be reconnected to its floodplain and adjacent riparian wetlands to provide storage and treatment of overbank flows, and streambank erosion will be greatly reduced, eliminating a source of sediment and nutrients. Time and development of a mature canopy will be required to realize the extent of physicochemical functional lift. Further, no water quality sampling has been conducted at the Site. For these reasons, physicochemical improvements will not be explicitly monitored for success, although visual observations will be documented, and these observations are expected to show that the Site is trending towards improved function.

4.1.4 Biology

There are no available biological data for the Site; however, the habitat conditions vary from poor in areas that are actively incising to moderate in reaches that exhibit more stable bedforms. Wildlands identified barriers to aquatic organism passage (i.e., the culvert at the upstream extent of UT1) and biological factors (i.e., adjacent fields) that provide little habitat value for terrestrial species. As such, there is opportunity to improve the instream and riparian habitat along the project reaches. Instream structures with a variety of rock and woody materials, pools of varying depths, and woody bank revetments will be added throughout the project to increase instream habitat diversity, and a riparian buffer will be planted which will eventually shade the stream and improve terrestrial habitat. Despite these immediate improvements, the biological response may be slow. The ultimate level of improvement in biology may not occur until after the completion of the seven-year monitoring period. Due to the anticipated response lag, improvements in the biological community will not be specifically monitored but are expected.

4.2 Overall Functional Uplift Potential

Overall, the Site serves as an opportunity to provide functional lift to degraded resources, specifically through improving in-stream hydraulics that will be seen throughout the Site with the stream restoration, to the improvements in geomorphology that will come with restoring streams that are suited to the valley types throughout the Site. Physicochemical and biological improvements are a likely result of the project. However, there is no existing basis for classifying the existing condition of these functions and the likely improvements will occur gradually after construction. Specific performance criteria and monitoring activities are identified in subsequent sections of this plan.

4.3 Site Constraints to Functional Uplift

Site constraints that could affect the proposed functional uplift have been eliminated to the extent practicable. The proposed easement boundary will allow for the development of stable pattern (and channel dimension) to promote functioning stream channels. Due to the immediate upstream forested land use the physicochemical and biological functions within the project streams have a great potential

for improvement. However, functional lift within the Site is limited by the watershed conditions beyond the project limits and upstream water quality.

5.0 Regulatory Considerations

Table 5, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in subsequent sections.

Table 5: Project Attribute Table Part 4 – *Key Mill Mitigation Site*

Regulatory Considerations		
Parameters	**Applicable?**	**Supporting Docs?**
Endangered Species Act	Yes	Appendix 5
Historic Preservation Act	Yes	Appendix 5
Essential Fisheries Habitat	No	N/A
Coastal Zone Management Act	No	N/A
FEMA Floodplain Compliance	Yes	N/A[1]
Water of the United States - Section 404	Yes	PCN[2]
Water of the United States - Section 401	Yes	PCN[1]

1. This project is not located in a Special Flood Hazard Area.
2. The PJD Request was submitted to the USACE in May 2018. The PCN will be provided to the IRT with the Final Mitigation Plan.

5.1 Biological and Cultural Resources

The Categorical Exclusion for the Key Mill Mitigation Site was approved on September 22, 2017. This document included investigation into the presence of threatened and endangered species on Site protected under The Endangered Species Act of 1973, as well as any historical resources protected under The National Historic Preservation Act of 1966.

Wildlands requested review and comment from the US Fish and Wildlife Service (USFWS) and the NC Wildlife Resources Commission (NCWRC) on July 24, 2017, regarding the results of the site investigation and the project's potential impacts biological resources. NCWRC responded on August 11, 2017 and stated they "This project should not impact wild trout resources or other known significant aquatic resources." The USFWS has not responded at this time. Since no response was received from the USFWS within a 30-day time frame, a "no effect" determination is assumed correct and that no additional, relevant information is available for the Site. All correspondence and a list of Threatened and Endangered Species in Surry County is included in Appendix 5.

The conclusion for cultural resources per the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. Additional information and regulatory communications are included in the Categorical Exclusion document in Appendix 5.

5.2 FEMA Floodplain Compliance and Hydrologic Trespass

Bull Creek and the unnamed tributaries are within Zone X, an area of minimal flood hazard. The Flood Insurance Rate Map (FIRM) for this site has not been published by FEMA. An index map identifies the Site location on FIRM 3710592600J for Surry County (CID 370364, Panel 5926).

One of the design goals for this project is to connect Bull Creek with its historic floodplain through Priority 1 restoration. To accomplish this goal, a hydrologic trespass agreement was secured with the adjoining and upstream landowner. This agreement facilitates the construction of a ford crossing that

will raise the stream bed immediately upstream of the proposed Priority 1 restoration activities. This increase in the bed elevation of the stream will create a backwater condition for approximately 1,500 feet upstream of the common property boundary and will facilitate Priority 1 restoration within approximately 450 feet downstream of the boundary. The project is in an area of minimal flood hazard and the proposed activities are not anticipated to adversely impact insurable structures.

5.3 401/404

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

The proposed stream channel alignment avoids a majority of the existing on-site wetlands. Impacts to Wetland A, a low-quality wetland within an abandoned (channel) meander, will be permanent due to restoration of the degraded stream reach within this proximity. Other wetlands within this area will be flagged with safety fence during construction to prevent unintended impacts. This will be denoted in the final construction plans on the Erosion and Sediment Control plan and Detail plan sheets, as well as in the project specifications. While wetland uplift is not part of the success criteria, construction of the new channels has the potential to increase groundwater elevations within the floodplain.

Table 6 estimates the anticipated impacts to wetland areas on this project. The Pre-Construction Notification, including this data, will be submitted to the IRT with the Final Mitigation Plan.

Table 6: Estimated Impacts to Project Wetlands – *Key Mill Mitigation Site*

Jurisdictional Feature	Classification	Acreage	Permanent (P) or Temporary (T)	Type of Activity	Impact Area (acres)
Wetland A	Riparian Riverine	0.028	P	Channel fill	0.028
Wetland B		0.021	N/A	N/A	---
Wetland C		0.220	N/A	N/A	---
Wetland D		0.002	N/A	N/A	---
Wetland E		0.001	N/A	N/A	---
Wetland F		0.009	N/A	N/A	---

6.0 Mitigation Site Goals and Objectives

The project will improve stream functions as described in Section 4 through stream and buffer restoration. Project goals are desired project outcomes that can be verified through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 8 of this report. The project goals and related objectives are described in Table 7.

Table 7: Mitigation Goals and Objectives – *Key Mill Mitigation Site*

Goal	Objective	Expected Outcomes	Function Supported
Improve stream channel stability.	Restore stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.	Significantly reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary. Support all stream functions above hydrology.	Hydraulic, Geomorphology, Physicochemical, Biology
Stabilize eroding stream banks.	Reconstruct stream channels slated for restoration with stable dimensions. Add bank revetments and in-stream structures to reaches to protect restored/enhanced streams.	Reduce sediment inputs and contribute to protection of or improvement to Yadkin River headwaters.	Hydraulic, Geomorphology, Physicochemical, Biology
Exclude livestock from stream channels.	Install livestock fencing and watering systems as needed to exclude livestock from stream channels and riparian areas.	Reduction in pollutant inputs to streams including fecal coliform, nitrogen, and phosphorous.	Hydraulic, Geomorphology, Physicochemical, Biology
Reconnect channels with historic floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the floodplain.	Raise water table and hydrate riparian wetlands. Allow more frequent flood flows to disperse on the floodplain and create overbank floodplain and depression storage for overland flow retention. Decrease direct runoff, increase infiltration. Support all stream functions above hydrology.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians. Promote aquatic species migration and recolonization to increase in biodiversity over time. Add complexity including LWD to the streams.	Geomorphology, Biology
Reduce sediment and nutrient input from adjacent farm fields.	Restore the streams' riparian buffers. Construct a BMP to slow and treat runoff from farm fields before entering Site streams.	Reduce agricultural and sediment inputs to the project, which will reduce likelihood of accumulated fines and excessive algal blooms from nutrients.	Hydraulic, Geomorphology, Physicochemical, Biology
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplain. Provide riparian and wetland habitat. Add a source of LWD and organic material to stream. Support all stream functions.	Hydraulic, Geomorphology, Physicochemical, Biology
Permanently protect the Site from degradational impacts.	Record a conservation easement on the Site and install cattle exclusion fencing.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Hydraulic, Geomorphic, Physicochemical, Biology

7.0 Design Approach and Mitigation Work Plan

7.1 Design Approach Overview

The design approach for this Site (Figure 6) was developed to meet the goals and objectives described in Section 6 which were formulated based on the potential for uplift described in Section 4. The design is also intended to provide the expected outcomes in Section 6, though these are not tied to performance criteria. The project streams proposed for restoration on the Site will be reconnected with an active floodplain and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. Instream structures will be constructed in the channels to help maintain stable channel morphology and improve aquatic habitat. The entire project area will be protected in perpetuity by a conservation easement.

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration and relies on empirical data and prior experiences and observations. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis which uses a combination of empirical and analytical data as described within this report. Designs were then verified and/or modified based on sediment transport analysis. These design approaches have been used on many successful Piedmont and Mountain restoration projects and is appropriate for the goals and objectives for this Site.

7.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. Eight reference reaches were identified to support the design of streams on this Site (Figure 7). These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. Due to the variety of slopes, stream types, and location of the Site with respect to the Piedmont and Blueridge ecoregion boundary, the distribution of reference reaches is well sorted throughout North Carolina foothills, Western Piedmont and Blueridge. Geomorphic parameters for these reference reaches are summarized in Appendix 4. The references used for the specific streams are shown in Table 8. A brief description of each reference reach is included below.

7.2.1 UT to Catawba River R1

UT to Catawba River Reach 1 (R1) is a flat (0.5% slope) E5 channel with a drainage area of 1.6 square miles. This reach is located west of Statesville in the Catawba River Basin and piedmont ecoregion. It runs into the Catawba River just south of the Lookout Shoals Dam. The banks along this reference reach are heavily forested. This reach was identified to support the designated design discharge (i.e., discharge analysis) for Bull Creek Reach 1A and 1B due to its flat slope and comparable drainage area and stream type.

Table 8: Stream Reference Data: *Key Mill Mitigation Site*

Design Stream		Bull Creek				UT1B	UT1C	UT2	UT2A	UT2B	UT2C	UT3B	UT3C
Reach		1A	1B	2	3								
Reference Stream	Stream Type	C3	C3	C3b	C3	B4	B4a	B4	B4	C4b	C4	B4	C4
UT to Catawba R1	E5	X	X										
UT to Catawba R2	E3b/C3b			X									
UT to Sandy Run	E4										X		X
Box Creek	C4	X	X		X								
UT to Kelly Branch	B4/B4a					X	X		X				
UT to Gap Branch	B4/B4a							X					
UT to South Fork Catawba	B4c									X			
Timber Tributary	B4											X	

7.2.2 UT to Catawba River R2

UT to Catawba River R2 is a E3b/C3b channel with a drainage area of 1.6 square miles. This reach has a steeper slope (2.7%) as compared to Reach 1. This reach is much like Bull Creek Reach 2 when considering drainage area and slope.

7.2.3 UT to Sandy Run

UT to Sandy Run is a small, sinuous, headwater stream located in Cleveland County, just southwest of the Town of Boiling Springs. It has a drainage area of 0.15 square miles and is part of the Broad River Basin in the Piedmont ecoregion. The reference reach drains into another unnamed tributary of Sandy Run before flowing into Sandy Run, which eventually empties into the Broad River. The reference reach is situated within the Broad River Greenway property which is densely forested and is protected by a conservation easement. The channel classifies as an E4 channel. The channel bed, however, is vertically contained by long, stable, gravel/cobble riffle sequences that serve as grade control, and a lower elevation, nested bankfull channel has formed within the original incised channel. UT to Sandy Run was determined to be a reference reach for UT2C and UT3C because of its drainage area and slope.

7.2.4 Box Creek

The Box Creek reference reach site is part of the Broad River Basin located in Rutherford County and has a drainage area of 2.13 square miles. This reference reach is in the Blue Ridge ecoregion but near its border with the Piedmont ecoregion. The drainage area and slope were similar to the Site and thus were considered. It is located within the Box Creek Wilderness area on the western periphery of the property, about two miles northeast of the town of Union Mills. The entire watershed is forested, and the reference reach site is located approximately a quarter mile upstream from a large pond. The reach is characterized by short riffles, deep pools, and long shallow runs. This moderately sinuous reach (1.3) classifies as a C4 channel. This reach, banks were typically stable due to a large extent of woody vegetation lining each bank, especially along the outer bends of a few tight meanders. In-stream habitat structures included undercut banks, woody debris, and coarse substrate.

7.2.5 UT to Kelly Branch

The UT to Kelly Branch reference reach is a small, steep (6.5% channel slope), headwater channel located in the McDowell County. This reach is also in the Blue Ridge ecoregion and near its border to the Piedmont ecoregion and therefore considered. The drainage area and slope were very comparable to reaches found on the Site. It has a drainage area of 0.08 square miles. The reach classifies as a B4a step-pool channel, but pool depths are unreliable as a reference as they are filled with sediment from an upstream source. Bankfull channel dimensions of riffle features were consistent throughout the reach. The channel

sinuosity is high for a steep gradient system, but planform is stable and makes use of the valley bottom where possible. Several long gravel/cobble riffles were observed that cascaded into pools over root mass, woody debris or a boulder step at the tail of riffle.

7.2.6 UT to Gap Branch

UT to Gap Branch is located in the Box Creek Wilderness in Union Mills, NC. This reach is in the Blue Ridge ecoregion near the Piedmont ecoregion. We considered this reach because of its comparable slope and drainage area. This stream flows through a confined valley with an alluvial bottom. The overall channel slope is 6.8%. The Rosgen classification for this reach is unclear. This reach could be classified either as a slightly entrenched B4a or a slightly entrenched A4. Available habitats at UT to Gap Branch include boulder/cobble steps, pools, rock riffles, runs, root and undercut banks.

7.2.7 UT to South Fork Catawba

UT to South Fork Catawba River - Vile Preserve is a perennial stream located in the floodplain of the South Fork Catawba River. The stream flows through a broad, flat, wetland floodplain complex, which receives runoff from adjacent agricultural uplands. The stream is completely connected to the floodplain wetlands. The reach has a low slope with a sandy substrate and classifies as a Rosgen B4c stream type.

7.2.8 Timber Tributary

Timber Tributary is a B4 classified channel 45 miles west of Winston Salem, NC. It has a drainage area of approximately 0.05 square miles. The stream meanders through confined valley surrounded by mature trees. The channel has a moderate slope of 3.2%. This system supports varied habitats which included woody debris, rock riffles and meander pools. This reach has been chosen to be a reference reach because of its slope, drainage area and its proximity to the Site.

7.3 Design Channel Morphological Parameters

Reference reaches were a primary source of information to develop the pattern and profile design parameters for the streams. Ranges of pattern parameters were developed within the reference reach parameter ranges with some exceptions based on best professional judgement and knowledge from previous projects. For example, for meandering C designs, radius of curvature ratio is kept above 1.6 on all reaches and meander width ratio is kept above a 1.5. Meandering designs have pool widths at 1.2 to 1.5 times the width of riffles to provide adequate point bars and riffle pool transition zones. Wildlands has found these minimum ratios to support stable geometry. Designer experience was used for pool design as well. Pool depths were designed to be approximately 3 times the riffle mean depth to provide habitat variation. Cross-section parameters such as area, depth, and width were designed based on the design discharge and stable bank slopes. In some cases, the width to depth ratio was increased beyond reference parameters as dictated by prior project experience to provide stable bank slopes prior to the development of a fully vegetated streambank. Key morphological parameters for the Site are listed in Tables 9 - 14. Complete morphological tables for existing, reference, and proposed conditions are in Appendix 4.

Table 9: Summary of Morphological Parameters Bull Creek – *Key Mill Mitigation Site*

Parameter	Bull Creek Reach 1A			Bull Creek Reach 1B		
	Existing	Box Creek	Proposed	Existing	Box Creek	Proposed
Contributing Drainage Area (sq mi)	1.63	2.13	1.63	1.68	2.13	1.68
Channel/Reach Classification	F3	C4	C3	F3	C4	C3
Design Discharge Width (ft)	16.2-19.1	23.5	19.5	16.2-19.1	23.5	17.5
Design Discharge Depth (ft)	1.1	1.2	1.6	1.1	1.2	1.3
Design Discharge Area (ft^2)	18.7-21.6	28.9	30.2	18.7-21.6	28.9	23.2
Design Discharge Velocity (ft/s)	4.8-4.9	3.4	3.2	4.8-4.9	3.4	3.9
Design Discharge (cfs)	90.0	99	90.0	90.0	99	90.0
Channel Slope (ft/ft)	0.013	0.008	0.007	0.009	0.008	0.012
Sinuosity	1.2	1.3	1.3	1.2	1.3	1.2
Width/Depth Ratio	14.1-16.8	19.1	12.6	14.1-16.8	19.1	13.2
Bank Height Ratio	3.7-4.1	1.5	1.0	3.7-4.1	1.5	1.0
Entrenchment Ratio	1.3	3.3	2.2-4.6	1.3	3.3	>2.2

Table 10: Summary of Morphological Parameters Bull Creek – *Key Mill Mitigation Site*

Parameter	Bull Creek Reach 2			Bull Creek Reach 3		
	Existing	UT to Catawba R2	Proposed	Existing	Box Creek	Proposed
Contributing Drainage Area (sq mi)	1.79	1.60	1.79	2.02	2.13	2.02
Channel/Reach Classification	F3	E3b/C3b	C3b	F3/G3c	C4	C3
Design Discharge Width (ft)	16.2-19.1	12.3	16.0	18.0-25.4	23.5	21.0
Design Discharge Depth (ft)	1.1	1.1	1.2	1.1-2.1	1.2	1.5
Design Discharge Area (ft^2)	18.7-21.6	13.2	19.3	26.2-39.5	28.9	31.1
Design Discharge Velocity (ft/s)	4.8-4.9	6.1	5.2	4.2-4.3	3.4	3.9
Design Discharge (cfs)	99	80.0	99	116	99	116
Channel Slope (ft/ft)	0.016	0.027	0.024	0.019	0.008	0.008-0.011
Sinuosity	1.2	1.1	1.2	1.2	1.3	1.3
Width/Depth Ratio	14.1-16.2	11.5	13.3	8.5-22.5	19.1	14.2
Bank Height Ratio	3.7-4.1	0.77-1.26	1.0	1.9-2.8	1.5	1.0
Entrenchment Ratio	1.3	4.3	6.3-7.8	1.3-2.9	3.3	>2.2

Table 11: Summary of Morphological Parameters UT1B and UT1C – *Key Mill Mitigation Site*

Parameter	UT1B			UT1C		
	Existing	UT to Kelly Branch	Proposed	Existing	UT to Kelly Branch	Proposed UT1C
Contributing Drainage Area (sq mi)	0.16	0.08	0.16	0.16	0.08	0.16
Channel/Reach Classification	G4c	B4/B4a	B4	G4	B4/B4a	B4a
Design Discharge Width (ft)	5.6-7.0	7.9	8.5	5.6-7.0	7.9	8.3
Design Discharge Depth (ft)	0.7-1.0	0.7	0.6	0.7-1.0	0.7	0.6
Design Discharge Area (ft^2)	3.9-6.8	5.7	5.3	3.9-6.8	5.7	4.8
Design Discharge Velocity (ft/s)	3.5-5.0	5.9	3.8	3.5-5.0	5.9	4.1
Design Discharge (cfs)	19.0	23	19.0	19.0	23	19.0
Channel Slope (ft/ft)	0.014	0.03-0.06	0.032	0.044	0.03-0.06	0.043
Sinuosity	1.1	1.2	1.1	1.3	1.2	1.1
Width/Depth Ratio	7.3-8.1	10.9	13.8	7.3-8.1	10.9	14.5
Bank Height Ratio	5.0-7.9	2.5	1.0	5.0-7.9	2.5	1.0
Entrenchment Ratio	2.4-2.5	1.2	2.8-3.3	2.4-2.5	1.2	2.7-2.9

Table 12: Summary of Morphological Parameters UT2 and UT2A – *Key Mill Mitigation Site*

Parameter	UT2			UT2A		
	Existing	UT to Gap Branch	Proposed	Existing	UT to Kelly Branch	Proposed
Contributing Drainage Area (sq mi)	0.01	0.04	0.01	0.05	0.08	0.04
Channel/Reach Classification	G4	B4a	B4	G5*	B4/B4a	B4*
Design Discharge Width (ft)	5.3	6.2	3.5	5.3	7.9	6.0
Design Discharge Depth (ft)	1.1-1.4	0.6	0.2	1.1-1.4	0.7	0.5
Design Discharge Area (ft^2)	5.7-7.4	3.8	0.9	5.7-7.4	5.7	2.7
Design Discharge Velocity (ft/s)	1.9-2.2	5.0	3.0	1.9-2.2	5.9	2.7
Design Discharge (cfs)	3.0	18.7	3.0	7.0	23.0	7.0
Channel Slope (ft/ft)	0.047	0.068	0.058	0.022	0.03—0.06	0.023-0.039
Sinuosity	1.1	---	N**	1.1	1.2	1.1
Width/Depth Ratio	3.7-4.8	10.1	14.2	3.7-4.8	10.9	13.3
Bank Height Ratio	1.4-1.9	1.0	1.0	1.4-1.9	2.5	1.0
Entrenchment Ratio	16.0-21.2	---	1.4-2.2	16.0-21.2	1.2	2.8-5.7

**Existing channel substrate is primarily composed of sand due to excessive sedimentation associated with bank erosion. Post restoration sediment is expected to coarsen and result in a gravel bed stream type. Gravel is prevalent within the upstream forested reach.

**Reach is too short to calculate an accurate sinuosity.

Table 13: Summary of Morphological Parameters UT2B and UT2C – *Key Mill Mitigation Site*

Parameter	UT2B			UT2C		
	Existing	UT to South Fork Catawba	Proposed	Existing	UT to Sandy Run	Proposed
Contributing Drainage Area (sq mi)	0.05	0.23	0.05	0.05	0.15	0.05
Channel/Reach Classification	G5c*	B4c	C4b*	G5*	E4	C4*
Design Discharge Width (ft)	5.3	8.2-11.2	6.0	5.3	7.3-7.8	6.8
Design Discharge Depth (ft)	1.1-1.4	1-1.4	0.5	1.1-1.4	0.7-0.8	0.5
Design Discharge Area (ft^2)	5.7-7.4	10.7-11.1	2.6	5.7-7.4	5.7-6.2	3.2
Design Discharge Velocity (ft/s)	1.9-2.2	2.7	2.4	1.9-2.2	3.4	2.2
Design Discharge (cfs)	7.0	26.2-32.3	7.0	7.0	20	7.0
Channel Slope (ft/ft)	0.017	0.007	0.02	0.020	0.015	0.014
Sinuosity	1.2	1.3	1.2	1.1	1.6	1.3
Width/Depth Ratio	3.7-4.8	6.0-11.7	13.3	3.7-4.8	6.6-9.8	12.9
Bank Height Ratio	1.4-1.9	1.8-2.1	1.0	1.4-1.9	1.7-2.6	1.0
Entrenchment Ratio	16.0-21.2	1.5-1.9	5.0-7.5	16.0-21.2	1.6-2.1	5.1-6.6

*Existing channel substrate is primarily composed of sand due to excessive sedimentation associated with bank erosion. Post restoration sediment is expected to coarsen and result in a gravel bed stream type. Gravel is prevalent within the upstream forested reach.

Table 14: Summary of Morphological Parameters UT3B and UT3C – *Key Mill Mitigation Site*

Parameter	UT3B			UT3C		
	Existing	Timber Trib	Proposed	Existing	UT to Sandy Run	Proposed UT3C
Contributing Drainage Area (acres)	0.07	0.05	0.07	0.07	0.15	0.07
Channel/Reach Classification	G5*	B4	B4*	G5c*	E4	C4*
Design Discharge Width (ft)	3.9-5.7	8.9	7.0	3.9-5.7	7.3-7.8	7.5
Design Discharge Depth (ft)	0.7	0.5	0.5	0.7	0.7-0.8	0.6
Design Discharge Area (ft^2)	2.8-4.1	4.6	3.6	2.8-4.1	5.7-6.2	4.7
Design Discharge Velocity (ft/s)	4.0-4.2	3.7	3.3	4.0-4.2	3.4	2.4
Design Discharge (cfs)	12.0	17.0	12.0	12.0	20	12.0
Channel Slope (ft/ft)	0.023	N/A	0.030-0.036	0.017	0.015	0.012-0.015
Sinuosity	1.5	N/A	1.1	1.2	1.6	1.2
Width/Depth Ratio	5.4-7.8	17.0-17.5	13.7	5.4-7.8	6.6-9.8	12.0
Bank Height Ratio	2.7-3.8	1.0-2.4	1.0	2.7-3.8	1.7-2.6	1.0
Entrenchment Ratio	1.6-3.5	1.5	3.1-6.0	1.6-3.5	1.6-2.1	>2.2

*Existing channel substrate is primarily composed of sand due to excessive sedimentation associated with bank erosion. Post restoration sediment is expected to coarsen and result in a gravel bed stream type. Gravel is prevalent within the upstream EII reach.

7.4 Design Discharge Analysis

Wildlands implemented multiple methods (listed below) to develop a bankfull discharge estimate for each of the project restoration reaches.

- The NC Rural Piedmont regional curve (Harman et al., 1999),
- NC Piedmont/Mountain regional curve (Walker, unpublished),
- Regional flood frequency analysis,
- A site-specific reference reach curve,
- Analytical calculations based on existing bankfull indicators and Manning's equation, and
- Data from previous successful design projects.

The resulting values were compared, and Wildlands utilized best professional judgment to determine a specific design discharge for each restoration reach. The results are illustrated on Figure 8 to show the relationship of the data to the design discharge selections.

7.4.1 Regional Curve Data

Discharge was estimated using the published NC Rural Piedmont Curve (Rural Data on Figure 8) as well as the updated curve for rural Piedmont and Mountain streams, shown as the Alan Walker Curve on Figure 8.

7.4.2 Wildlands Regional USGS Flood Frequency Analysis

Wildlands developed a regional flood frequency analysis tool that tailored the USGS 2009 publication *Magnitude and Frequency of Rural Floods in the Southeastern United States through 2006* to the Piedmont of North Carolina. Of the 103 stations referenced in the publication, 23 were used in the development of the tool. To fill gaps in data, six additional stations were added by Wildlands to represent streams with drainage areas less than one square mile. The Hosking and Wallis homogeneity test was performed in R© to identify the most appropriate gages based on homogeneity (Hosking and Wallis, 1993). The gages used were:

- USGS 2077210 – Kilgore Creek Tributary near Leasburg, NC (DA = 0.25 mi^2)
- USGS 2068610 – Hog Rock Creek near Moores Springs, NC (DA = 0.31 mi^2)
- USGS 214399575 – Long Creek Tributary at headwater near Bessemer City, NC (DA = 0.16 mi^2)
- USGS 3463910 – Phipps Creek near Burnsville, NC (DA = 1.61 mi^2)
- USGS 2097010 – Robeson Creek near Pittsboro, NC (DA = 1.71 mi^2)
- USGS 2077310 – Storys Creek near Roxboro, NC (DA = 1.86 mi^2)

The data from these 29 gage stations were used to develop flood frequency curves for the 1-year, 1.2-year, 1.5-year, 1.8-year, and 2-year recurrence interval discharges. These relationships can be used to estimate discharge of those recurrence intervals for ungaged streams in the same hydrologic region and were solved for each project reach's discharge with the drainage area as the input. The discharge estimates are shown on Figure 8 as the USGS Rural Piedmont Calculator 1.2 yr predictions.

7.4.3 Site Specific Reference Reach Curve

Eight reference reaches were identified for this project. Each reference reach was surveyed to develop information for analyzing drainage area-discharge relationships as well as development of design parameters. Stable cross-sectional dimensions and channel slopes were used to compute a bankfull discharge with the Manning's equation for each reference reach. The resulting discharge values were plotted with drainage area on Figure 8 (Reference Reach Curve) and compared the other discharge estimation methods.

7.4.4 Maximum Discharge (Manning's Equation)

A riffle cross-section was surveyed on each major design reach on the Site. Manning's equation was used to calculate a maximum discharge associated with the top of banks at all cross sections. Stream slope was calculated from the surveyed channel slope, and roughness was estimated using guidelines from Chow (1959). This corresponding discharge was plotted on Figure 8 (Qmax – Existing Site Streams) and considered as an upper limit for potential bankfull discharge values throughout the Site.

7.4.5 Design Discharge Analysis Summary

One of the main design goals at Key Mill is to improve the stability of the stream channels throughout the Site. Channels were sized so that any discharge larger than the design discharge will access the floodplain. The design discharge was selected so that, during typical precipitation conditions, the design streams would flood with the desired frequency. The results of each method described above to estimate discharge and the final selected design discharges for each reach are shown in the Tables 15 and 16.

Table 15: Summary of Bull Creek Design Discharge Analysis – *Key Mill Mitigation Site*

		Bull Creek		
		Reach 1A[1]	**Reach 2**	**Reach 3**
DA (acres)		1,045	1,146	1,293
DA (sq. mi.)		1.63	1.79	2.02
NC Rural Piedmont Regional Curve (cfs)		127	136	148
Alan Walker Curve (cfs)		82	88	97
Regional Flood Frequency Analysis (cfs)	**1.2-year event**	111	119	130
	1.5-year event	157	168	183
Site Specific Reference Reach Curve		80	83	88
Max Q from Manning's Eq. from XS survey (cfs)		1484	N/A	922
Final Design Q (cfs)		90	99	116

1. Applicable to Bull Creek Reach 1A and 1B

Table 16: Summary of Tributary Design Discharge Analysis – *Key Mill Mitigation Site*

		UT1A[1]	**UT2A[2]**	**UT2**	**UT3A[3]**
DA (acres)		102	32	6	45
DA (sq. mi.)		0.16	0.05	0.01	0.07
NC Rural Piedmont Regional Curve (cfs)		23	10	2	14
Alan Walker Curve (cfs)		13	5	1	7
Regional Flood Frequency Analysis (cfs)	**1.2-year event**	20	9	3	11
	1.5-year event	29	13	4	16
Site Specific Reference Reach Curve		29	18	8	21
Max Q from Manning's Eq. from XS survey (cfs)		1159	62	N/A	102
Final Design Q (cfs)		19	3	7	12

1. Applicable to UT1A, UT1B, and UT1C
2. Applicable to UT2A, UT2B and UT2C
3. Applicable to UT3, UT3A, UT3B, and UT3C

7.5 Sediment Transport Analysis

A current and historical analysis of the streams and land use within and adjacent to the project, was conducted to facilitate the sediment transport analysis. The existing watershed conditions have been

relatively static in this rural area over an extended period with minor exceptions, and the potential for future land use changes was determined to be insignificant based on historical trends and the rural character of the surrounding area. Sediment contributions from the watershed are deemed to be constant and are not expected to vary significantly in the future. The forested conditions immediately upstream of the project on Bull Creek suggest that local factors predominately contribute sediment within the project corridor and that the sediment load contributed by the upstream watershed (beyond the project limits) is stable. Sediment deposition observed in the existing channels is attributed to local bank erosion within the project streams and input from adjacent pastures. Thus, the design approach will address the major sediment source (i.e., bank erosion) within the project area by protecting stream banks and increasing shear resistance via the construction of in-stream structures. The constructed streams will not be capacity limited; therefore, the focus of sediment transport analysis was to verify that the designed channels will be stable over time and provide the competence to pass the sediment delivered by the watershed.

7.5.1 Capacity Analysis

For watersheds with rapidly changing land uses and for streams with visual signs of high bedload supply, a detailed capacity analysis along with field data collection may be necessary for proper design. Based on the analysis described above, the project streams currently appear to be supply limited (e.g. have capacity to move a sediment load greater than the supplied load). There is no reason to believe that the watershed will be altered in the future to increase the sediment yield. Most of the restoration reaches have been designed to maintain or exceed the competency of the existing channels and grade control structures have been utilized to prevent future incision.

7.5.2 Competence Analysis

In natural streams, the shear stress in a channel increases corresponding to an increase in discharge until the point at which the stream is flowing full and gains access to the floodplain. The floodplain access disperses the flow and prevents further increases in shear stress within the channel. This relationship of shear stress, channel dimension, and discharge influences erosion potential within the channel and the channel's ability to entrain certain sizes of sediment (competence). To support the competence analysis, the calculated shear stresses for both existing and proposed conditions along restoration reaches were compared to determine if the proposed stream will be able to move the bed material within the channel and to support material sizing within the constructed riffles. The proposed channels were modeled using their design bankfull flow. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001). Channel slope and design dimensions were varied until the resulting design verified that the stream reach could move the bed load supplied to the stream. The competence analysis for each project reach is summarized in Tables 17 and 18.

The initial competence analysis was based on the size material naturally found in the stream to mimic potential bed load. The results were used to inform further design of the reach. Wood and rock structures, including various riffle types (i.e., chunky riffles, etc.), were located based on the shear stress results and integrated into the design as grade control. Also, the proposed D50 and D100 for the constructed riffles were sized to ensure a stable pavement layer while allowing for bed load material to be active within the system. Riffles will be supplemented with Class A stone where the predicted shear stress is equal to or less than the calculated bankfull shear stress. Class B stone will be utilized along Bull Creek Reach 2 and UT1C.

Table 17: Sediment Transport Competency Analysis Bull Creek – *Key Mill Mitigation Site*

	Bull Creek			
	Reach 1A	**Reach 1B**	**Reach 2**	**Reach 3**
Dbkf (ft)	1.6	1.3	1.2	1.5
Schan (ft/ft)	0.0069	0.0123	0.0242	0.0076-0.0114
Bankfull Shear Stress, t (lb/sq ft)	0.64	0.98	1.76	1.02
Existing Dmax Subpavement (mm)	49	76	76	45
Dcrit (ft)	1.49	1.27	0.65	0.83
Scrit (ft/ft)	0.0064	0.012	0.013	0.0063
Movable particle size (mm)	49	77	140	80
Predicted Shear Stress to move Dmax	0.64	0.98	0.98	0.59

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

Table 18: Sediment Transport Competency Analysis Tributaries – Key Mill Mitigation Site

	Tributaries							
	UT1B	**UT1C**	**UT2A**	**UT2B**	**UT2C**	**UT2**	**UT3B**	**UT3C**
Dbkf (ft)	0.6	0.6	0.5	0.5	0.5	0.2	0.5	0.6
Schan (ft/ft)	0.0168	0.0389	0.0368	0.0115	0.0135	0.0584	0.0230	0.0121-0.0192
Bankfull Shear Stress, t (lb/sq ft)	1.19	1.50	1.05	0.52	0.38	1.06	1.13	0.55
Existing Dmax Subpavement (mm)	74	74	28	28	28	28	50	50
Dcrit (ft)	0.48	0.36	0.15	0.3	0.44	0.09	0.29	0.72
Scrit (ft/ft)	0.0254	0.0254	0.012	0.012	0.012	0.03	0.0209	0.0174
Movable particle size (mm)	94	119	83	40	29	84	89	42
Predicted Shear Stress to move Dmax	0.95	0.95	0.38	0.38	0.38	0.38	0.65	0.65

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

The predicted largest movable particle is less than the existing maximum diameter of a subpavement particle for reach UT3C. Existing native subpavement material will be utilized to the extent practicable along this reach because the largest measured particle is not expected to be transported as bedload in the proposed stream. Note, the D50 of the pavement material is expected to coarsen over time with the reduction and elimination of bank erosion, promoting further stabilization of the riffle substrate.

7.6 Project Implementation

7.6.1 Bull Creek Reach 1A

One of the design goals for this project is to connect Bull Creek with its historic floodplain through Priority 1 restoration. To accomplish this goal, an agreement was secured with the adjoining and

upstream landowner to raise the stream bed at the headwaters of this project and facilitate hydraulic trespass. Previously introduced in Section 5.2, this design approach facilitates Priority 1 restoration within approximately 500 feet of the upstream property boundary. The channel will be constructed as a C3 channel with a flat slope (approximately 0.7%) to transition from Priority 2 to Priority 1 restoration. Brush toe has been incorporated to increase shear resistance along outside meanders and riffles consist of native and chunky material, per the details.

7.6.2 Bull Creek Reach 1B

Bull Creek Reach 1B carries Priority 1 restoration for approximately seven hundred feet. The slope along this reach steepens to approximately 1.2%, allowing a reduction in the physical characteristics (i.e., bankfull width and depth) of the cross-section while promoting more frequent inundation of the floodplain. The Priority 1 restoration approach allows for construction of a new C3 channel within the historic floodplain and outside of the existing channel. Log vanes and J-hooks are proposed along this reach to re-direct flow towards the center of the channel and reduce near bank shear stress. Brush toe and lunker logs have been incorporated to promote the beneficial re-use of woody debris in the proposed channel. Riffle types are more diverse along this reach (as compared to Reach 1A) to promote bed form diversity.

7.6.3 Bull Creek Reach 2

Restoration activities must tie into the existing Bull Creek to avoid disturbance to the historic mill and to allow the stream to pass beneath Key Road. A Priority 2 restoration approach and C3b channel type (~2.4% slope) are proposed for approximately four hundred feet (upstream of the mill) to facilitate this transition. Structures (i.e., brush mattress, boulder toe, J-hooks and log-rock cascade riffles, etc.) are proposed along this reach to dissipate shear stress along the bank and bed of the proposed channel.

7.6.4 Bull Creek Reach 3

Two existing corrugated metal pipes carry Bull Creek beneath Key Road. A cattle crossing (designated as an internal crossing) is required immediately downstream of these existing culverts and is followed by the upstream extent of Bull Creek Reach 3. Reach 3 carries a C3 channel type with an average channel slope of 0.95% approximately 1,700 feet. UT2 and UT3 confluence with this reach before a proposed internal crossing and dual arch pipe culverts. This crossing will conjoin with an existing access road on the right floodplain to facilitate on-going farming activities. Reach 3 continues past the culvert as a Priority 2 C3 channel type for approximately 850 linear feet prior to tying into the downstream preservation reach. J-hooks, log vanes, brush toe, and brush mattress have been incorporated within this reach to reduce bank erosion.

Along Reach 3, a step-pool BMP will be created in the right floodplain, approximately 500 feet downstream of Key Road. The step-pools will capture runoff from a gully with a drainage area of approximately 20 acres and will provide initial treatment before water enters the restored stream.

7.6.5 Bull Creek Reach 4

Bull Creek Reach 4 is identified for preservation and continues from the downstream extent of Reach 3 to the property boundary.

7.6.6 UT1

Unnamed Tributary 1 (UT1) confluences with Bull Creek west of Key Road. This reach will be enhanced along its upstream extent (UT1A) through fencing, cattle exclusion, isolated grading, and planting. A collapsed culvert will be removed, and bank and bed grading will be conducted to promote long-term stability. A new culvert will be installed approximately 250 feet downstream and will be accommodated via bank and bed grading. The grass road leading to the existing crossing will be re-established and lead to the new culvert. The replacement of the collapsed culvert, along with profile adjustments, is expected

to restore a more natural sediment transport regime along this reach. A cucumber magnolia tree is located on the right bank of UT1A approximately 100 feet downstream of the existing culvert. This tree will be preserved at the request of the landowner.

Downstream of the enhancement reach, approximately 200 feet of UT1B is designated for restoration via a Priority 2 approach. Priority 1 restoration is unachievable due to the narrow and steep valley and short valley length. The break between restoration and enhancement II was agreed upon during the IRT site visit in August 2017. This B4 channel type has an average slope of 3.2%. Log sills and woody riffles are utilized for grade control along this reach, and native and chunky riffles are proposed to promote bedform diversity. UT1B terminates at an internal crossing and is succeeded by UT1C.

UT1C begins at the downstream extent of an internal crossing and restores approximately 250 linear feet of channel as a B4a stream type. Priority 2 restoration is necessary to tie into the confluence with Bull Creek Reach 2. The designed floodplain for Bull Creek Reach 2 will result in a wider valley along UT1C, as compared to existing conditions. The wider valley will allow the B4a stream to be constructed almost entirely offline, within the left floodplain of the existing channel. This reach follows a similar approach to UT1B, it has an average channel slope of 4.3% and incorporates log sills for grade control and brush toe for bank stability.

7.6.7 UT2

UT2, begins on the adjacent property to the south along Key Road. It begins from a spring box and only collects a 0.01 square mile drainage area. After entering the Site under the existing fence, it conjoins with UT2A just after 42 feet. This reach is very steep with steep valley walls. It has a channel slope of 5.8%. The restoration here is Priority 2 before the confluence with UT2A. Log sills are used for grade control on this reach.

UT2A begins off property and conveys a 0.05 square mile drainage area onto the site. Beginning at the fence line, UT2A is approximately 315 feet and ends at an internal crossing. This reach will be restored as a B4 stream type using Priority 2 restoration. UT2A follows a steep constricted valley which limited its access to the floodplain in areas. Its average channel slope is 2.5%. Chunky riffles have been utilized here to dissipate channel velocity and log sills are frequently used to facilitate grade control. The valley walls begin to open up at its end near the internal crossing.

UT2B will be restored as a C4b channel for approximately 263 linear feet as Priority 2 restoration. It begins after an internal crossing and runs down the valley until being succeeded but UT2C. UT2B continues to be confined by steep valley walls until completely opening up to pasture near its end. The surrounding valley and change in slopes facilitate a transition to the C4 channel UT2C. UT2B's channel slope is 2%. Log sills and Brush toe are frequent for this reach.

UT2C will be restored as a C4 channel consisting of Priority 2 restoration, because of the elevation drop needed for the confluence to Bull Creek. UT2C is approximately 469 linear feet before the confluence with Bull Creek. This reach has a wide floodplain and has very few trees along its banks. This allowed an increase in sinuosity and larger meanders, emphasizing C4 channel type characteristics. On the left floodplain about 150 feet upstream of the bull creek confluence is an old utility pole. This will be removed to not interfere with construction and grading. Behind it, the fully functioning utility pole, will not be disturbed and is excluded from the conservation easement. UT2C has an average slope of 1.4%. Brush toe is commonly used here to stabilize the stream banks.

7.6.8 UT3

UT3 begins at one of the outlets of the existing farm pond and extends 19 feet before the confluence with UT3A. UT3 is an enhancement II reach.

UT3A is an enhancement II reach, beginning from the other outlet of the existing farm pond. Cattle currently have access to the channel and bank erosion is common due to hoof shear. Areas of bank grading and profile manipulation are proposed to in this area to enhance the functionality of this stream. The enhancement reach spans approximately 400 linear feet before its transition to UT3B, restoration.

UT3B is Priority 2 restoration for approximately 300 linear feet. Confined by a narrow steep valley and constrained by existing grades, the proposed stream runs down the center of the valley. The average channel slope is 3.2%. This reach has tall mature trees on both of banks which will be avoided to the extent possible. Log sills were frequently incorporated into the design to maintain grade control and to facilitate flatter riffle slopes. Brush toe was also incorporated to protect the stream's banks. UT3B is a B4 channel and ends at an internal crossing before transition to UT3C.

UT3C begins after an internal crossing and runs for approximately 400 feet until the confluence with Bull Creek. The majority of this reach is Priority 1 restoration with the last 150 feet Priority 2 before the confluence. The valley for this reach transitions from constricted to open and pastureland is on both floodplains with a designed channel slope of 1.3%. Brush toe and log sills are incorporated regularly on this reach to maintain the stream's structural integrity. The low slope in this area supports the design of UT3C as a C4 channel type.

7.7 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a thriving riparian buffer composed of native tree species. This restored buffer will improve riparian habitat, help the restored streams stay stable, shade the streams, and provide a source for LWD and organic material to the streams. Non-forested areas as well as areas with limited, existing tree densities within the conservation easement will be planted, as illustrated in the plans. Riparian buffers will be seeded and planted with native vegetation chosen to develop the species diversity of a Piedmont Bottomland Forest community (Schafale, 2012). The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the Site, and best professional judgement on species establishment and anticipated Site conditions in the early years following project implementation. Species chosen for the planting plan are listed in the enclosed plans.

The riparian buffer will be planted with bare root seedlings. In addition, the stream banks will be planted with live stakes and the channel toe will be planted with multiple herbaceous species. Permanent herbaceous seed will be applied to streambanks, floodplain areas, and disturbed areas within the project easement.

Invasive species within the riparian buffers of restoration reaches will be treated at the time of construction. The extent of invasive species coverage will be monitored, mapped, and controlled as necessary throughout the required monitoring period. Refer to Appendix 6 for the invasive species plan. Additional monitoring and maintenance issues regarding vegetation are in Sections 8 and 9.

7.8 Project Risk and Uncertainties

The land use surrounding the project is currently being utilized as an active cattle farm. Following construction, livestock will be precluded from accessing the restored stream and buffer. Due to the rural nature of the area, the potential for the urban development is low, and the remaining watersheds are zoned to remain rural.

8.0 Performance Standards

The stream and vegetation performance standards for the project have been developed based on guidance presented in the DMS Mitigation Plan Template (DMS, August 2016) and the Stream and Wetland Mitigation Guidance (USACE, 2016). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance criteria will be evaluated throughout the seven-year post-construction monitoring period. An outline of the performance criteria components follows.

8.1 Streams

8.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored C and E channel types to be considered stable. For restored B channel types, the entrenchment ratio shall be above 1.4 for all measured riffle cross-sections. All riffle cross-sections should fall within the parameters defined for the designated stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Remedial action would not be taken if channel changes indicate a movement toward stability.

8.1.2 Pattern and Profile

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

8.1.3 Substrate

Channel substrate materials will be sampled with the pebble count method along restoration reaches. These reaches should show maintenance of coarser materials in the riffle features and smaller particles in the pool features. Riffles may fine over the course of monitoring due to the stabilization of contributing watershed sediment sources.

8.1.4 Photo Documentation

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

8.1.5 Hydrology

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented on the restoration reaches within the seven-year monitoring period. The four bankfull events must occur in separate years. In addition, the low flow channel (UT2) will have a stream gage pressure transducer installed mid-reach to document 30 consecutive days of baseflow.

8.2 Vegetation

The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period (MY7). The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of monitoring year MY3) and at least 260 stems per acre at the end of monitoring year 5 (MY5). Additionally, trees in each plot must average 7 feet in height by MY5 and 10 feet by MY7. The extent of

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

8.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

9.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met and project goals and objectives are achieved. Annual monitoring data will be reported using the DMS Annual Monitoring Reporting Template (DMS, 2015). The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes, and assist in close-out decision making.

Using the DMS As-Built Baseline Monitoring Report Template (DMS, 2014), a baseline monitoring document and as-built record drawings of the project will be developed within 60 days of the planting completion and monitoring installation at the Site. Monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS by November 30. These reports will be based on the DMS Annual Monitoring Template, Closeout Template Guidance, and Closeout Report Template (DMS, 2015). Standard DMS monitoring reports will be submitted in monitoring years 1, 2, 3, 5, and 7. Monitoring activities in years 4 and 6 will documented in a memorandum to include a project summary update, annual photos, and updated monitoring plan map. Closeout will occur seven years beyond completion of construction or once performance standards are met.

Table 18, below, describes how the monitoring plan is set up to verify that project goals and objectives have been achieved.

9.1 Monitoring Components

Project monitoring components are listed in more detail in Tables 19 - 21. Approximate locations of the proposed stream and vegetation monitoring components are illustrated in Figure 9.

Table 19: Monitoring Plan – *Key Mill Mitigation Site*

Goal	Objective	Performance Standard	Monitoring Metric
Improve stream channel stability.	Restore stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.	Bank height ratios stay below 1.2. Visual assessments indicate progression towards stability. Entrenchment ratios should be >1.4 for restored B channels and ≥2.2 for C/E channels.	Cross-section monitoring and visual assessment.
Stabilize eroding stream banks.	Reconstruct stream channels slated for restoration with stable dimensions. Create stable tie-ins for. Add bank revetments and in-stream structures to reaches to protect restored/enhanced streams.	Cross-sections should be stable and show little change in bankfull area, and width-to-depth ratio.	Cross-section monitoring and visual assessment.
Exclude livestock from stream channels.	Install livestock fencing and watering systems as needed to exclude livestock from stream channels and riparian areas.	Exclusion fencing to be maintained if livestock are present. Livestock are not within the conservation easement area.	Visual assessment of fencing and signs of livestock encroachment.
Reconnect channels with historic floodplains.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the floodplain.	There is no required performance standard for this metric.	Visual assessment
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	There is no required performance standard for this metric.	Visual assessment
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Survival of 210 planted stems per acre at MY7. Interim survival of at least 320 planted stems at MY3 and at least 260 planted stems per acre at MY5. Additionally, trees in each plot must average 7 feet in height by MY5 and t10 feet by MY7.	Permanent and mobile 100 square meter vegetation plots within planted areas.
Permanently protect the Site from degradational impacts.	Establish a conservation easement on the Site and install cattle exclusion fencing.	Record and close conservation easement prior to implementation.	Visual assessment

Table 20: Monitoring Components Restoration Reaches – *Key Mill Mitigation Site*

Parameter	Monitoring Feature	Quantity/Length by Reach						Frequency	Notes
		Bull Creek Reach 1A	Bull Creek Reach 1B	Bull Creek Reach 2	Bull Creek Reach 3	UT1B	UT1C		
Dimension	Riffle Cross-sections	1	1	1	2	1	1	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	---	1	---	2	---	---		
Pattern	Pattern	N/A						N/A	2
Profile	Longitudinal Profile	N/A						N/A	
Substrate	(RW), Riffle (RF) 100 Pebble Count	1 RW, 1 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 2 RF	1 RW, 1 RF	1 RW, 1 RF	Year 1, 2, 3, 5, and 7	3
Stream Hydrology	Crest Gage (CG) / Stream Gage (SG)	1 CG & SG			1 CG & SG	1 CG & SG		Quarterly	4
Vegetation	CVS Level 2	8						Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes						Semi-Annually	
Exotic and Nuisance Vegetation								Semi-Annually	6
Project Boundary								Annually	7
Reference Photos	Photographs	13						Annually	

Parameter	Monitoring Feature	Quantity/Length by Reach						Frequency	Notes
		UT2	UT2A	UT2B	UT2C	UT3B	UT3C		
Dimension	Riffle Cross-sections	---	1	1	1	1	1	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	---	---	---	---	---	---		
Pattern	Pattern	N/A						N/A	2
Profile	Longitudinal Profile	N/A						N/A	
Substrate	(RW), Riffle (RF) 100 Pebble Count	---	1	1	1	1	1	Year 1, 2, 3, 5, and 7	3
Stream Hydrology	Crest Gage (CG) / Stream Gage (SG)	1 SG	1 CG & SG			1 CG & SG		Quarterly	4
Vegetation	CVS Level 2	3						Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes						Semi-Annually	
Exotic and Nuisance Vegetation								Semi-Annually	6
Project Boundary								Annually	7
Reference Photos	Photographs	8						Annually	

1. Cross-sections will be permanently marked with rebar to establish location. Surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile data will be collected during as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Reach wide pebble counts will be conducted each year a monitoring report is submitted. Riffle (100) pebble counts will be conducted during as-built baseline monitoring only unless observations indicate otherwise during post-construction monitoring.
4. Crest gages and/or stream gages (pressure transducers) will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. The stream gage (pressure transducer) will be set to record stage once every 2 hours.
5. Both mobile and permanent vegetation plots will be utilized to evaluate the vegetation performance for the areas planted. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems and species using a circular or 100 m^2 square/rectangular plot.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

Table 21: Monitoring Components Enhancement | Preservation Reaches – *Key Mill Mitigation Site*

Parameter	Monitoring Feature	Quantity/Length by Reach				Frequency	Notes
		UT1A	UT3	UT3A	Bull Creek Reach 4		
Dimension	Riffle Cross-sections	---	---	---	---	Year 1, 2, 3, 5, and 7	
	Pool Cross-sections	---	---	---	---		
Pattern	Pattern	N/A				N/A	
Profile	Longitudinal Profile	N/A				N/A	
Substrate	(RW), Riffle (RF) 100 Pebble Count	---	---	---	---	Year 1, 2, 3, 5, and 7	
Stream Hydrology	Crest Gage (CG) / Stream Gage (SG)	---	---	---	---	Quarterly	
Vegetation	CVS Level 2	2			---	Year 1, 2, 3, 5, and 7	1
Visual Assessment		Yes				Semi-Annually	
Exotic and Nuisance Vegetation						Semi-Annually	2
Project Boundary						Annually	3
Reference Photos	Photographs	4				Annually	

1. Both mobile and permanent vegetation plots will be utilized to evaluate the vegetation performance for the areas planted. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems and species using a circular or 100 m^2 square/rectangular plot.
2. Locations of exotic and nuisance vegetation will be mapped.
3. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

10.0 Long-Term Management Plan

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

The Stewardship Program will periodically install signage if needed to identify boundary markings as needed. Maintenance of the proposed fencing and permanent crossings will be the responsibility of the landowner and not NCDEQ. The template site protection instrument is enclosed in Appendix 7. The site protection instrument associated with this project will be enclosed with the final mitigation plan.

Table 22: Long-term Management Plan – *Key Mill Mitigation Site*

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
Signage will be installed and maintained along the Site boundary to denote the area protected by the recorded conservation easement.	The long-term steward will be responsible for inspecting the Site boundary and for maintaining or replacing signage to ensure that the conservation easement area is clearly marked.	The landowner shall report damaged or missing signs to the long-term manager, as well as contact the long-term manager if a boundary needs to be marked, or clarification is needed regarding a boundary location. If land use changes in future and fencing is required to protect the easement, the landowner is responsible for installing appropriate approved fencing.
The Site will be protected in its entirety and managed under the terms outlined in the recorded conservation easement.	The long-term manager will be responsible for conducting annual inspections and for undertaking actions that are reasonably calculated to swiftly correct the conditions constituting a breach. The USACE, and their authorized agents, shall have the right to enter and inspect the Site and to take actions necessary to verify compliance with the conservation easement.	The landowner shall contact the long-term manager if clarification is needed regarding the restrictions associated with the recorded conservation easement.

11.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 8 and 9. Project maintenance will be performed during the monitoring years to address minor issues as necessary (Appendix 8). If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

12.0 Determination of Credits

Mitigation credit projections are presented in Table 23. The Site is submitted for mitigation credit in the Yadkin 03040101. This Site contains five internal easement crossings and the affected length of stream within the crossings are excluded from the restored footage and proposed SMU values in the table below. The credit ratios proposed for the Site have been developed in consultation with the Interagency Review Team (IRT) as summarized in meeting minutes dated August 14, 2017. Note, per a special condition of RFP 16-006993, no more than 10% of the total linear feet of stream offered for mitigation can be stream preservation.

The buffer width falls below the minimum required 30-foot buffer along approximately 45 linear feet of Bull Creek. At this location, the channel design is constrained by topography (a narrow valley) and the easement ties into the property boundary, taking advantage of all the available space. This short segment of Bull Creek accounts for less than 1% of the total streams within the project. UT1A does not maintain a 30-foot buffer along a minor (less than five feet) length of the channel due to property boundary restrictions. The easement along UT2C, near the confluence to Bull Creek, infringes on the 30-foot buffer requirement to accommodate an active utility pole. The remaining reaches meet or exceed the 30-foot buffer requirement. Note, more than 12% of the streams will have a buffer width that exceeds the 30-foot requirement.

Table 23: Project Asset Table - *Key Mill Mitigation Site*

Mitigation Credits								
	Stream		Riparian Wetland		Non-Riparian Wetland		Riparian Buffer	
Type	R	RE	R	RE	R	RE	R	RE
Totals	6,038	68	N/A	N/A	N/A	N/A	N/A	N/A

Project Components						
Project Component or Reach ID	Proposed Stationing Location	Approach (PI, PII, EII, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Length (ft)	Mitigation Ratio (X:1)	Proposed Credit[1]
Bull Creek - R1A	100+95 - 105+39	Restoration	R	444	1.0	444
Bull Creek - R1B	105+39 - 112+61	Restoration	R	722	1.0	722
Bull Creek - R2	112+61 - 116+79	Restoration	R	418	1.0	418
Bull Creek - R3	150+30 - 159+11	Restoration	R	881	1.0	881
	159+63 - 167+56	Restoration	R	793	1.0	793
Bull Creek - R4	167+56 - 174+39	Preservation	RE	683	10.0	68
UT1A	200+21 - 203+47	Enhancement II	R	326	2.5	130
	203+82 - 208+85	Enhancement II	R	503	2.5	201
UT1B	208+85 - 210+97	Restoration	R	212	1.0	212
UT1C	211+36 - 213+93	Restoration	R	257	1.0	257
UT2A	300+00 - 303+15	Restoration	R	315	1.0	315
UT2B	303+50 - 306+13	Restoration	R	263	1.0	263
UT2C-	306+13 - 310+82	Restoration	R	469	1.0	469
UT2	350+00 - 350+42	Restoration	R	42	1.0	42
UT3A	400+57 - 404+70	Enhancement II	R	413	2.5	165
UT3B	404+70 - 407+77	Restoration	R	307	1.0	307
UT3C	408+12 - 412+24	Restoration	R	412	1.0	412
UT3	450+38 - 450+56	Enhancement II	R	18	2.5	7

Component Summation					
Restoration Level	Proposed Stream (LF)	Riparian Wetland (Acres)	Non-Riparian Wetland (Acres)	Buffer (Sq.Ft.)	Upland (Acres)
Restoration	5,535	N/A	N/A	N/A	N/A
Enhancement	1,260	N/A	N/A	N/A	N/A
Preservation	683	N/A	N/A	N/A	N/A

1. Internal crossings excluded from the stationing listed above and the credit computations.
2. Lengths and mitigation credits rounded down to the nearest whole number.

13.0 References

Chartrand, S.M., Jellinek, M., Whiting, P.J., Stamm, J. 2011. Geometric scaling of step-pools in mountain streams: Observations and implications. Geomorphology 129:141-151.

Dunne, T. and L. B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company. New York.

Giese, G.I and Robert R. Mason Jr. 1993. Low-Flow Characteristics of Streams in North Carolina. U.S. Geological Survey Water Supply Paper 2403.

Harman et al. 1999. Bankfull Hydraulic Geometry Relationships for North Carolina Streams. AWRA Wildland Hydrology Symposium Proceedings. Edited by: D. S. Olsen and J.P. Potyondy. AWRA Summer Symposium. Bozeman, MT.

Harman, W. R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. *A Function Based Framework for Stream Assessment and Restoration Projects.* US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006.

Hosking, J. R. M., and J. R. Wallis. 1993. Some statistics useful in regional frequency analysis, Water Resour. Res., 29(2), 271–281, doi:10.1029/92WR01980.

Montgomery County Department of Environmental Protection Division of Water Resources Management. 1996. *Rapid Stream Assessment Technique (RSAT) Field Methods.* Montgomery County, Maryland.

Natural Resources Conservation Service (NRCS). Web Soil Survey of Surry County. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

North Carolina Department of Environmental Quality Division of Mitigation Services (DMS), 2016. Stream and Wetland Mitigation Plan Template and Guidance August 2016.

North Carolina Department of Environmental Quality Division of Mitigation Services (DMS), 2015. Closeout Template Guidance Version 2.1 February 2015.

North Carolina Department of Environmental Quality Division of Mitigation Services (DMS), 2015. Closeout Report Template Version 2.1 March 2015.

North Carolina Department of Environmental Quality Division of Mitigation Services (DMS), 2015. Annual Monitoring Report Format, Data Requirements, and Content Guidance April 2015.

North Carolina Department of Environmental Quality Division of Mitigation Services (DMS), 2014. As-Built Baseline Monitoring Report Template February 2014.

North Carolina Department of Natural Resources Division of Mitigation Services, 2009. Upper Yadkin Pee-Dee River Basin Restoration Priorities. https://files.nc.gov/ncdeq/PublicFolder/Work%20With/Watershed%20Planners/Upper_Yadkin_RBRP_2009.pdf

North Carolina Division of Water Quality (NCDWQ), 2011. Surface Water Classifications. http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

North Carolina Geological Survey (NCGS), 2016. Mineral Resources. http://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/ncgs-maps/1985-geologic-map-of-nc

North Carolina Geological Survey (NCGS), 1985. Geologic map of North Carolina 1:500,000 scale.

North Carolina Natural Heritage Program (NHP), 2009. Natural Heritage Element Occurrence Database, Surry County, NC.

North Carolina Wildlife Resources Commission, 2015. North Carolina Wildlife Action Plan. Raleigh, NC

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

Rosgen, D.L. 2001. A stream channel stability assessment methodology. Proceedings of the Federal Interagency Sediment Conference, Reno, NV, March 2001.

Schafale, M.P. 2012. Classification of the Natural Communities of North Carolina, Fourth Approximation. North Carolina Natural Heritage Program, Raleigh, North Carolina.

Shields, D. F., Copeland, R. R, Klingman, P. C., Doyle, M. W., and Simon, A. 2003. Design for Stream Restoration. Journal of Hydraulic Engineering 129(8): 575-582.

Simon, A. 1989. A model of channel response in disturbed alluvial channels. Earth Surface Processes and Landforms 14(1):11-26.

Simon, A., Darby, S.E., 1997. Process-form interactions in unstable sand-bed river channels: a numerical modeling approach. Geomorphology 21, 85–106.

Simon, A., Dickerson, W., Heins, 2004b. Suspended-sediment transport rates at the 1.5-year recurrence interval for ecoregions of the United States: transport conditions at the bankfull and effective discharge? Geomorphology 58, 243–262.

Simon, A., Hupp, C.R., 1986. Channel evolution in modified Tennessee channels. Proceedings, Fourth Federal Interagency Sedimentation Conference, Las Vegas, March 24–27, 1986, vol. 2, pp. 5–71–5–82.

Simon, A., Langendoen, E., Bingner, R., Wells, R.R., Yuan, Y., Alonso, C., 2004a. Suspended-sediment transport and bed-material characteristics of Shades Creek, Alabama and Ecoregion 67: developing water-quality criteria for suspended and bed-material sediment. National Sedimentation Laboratory Technical Report, vol. 43. 150 pp.

United States Department of Agriculture (USDA) Natural Resource Conservation Services-(NRCS), 2018. Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

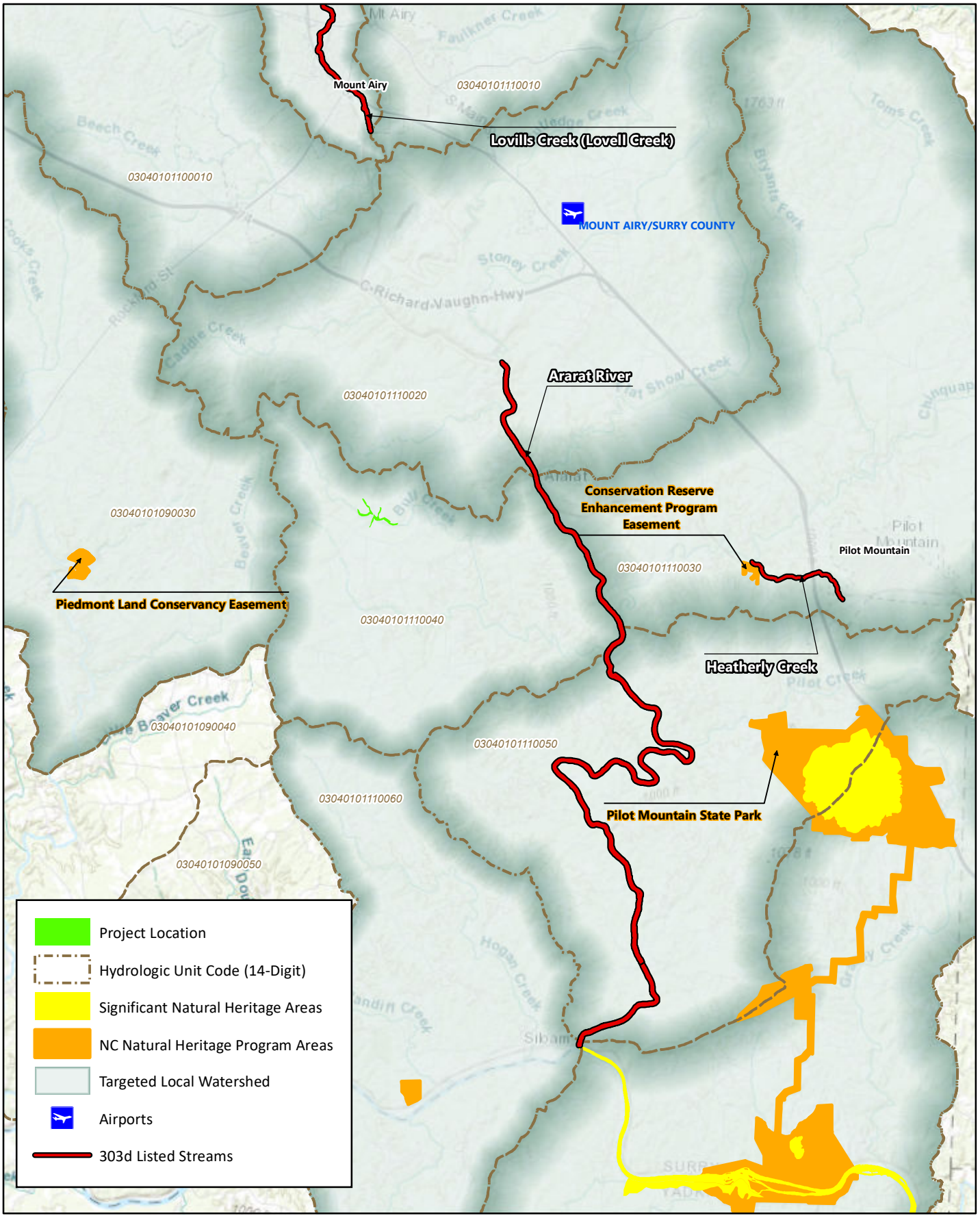
United States Army Corps of Engineers (USACE). 2016. Federal Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District. October 24, 2016.

United States Fish and Wildlife Service (USFWS), 2014. Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species, Surry County, NC. http://www.fws.gov/raleigh/species/cntylist/Yadkin.html

Walker, Alan, unpublished. NC Rural Mountain and Piedmont Regional Curve.

Figures

Key Mill Mitigation Site



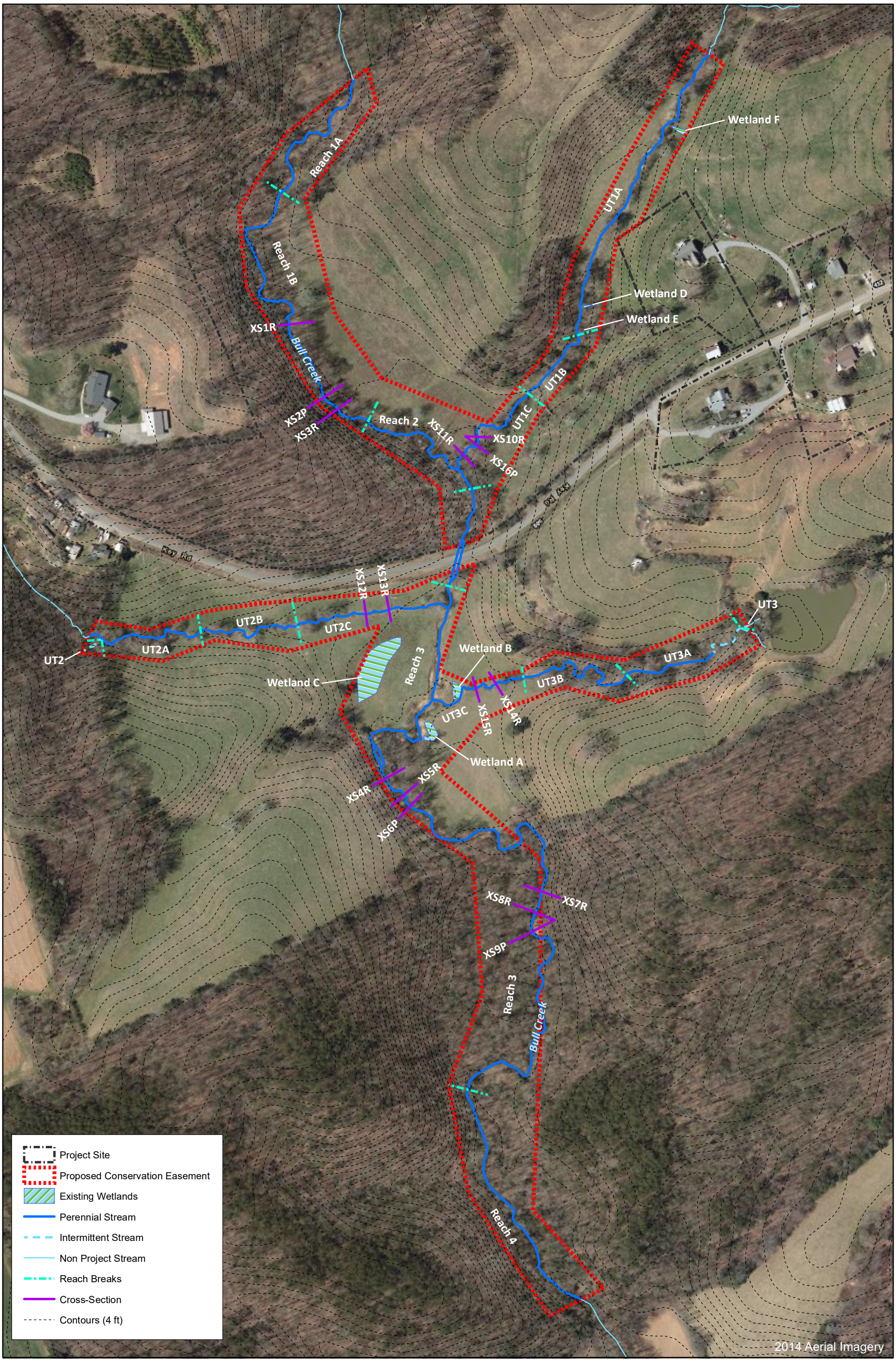
WILDLANDS ENGINEERING

0 1 2 Miles

N

Figure 1 Vicinity Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC

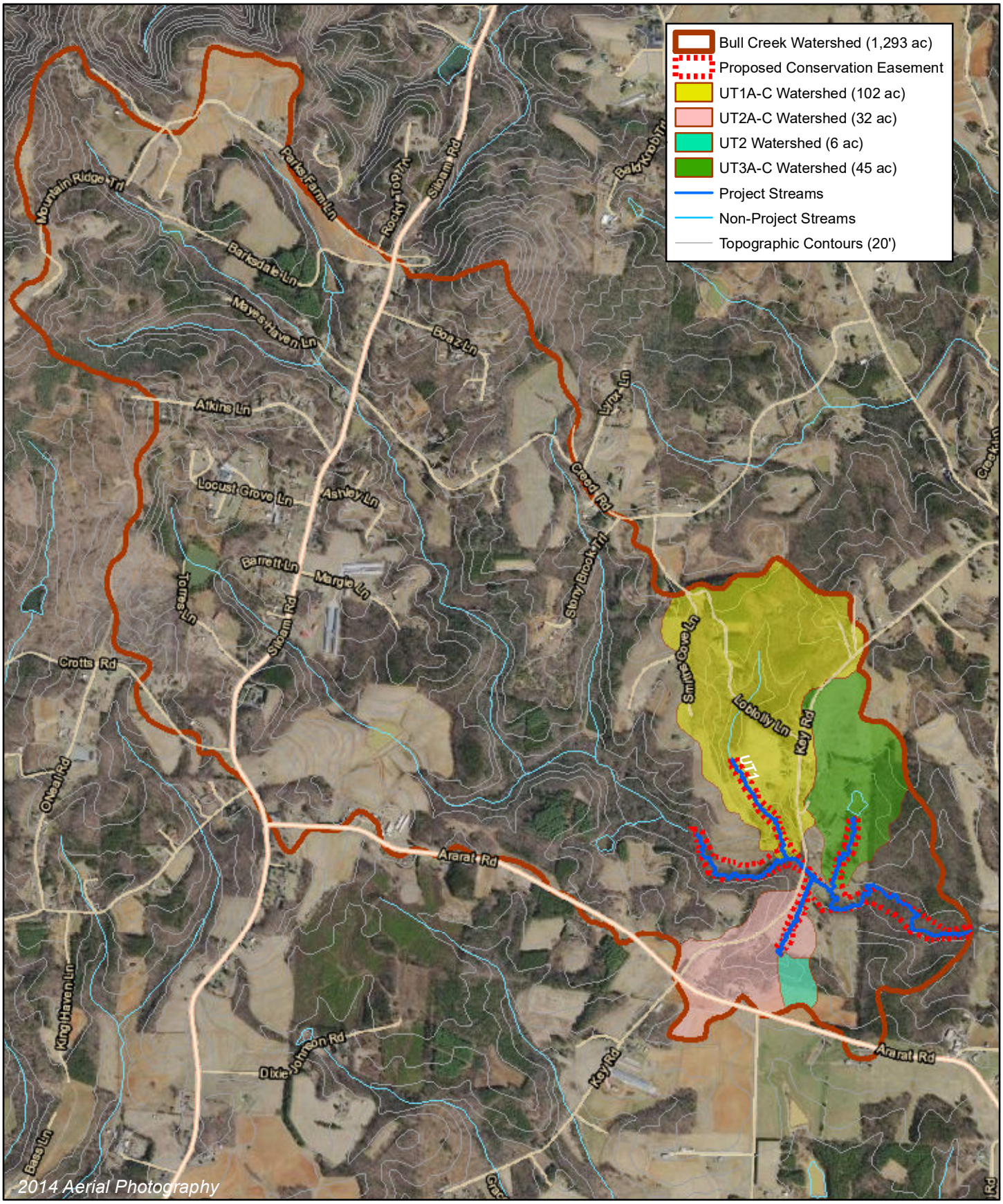


WILDLANDS ENGINEERING

0 250 500 Feet

Figure 2 Site Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

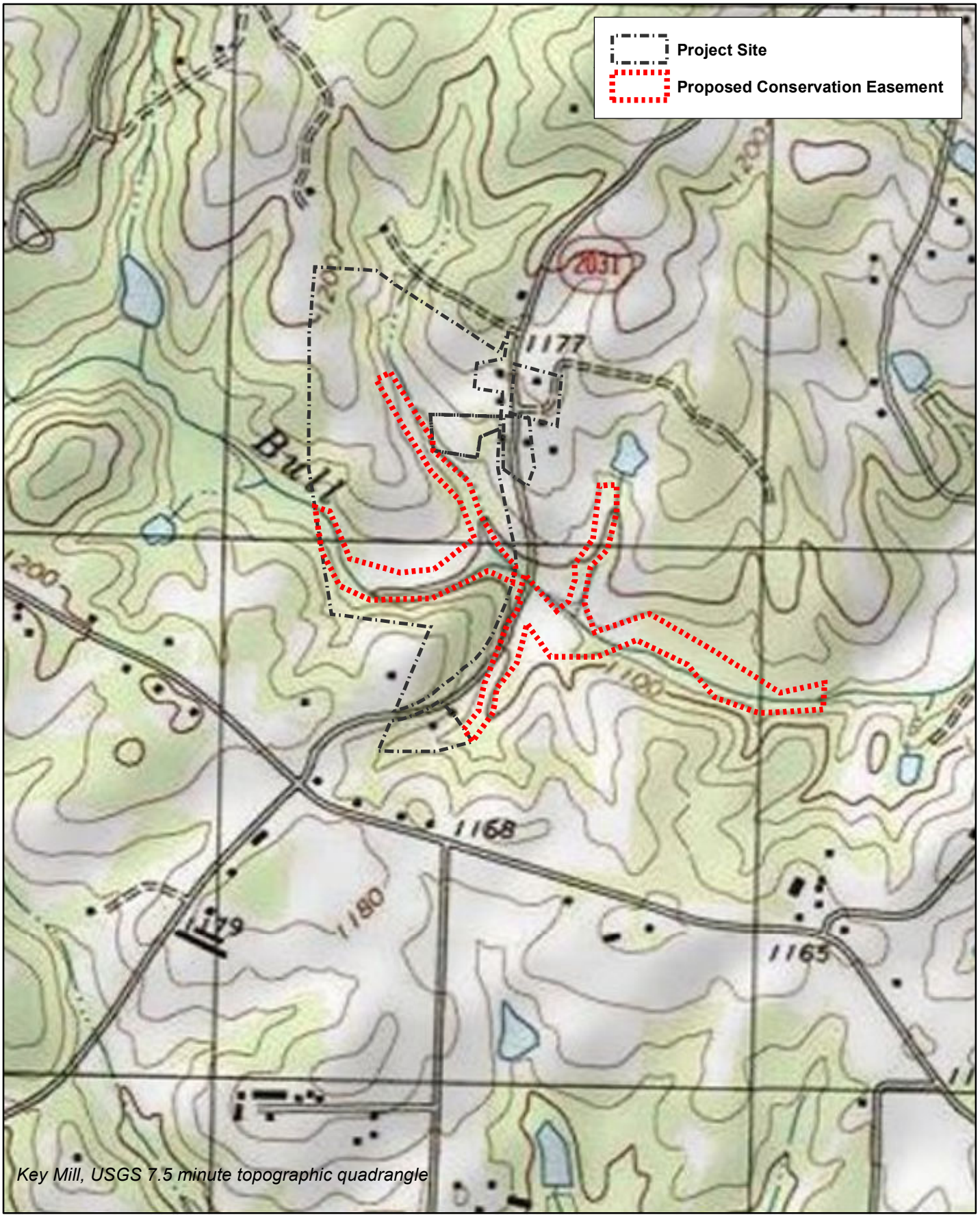
Surry County, NC



WILDLANDS ENGINEERING

Figure 3 Watershed Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC



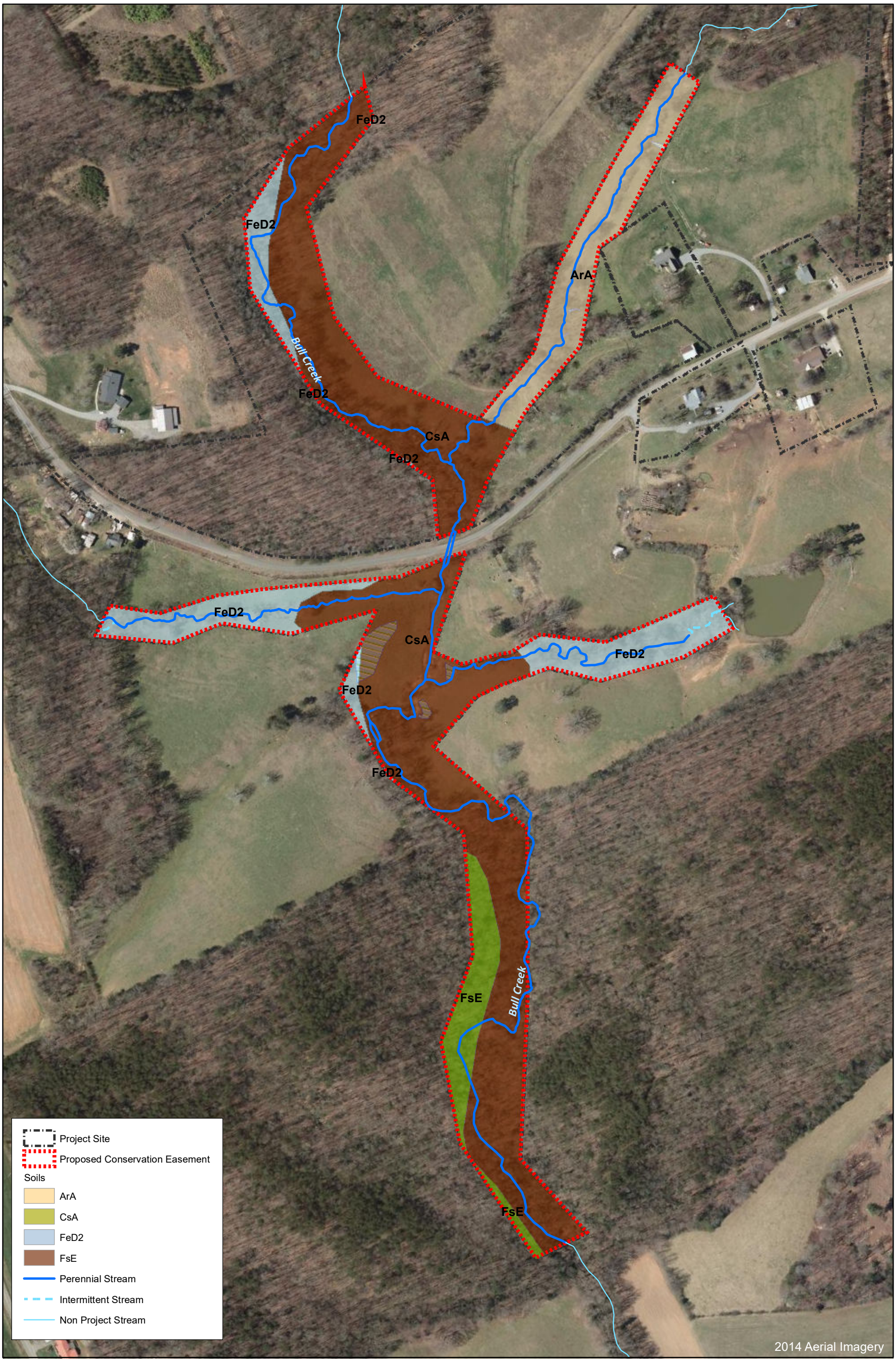
WILDLANDS ENGINEERING

0 500 1,000 Feet

N

Figure 4 USGS Topographic Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC

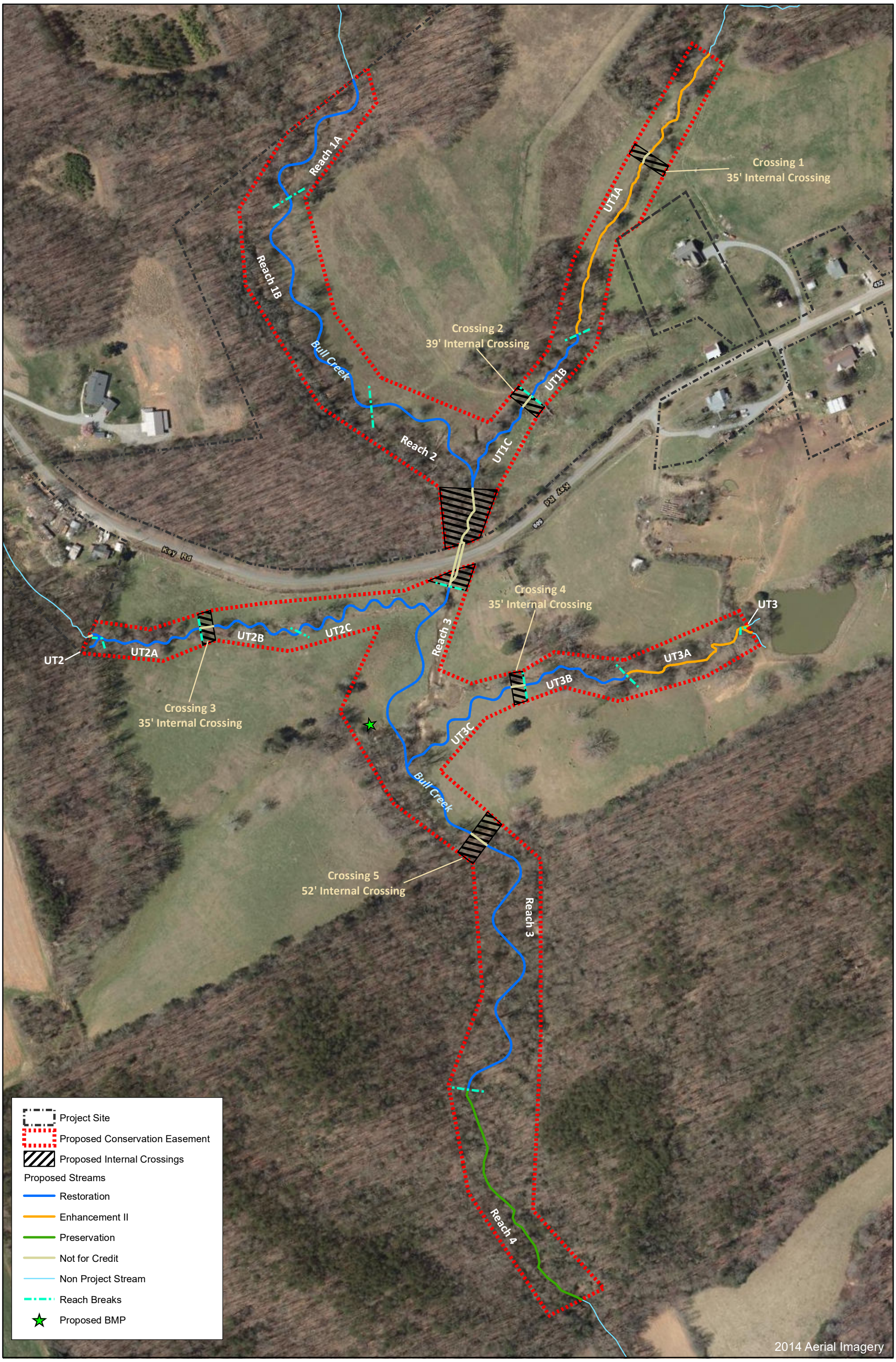


WILDLANDS ENGINEERING

0 250 500 Feet

Figure 5 Soils Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC

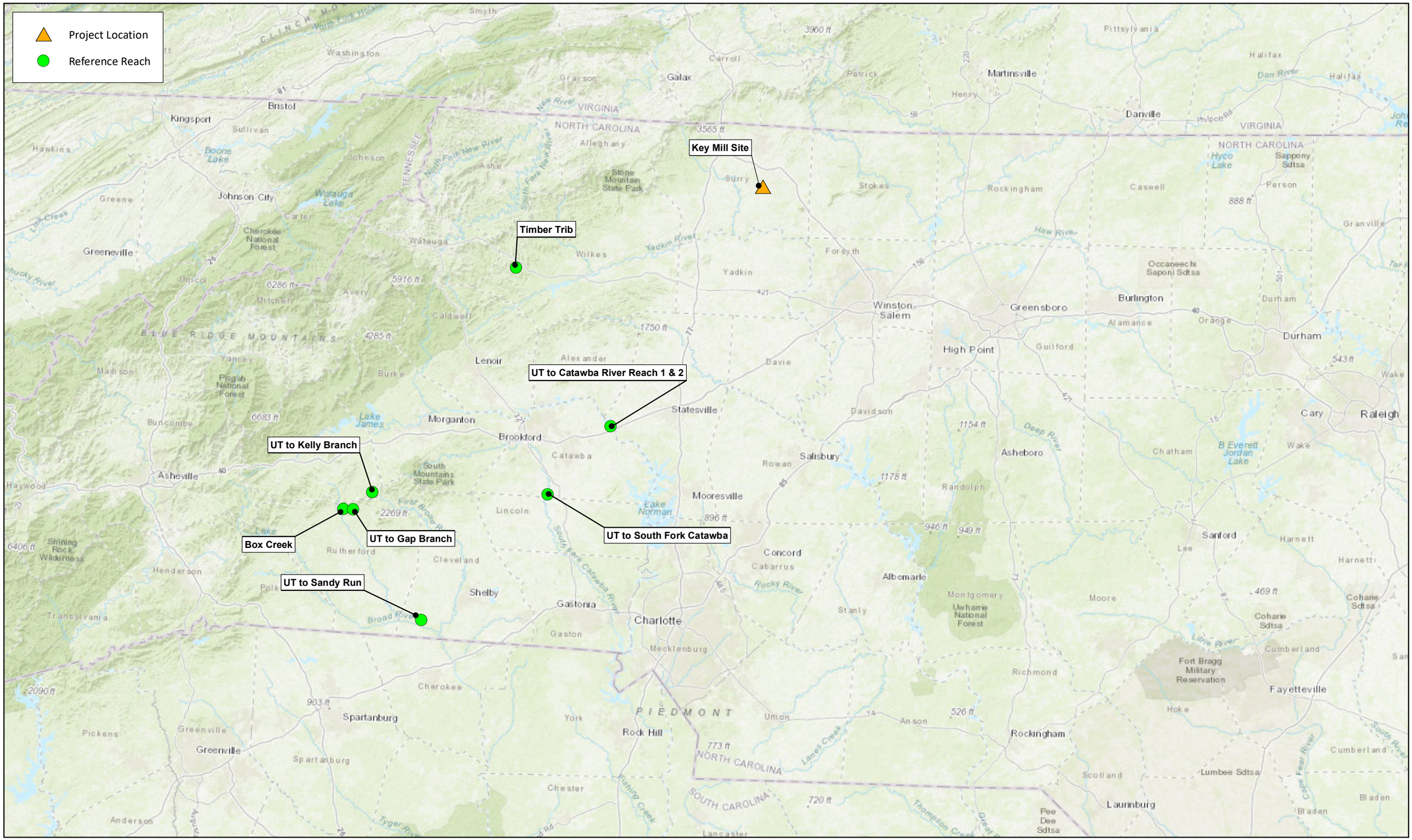


WILDLANDS ENGINEERING

0 250 500 Feet

Figure 6 Concept Design Map
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC

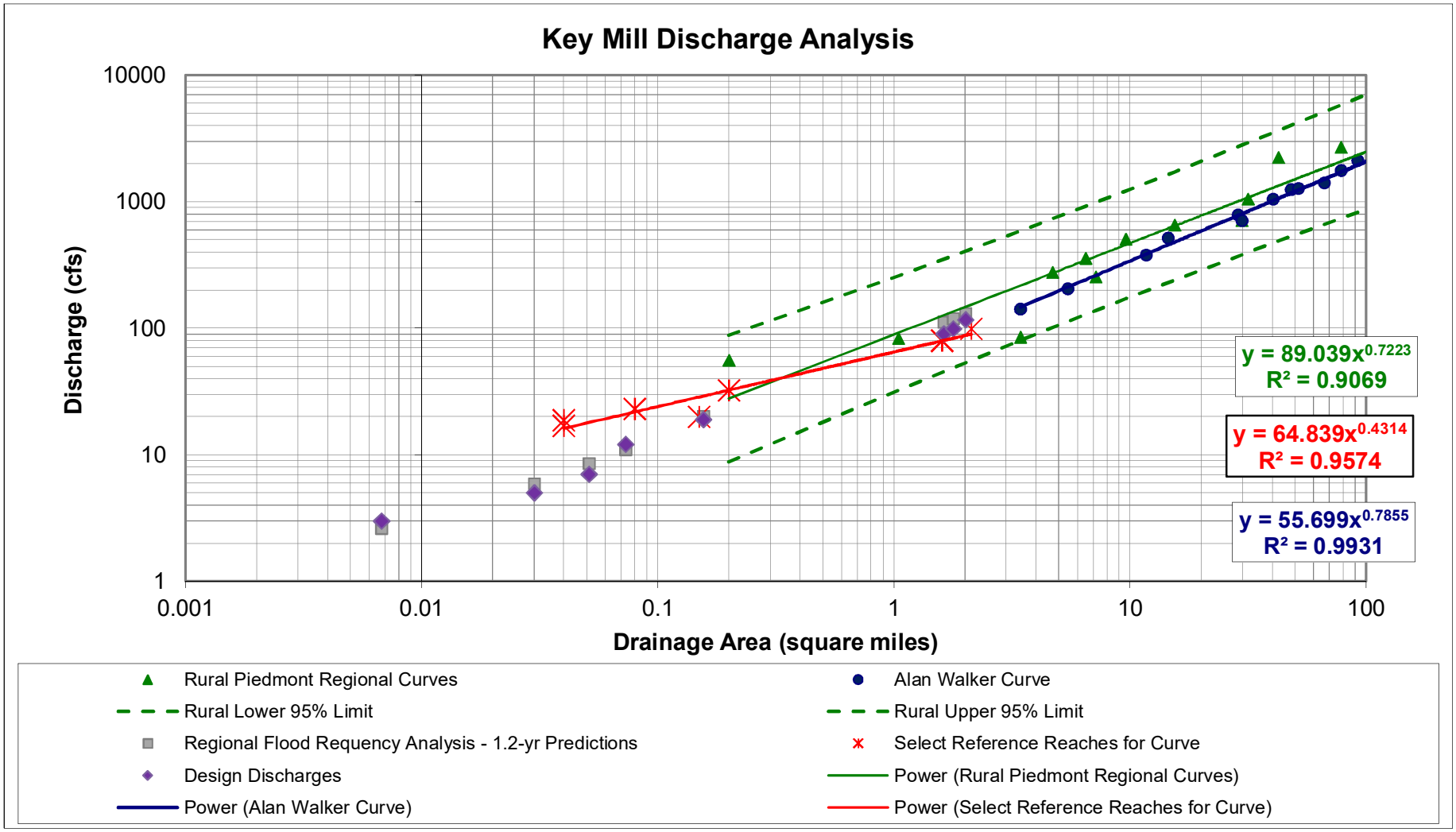


0 7 14 Miles

N

WILDLANDS ENGINEERING

Figure 7 Reference Reach Vicinity Map
Key Mill Mitigation Site
Yadkin River Basin 03040101
Surry County, NC


Key Mill Discharge Analysis
Discharge (cfs)
10000
1000
100
10
1
0.001
0.01
0.1
1
10
100
Drainage Area (square miles)
y = 89.039x^0.7223
R² = 0.9069
y = 64.839x^0.4314
R² = 0.9574
y = 55.699x^0.7855
R² = 0.9931
Rural Piedmont Regional Curves
Alan Walker Curve
Rural Lower 95% Limit
Rural Upper 95% Limit
Regional Flood Requency Analysis - 1.2-yr Predictions
Select Reference Reaches for Curve
Design Discharges
Power (Rural Piedmont Regional Curves)
Power (Alan Walker Curve)
Power (Select Reference Reaches for Curve)

		Bull Creek Reach 1A[1]	Bull Creek Reach 2	Bull Creek Reach 3	UT1B[2]	UT2A[3]	UT2	UT3B[4]
	DA (acres)	1,045	1,147	1,293	100	33	4	47
	DA (sq. mi.)	1.63	1.79	2.02	0.16	0.05	0.01	0.07
		Qbkf (cfs)	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*
USGS Peak Discharge Estimation for NC Rural Piedemont	**1-yr event**	38	41	46	6	2	1	3
	1.2-yr event	111	119	130	20	9	3	11
	1.5-yr event	157	168	183	29	13	4	16
	1.8-yr event	192	205	223	36	16	5	20
	2-yr event	209	205	243	40	17	5	22
Manning's equation at surveyed XS from Mecklenburg spreadsheets	**XS1**	91	-	-	-	-	-	-
	XS2	105	-	-	-	-	-	-
	XS4	-	-	98	-	-	-	-
	XS5	-	-	101	-	-	-	-
	XS7	-	-	164	-	-	-	-
	XS8	-	-	164	-	-	-	-
	XS10	-	-	-	14	-	-	-
	XS11	-	-	-	34	-	-	-
	XS12	-	-	-	-	11	-	-
	XS13	-	-	-	-	17	-	-
	XS14	-	-	-	-	-	-	11
	XS15	-	-	-	-	-	-	17
Piedmont Regional Curve	**low range**	45	48	53	8	4	1	5
	exact calc	127	136	148	23	10	2	14
	high range	358	383	416	68	31	7	40
Alan Walker Curve	**exact calc**	82	88	97	13	5	1	7
Manning's equation at surveyed TOB	**Max Q**	1,484	-	735	905	34	-	91
		1,231	-	922	1,159	62	-	102
Qbkf from Reference Reach Curve	**exact calc**	80	83	88	29	18	8	21
Final Design Q		90	99	116	19	7	3	12

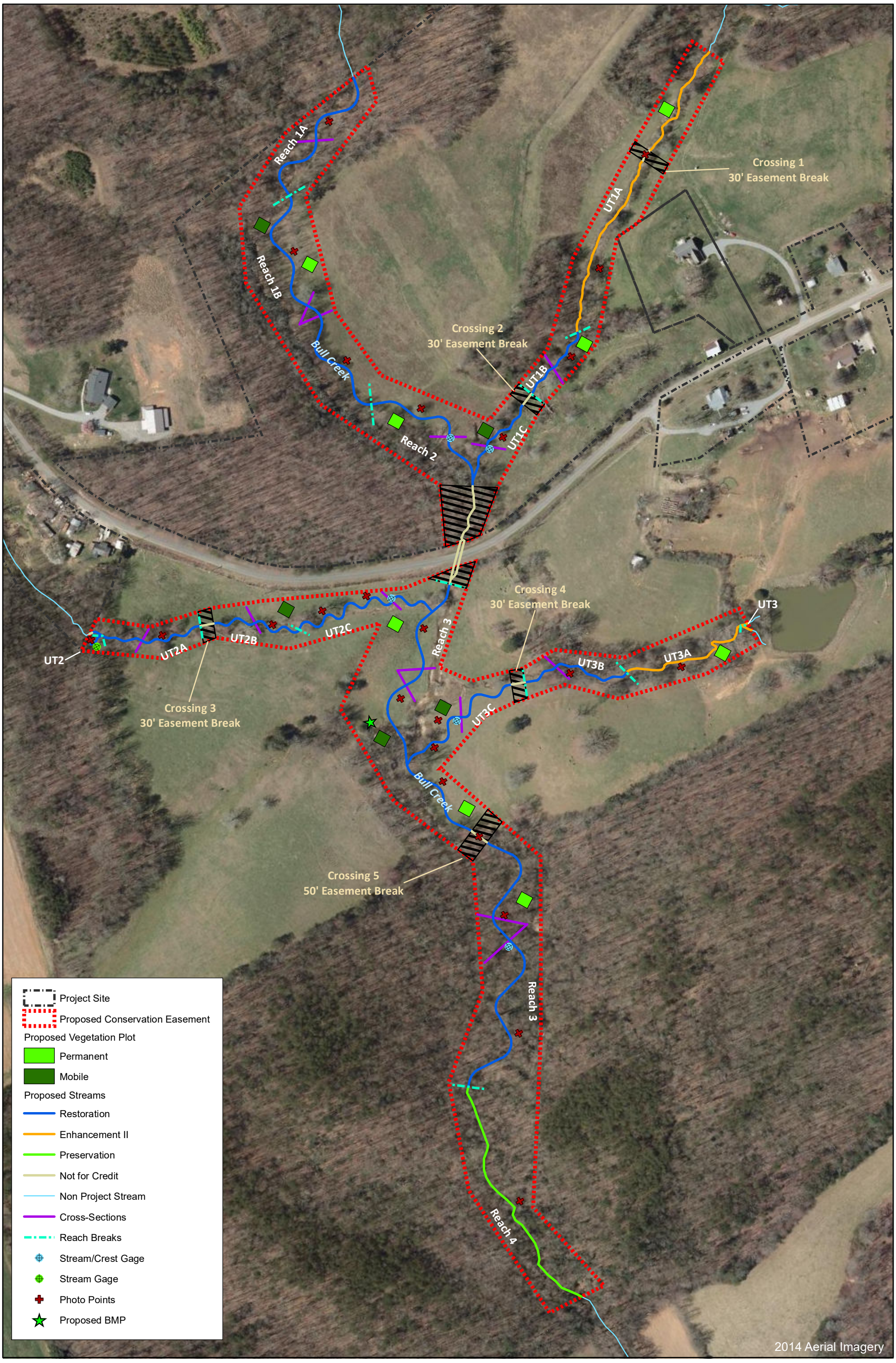
Notes:

1 Bull Creek Reach 1A drainage characteristics applied to Bull Creek Reach 1B

2 UT1B drainage characteristics applied to UT1C

3 UT2A drainage characteristics applied to UT2B and UT2C

4 UT3B drainage characteristics applied to UT3C



WILDLANDS ENGINEERING

0 250 500 Feet

Figure 9 Proposed Monitoring Plan
Key Mill Mitigation Site
Yadkin River Basin 03040101

Surry County, NC

Appendix 1 – Historical Aerial Photos

Key Mill Mitigation Site

Key Mill

483 Key Road

Ararat, NC 27007

Inquiry Number: 4799004.1

December 07, 2016

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

12/07/16

Site Name:

Key Mill
483 Key Road
Ararat, NC 27007
EDR Inquiry # 4799004.1

Client Name:

Wildlands Eng, Inc.
1430 South Mint Street
Charlotte, NC 28203
Contact: Andrea Eckardt

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2010	1"=500'	Flight Year: 2010	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2008	1"=500'	Flight Year: 2008	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
2005	1"=500'	Flight Year: 2005	USDA/NAIP
1993	1"=500'	Acquisition Date: January 28, 1993	USGS/DOQQ
1982	1"=500'	Flight Date: March 28, 1982	USGS
1976	1"=1000'	Flight Date: February 12, 1976	USGS
1966	1"=750'	Flight Date: March 21, 1966	USGS

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.


INQUIRY #: 4799004.1
YEAR: 2012
= 500'
N
EDR


INQUIRY #: 4799004.1
YEAR: 2010
= 500'
N
EDR


INQUIRY #: 4799004.1
YEAR: 2009
= 500'
N
EDR


INQUIRY #: 4799004.1
YEAR: 2008
= 500'
N
EDR


INQUIRY #: 4799004.1
YEAR: 2006
= 500'
N
EDR


INQUIRY #: 4799004.1
YEAR: 2005
= 500'
N
EDR

INQUIRY #: 4799004.1

YEAR: 1993

= 500'

N

EDR


INQUIRY #: 4799004.1
YEAR: 1982
= 500'
N
EDR

INQUIRY #: 4799004.1

YEAR: 1976

= 1000'

N

EDR

INQUIRY #: 4799004.1

YEAR: 1966

= 750'

N

EDR

Appendix 2 – Preliminary Jurisdictional Determination

Key Mill Mitigation Site

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action ID: **SAW-2017-01504** County: **Surry** U.S.G.S. Quad: **Mount Airy South**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Win Taylor**
Address: **497 Bramson Court, Suite 104**
Mt Pleasant, SC 29464
Telephone Number: **843-277-6221**

Size (acres): **20 Acres** Nearest Town: **Mt Pleasant**
Nearest Waterway: **Bull Creek** Coordinates: **36.3993, -80.60325**
River Basin/ HUC: **Upper Pee Dee**

Location description: **The project is located at 483 Key Road, Ararat North Carolina**

Indicate Which of the Following Apply:

A. Preliminary Determination

X There are waters, including wetlands, on the above described project area, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The waters, including wetlands, have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

_ There are wetlands on the above described property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the waters, including wetlands, have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the waters, including wetlands, at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the waters of the U.S. on your property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

B. Approved Determination

_ There are Navigable Waters of the United States within the above described property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are waters of the U.S. including wetlands on the above described property subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ We recommend you have the waters of the U.S. on your property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

_ The waters of the U.S. including wetlands on your project area have been delineated and the delineation has been verified by the Corps. If you wish to have the delineation surveyed, the Corps can review and verify the survey upon completion. Once verified, this survey will provide an accurate depiction of all areas subject to CWA and/or RHA

jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

_ The waters of the U.S. including wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on_____. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are no waters of the U.S., to include wetlands, present on the above described project area which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management to determine their requirements.

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **William Elliott** at **828-271-7980, ext. 4225** or **amanda.jones@usace.army.mil**.

C. Basis for Determination:

See attached preliminary jurisdictional determination form.

The site contains wetlands as determined by the 1987 Corps of Engineers Wetland Delineation Manual and the Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Eastern Mountain and Piedmont Region (version 2.0). These wetlands are adjacent to stream channels located on the property that exhibit indicators of ordinary high water marks. The stream channel on the property "is known as" **Bull Creek** which flows into the Ararat River which flows to the Yadkin River.

D. Remarks:

The potential waters of the U.S., at this site, were verified on-site by the Corps on July 25, 2018 and are as approximately depicted on the attached Potential Wetland/Waters Map (dated August 23, 2018)

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **N/A (Preliminary-JD)**.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: William Elliott

William Elliott

Issue Date of JD: **October 17, 2018**

Expiration Date: N/A Preliminary JD

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Copy furnished:

Linda Faye Kee 483 Key Road, Ararat NC 27007,

Zacharey Neil Hardy 728 Key Road, Ararat NC 27007

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Win Taylor**	File Number: **SAW-SAW-2017-01504**	Date: **October 17, 2018**

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
☒ PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT		
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)		
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.		
POINT OF CONTACT FOR QUESTIONS OR INFORMATION:		
If you have questions regarding this decision and/or the appeal process you may contact: **District Engineer, Wilmington Regulatory Division,** **Attn: William Elliott** **151 Patton Avenue, Room 208** **Asheville, North Carolina 28801-5006** **828-271-7980, ext. 4232**	If you only have questions regarding the appeal process you may also contact: Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137	
RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.		
_____ Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn.: William Elliott, 69 Darlington Avenue, Wilmington, North Carolina 28403

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

PRELIMINARY JURISDICTIONAL DETERMINATION (JD) FORM
U.S. Army Corps of Engineers

BACKGROUND INFORMATION

A. **REPORT COMPLETION DATE FOR PRELIMINARY JD: October 17, 2018**

B. **NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:**
Win Taylor
497 Bramson Court, Suite 104
Mt Pleasant, SC 29464

C. **DISTRICT OFFICE, FILE NAME, AND NUMBER:**
CESAW-RG-A, SAW-2017-01504,

D. **PROJECT LOCATION(S) AND BACKGROUND INFORMATION:**
The project is located at 483 Key Road, Ararat North Carolina

State: **NC** County/parish/borough: **Surry** City: **Mt Pleasant**
Center coordinates of site (lat/long in degree decimal format): **36.3993, -80.60325**
Universal Transverse Mercator: **N/A**
Name of nearest waterbody: **Bull Creek**

E. **REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):**
☒ Office (Desk) Determination. Date: **October 17, 2018**
☒ Field Determination. Date(s): **July 25, 2018**

Use the table below to document aquatic resources and/or aquatic resources at different sites

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

Site Number	Centered Coordinates (decimal degrees) Latitude	Longitude	Estimated Amount of Aquatic Resource in Review Area (linear feet or acre)	Type of Aquatic Resources	Geographic Authority to Which Aquatic Resource "May Be" Subject
	See Enclosed Table			☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404
				☐ Wetland ☐ Non-wetland Waters	☐ Section 404 ☐ Section 10/404

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: _____.
- ☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report. Rationale: _____.
- ☐ Data sheets prepared by the Corps: _____.
- ☐ Corps navigable waters' study: _____.
- ☐ U.S. Geological Survey Hydrologic Atlas: _____.
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 7.5 Minute Mount Airy South Quadrangle.
- ☒ Natural Resources Conservation Service Soil Survey. Citation: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.
- ☐ National wetlands inventory map(s). Cite name: _____.
- ☐ State/local wetland inventory map(s): _____.
- ☐ FEMA/FIRM maps: _____.
- ☐ 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): 2014.
  or ☐ Other (Name & Date): _____.
- ☐ Previous determination(s). File no. and date of response letter: _____.
- ☐ Other information (please specify): _____.

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

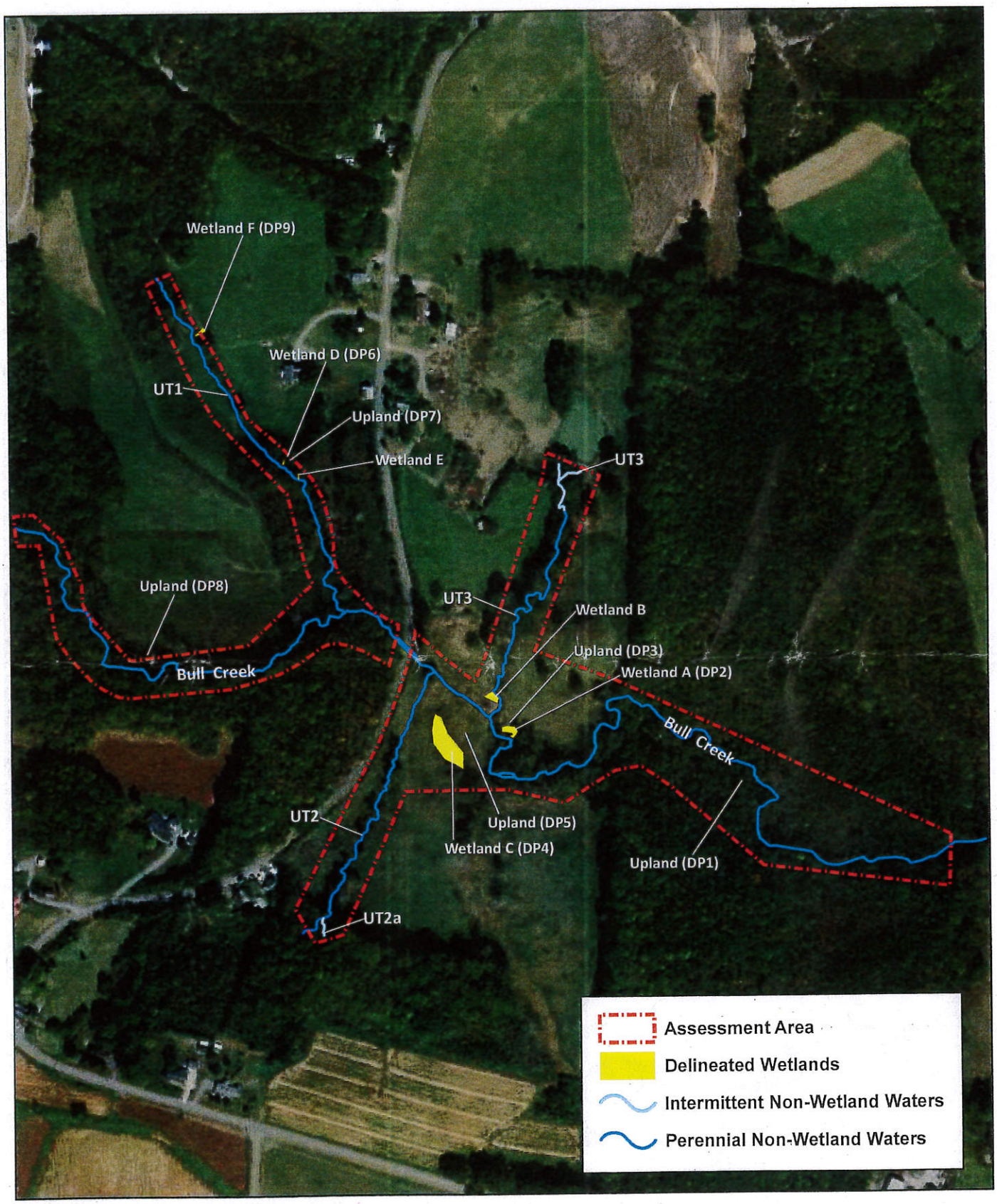
William Gilbert 10/17/18
Signature and date of
Regulatory staff member
completing PJD

5/24/2018
Signature and date of
person requesting PJD
(REQUIRED, unless obtaining
the signature is impracticable)[1]

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

Table 1. Summary of On-Site Jurisdictional Waters

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Bull Creek	36.395534	-80.602728	Riverine-Streambed	5,370	Perennial Non-Wetland Waters of the US
UT1	36.397589	-80.604722	Riverine-Streambed	1,445	Perennial Non-Wetland Waters of the US
UT2	36.394560	-80.603659	Unconsolidated Bottom	1,138	Perennial Non-Wetland Waters of the US
UT2a	36.393338	-80.604265	Unconsolidated Bottom	61	Intermittent Non-Wetland Waters of the US
UT3 - Lower	36.395874	-80.602206	Unconsolidated Bottom	959	Perennial Non-Wetland Waters of the US
UT3 - Upper	36.397155	-80.601507	Unconsolidated Bottom	279	Intermittent Non-Wetland Waters of the US
Wetland A	36.395180	-80.602126	Palustrine-Emergent	0.028	Non-Section 10 – Wetland
Wetland B	36.395510	-80.602308	Palustrine-Emergent	0.021	Non-Section 10 – Wetland
Wetland C	36.395052	-80.602889	Palustrine-Emergent	0.220	Non-Section 10 – Wetland
Wetland D	36.397724	-80.604762	Palustrine-Emergent	0.002	Non-Section 10 – Wetland
Wetland E	36.397542	-80.604604	Palustrine Forested	0.001	Non-Section 10 – Wetland
Wetland F	36.398892	-80.605750	Palustrine-Emergent	0.009	Non-Section 10 – Wetland



WILDLANDS ENGINEERING

0 1,000 Feet

N

Figure 3 Site Map
Key Mill Mitigation Site
Yadkin River Basin (03040101)

Surry County, NC

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP1

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range:

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.394750 Long: W -80.599429 Datum:

Soil Map Unit Name: Colvard and Suches (CsA) NWI classification: n/a

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

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

Wetland Hydrology Present? **Yes** _____ **No** ✓

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

Remarks:

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

Sampling Point: Upland - DP1

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	30	Yes	FACU
2. Acer rubrum	20	Yes	FAC
3. Betula nigra	10	No	FACW
4. Fagus grandifolia	10	No	FACU
5. Pinus taeda	5	No	FAC
6.			
7.			
8.			
	75	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Magnolia tripetala	30	Yes	FACU
2. Ilex opaca	15	No	FACU
3. Ligustrum sinense	40	Yes	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	85	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Polystichum acrostichoides	5	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5	= Total Cover	

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 20 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	25	x 3 =	75
FACU species	130	x 4 =	520
UPL species	0	x 5 =	0
Column Totals:	165 (A)		615 (B)

Prevalence Index = B/A = 3.7

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** _____ **No** ✓

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

SOIL

Sampling Point: Upland - DP1

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5YR 4/4	100					Loam	
12-14	7.5YR 4/6	100					Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetlands A & B - DP2

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range:

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.395180 Long: W -80.602126 Datum:

Soil Map Unit Name: Colvard and Suches (CsA) NWI classification: n/a

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

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

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

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

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

Remarks:

Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✓ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0 - 12+

Wetland Hydrology Present? Yes ✓ No _____

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

Remarks:

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

Sampling Point: Wetlands A & B - DP2

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Juncus effusus	50	Yes	FACW
2. Carex bullata	35	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ✓ **No** _____

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

SOIL

Sampling Point: Wetlands A & B - DP2

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	2.5Y 5/2	90	7.5YR 4/6	10	C	PL	Silty Sand	
5-10	2.5Y 5/3	85	7.5YR 4/6	15	C	PL	Sand	
10-14	2.5Y 5/2	100					Sandy Silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland C - DP4

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range:

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.395052 Long: W -80.602889 Datum:

Soil Map Unit Name: Colvard and Suches (CsA) NWI classification: n/a

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

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

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

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

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

Remarks:

Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

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

Wetland Hydrology Present? Yes ✓ No _____

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

Remarks:

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

Sampling Point: Wetland C - DP4

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Juncus effusus	60	Yes	FACW
2. Festuca paradoxa	30	Yes	FAC
3. Eupatorium capillifolium	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

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

SOIL

Sampling Point: Wetland C - DP4

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 5/2	85	5YR 5/8	15	C	PL	Silt Loam	
4-14	2.5Y 5/3	75	5YR 5/8	25	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP5

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range: _____

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.395188 Long: W -80.602659 Datum: _____

Soil Map Unit Name: Colvard and Suches (CsA) NWI classification: n/a

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

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

Wetland Hydrology Present? **Yes** _____ **No** ✓

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

Remarks:

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

Sampling Point: Upland - DP5

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Festuca paradoxa	80	Yes	FAC
2. Eupatorium capillifolium	10	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	25	x 3 =	75
FACU species	130	x 4 =	520
UPL species	0	x 5 =	0
Column Totals:	165 (A)		615 (B)

Prevalence Index = B/A = 3.7

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

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

SOIL

Sampling Point: Upland - DP5

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/4	100					Loam	
3-14	10YR 4/6	100					Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetlands D & E- DP6

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range:

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.397724 Long: W -80.604762 Datum:

Soil Map Unit Name: Arkaqua loam (ArA) NWI classification: n/a

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

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

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

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

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

Remarks:

Concave depression devoid of vegetation.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✓ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): 2
Water Table Present?	Yes ✓	No _____	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0-12+

Wetland Hydrology Present? Yes ✓ No _____

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

Remarks:

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

Sampling Point: Wetlands D & E- DP6

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

✓ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** _____ **No** ✓

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

Concave depression devoid of vegetation.

SOIL

Sampling Point: Wetlands D & E- DP6

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/1	95	10YR 5/6	5	C	PL	Silt Loam	
3-14	10YR 4/1	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP7

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range: _____

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.397690 Long: W -80.604714 Datum: _____

Soil Map Unit Name: Arkaqua loam (ArA) NWI classification: n/a

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

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

Wetland Hydrology Present? **Yes** _____ **No** ✓

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

Remarks:

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

Sampling Point: Upland - DP7

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	60	Yes	FAC
2. Liriodendron tulipifera	10	No	FACU
3. Quercus phellos	10	No	FAC
4.			
5.			
6.			
7.			
8.			
	80	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Ligustrum sinense	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	80	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90	= Total Cover	

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	150	x 3 =	450
FACU species	30	x 4 =	120
UPL species	0	x 5 =	0
Column Totals:	180 (A)		570 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes _____ No ✓

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

SOIL

Sampling Point: Upland - DP7

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	5YR 5/6	100					Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 12/13/2017

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Upland - DP8

Investigator(s): Ian Eckardt and Win Taylor Section, Township, Range: _____

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.397541 Long: W -80.604599 Datum: _____

Soil Map Unit Name: Arkaqua loam (ArA) NWI classification: n/a

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

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

Wetland Hydrology Present? Yes _____ No ✓

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

Remarks:

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

Sampling Point: Upland - DP8

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Fraxinus pennsylvanica	60	Yes	FACW
2. Liriodendron tulipifera	10	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	70	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Ligustrum sinense	5	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	70	Yes	FAC
2. Festuca paradoxa	25	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	60	x 2 =	120
FAC species	95	x 3 =	285
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	170 (A)		465 (B)

Prevalence Index = B/A = 2.74

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

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

SOIL

Sampling Point: Upland - DP8

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-1	7.5Y 2/2	100					Loam	
1-14	7.5Y 4/6	100					Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Key Mill Mitigation Site City/County: Mount Airy/Stokes Sampling Date: 7/11/2018

Applicant/Owner: Wildlands Engineering State: NC Sampling Point: Wetland F- DP9

Investigator(s): Win Taylor Section, Township, Range:

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

Subregion (LRR or MLRA): MLRA 136 Lat: N 36.398892 Long: W -80.605750 Datum:

Soil Map Unit Name: Arkaqua loam (ArA) NWI classification: n/a

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

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

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

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

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

Remarks:

Area mowed as part of pasture area.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✓ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 0.5
Water Table Present?	Yes ✓	No ____	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0-12+

Wetland Hydrology Present? Yes ✓ No ____

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

Remarks:

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

Sampling Point: Wetland F- DP9

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Leersia oryzoides	5	Yes	OBL
2. Persicaria lapathifolia	1	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	6 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ✓ **No** _____

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

Concave depression devoid of vegetation.

SOIL

Sampling Point: Wetland F- DP9

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/1	95	10YR 5/6	5	C	PL	Silt Loam	
6-12	10YR 4/1	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

Appendix 3 – DWR Stream Identification Forms

Key Mill Mitigation Site

NC DWQ Stream Identification Form Version 4.11

Date: 1-6-17	**Project/Site:** Key Mill	**Latitude:** 36.397350°
Evaluator: Alea Tuttle	**County:** Surry Co.	**Longitude:** -80.608666°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 45	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** e.g. Quad Name: Bull Creek

A. Geomorphology (Subtotal = 27)

	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	2	(3)
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)

12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter * winter - leaf packs	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9.5)

18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	(3)
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	0	(0.5)	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes: large tipulidae (1), mayfly (1), stonefly (1), chironomid (1) readily found. many habitats available

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1-6-17	**Project/Site:** Key Mill	**Latitude:** 36.400896°
Evaluator: ALEA TUTTLE	**County:** Surry Co.	**Longitude:** -80.606023°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 43	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* UT1A-C

A. Geomorphology (Subtotal = 24)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 10.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	(3)
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	0	0.5	(1)	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	0	(0.5)	1	1.5
26. Wetland plants in streambed	~~FACW = 0.75; OBL = 1.5 Other = 0~~			

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

Notes: tipulidae (1), numerous chironomids, mayfly (1), stonefly (1) all in first habitat sampled (dipnet in riffle with leaf packs).

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1-6-17	**Project/Site:** Key Mill	**Latitude:** 36.393322°
Evaluator: Alea Tuttle	**County:** Surry Co.	**Longitude:** -80,604674
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 39	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* UT2A-C

A. Geomorphology (Subtotal = 23)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	2	(3)
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 8.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	0	0.5	(1)	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes: marginal habitat, no macrobenthos located → juncus, sedges.

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1-6-17	**Project/Site:** Key Mill	**Latitude:** 36.393291°
Evaluator: Alea Tuttle	**County:** Surry Co.	**Longitude:** -80.604278°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* UT2

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	1	0.5	(0)
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	0	0.5	(1)	1.5
26. Wetland plants in streambed	~~FACW = 0.75; OBL = 1.5 Other = 0~~			

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

Notes: amphipod (scud shrimp) (1), oligochete (aquatic worm) 1

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1/6/17	Project/Site: Key Mill	Latitude: 36.397254°
Evaluator: Alea Tuttle	County: Surry	Longitude: -80.601546°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 37.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* UT3A-C

A. Geomorphology (Subtotal = 18.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	2	(3)
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

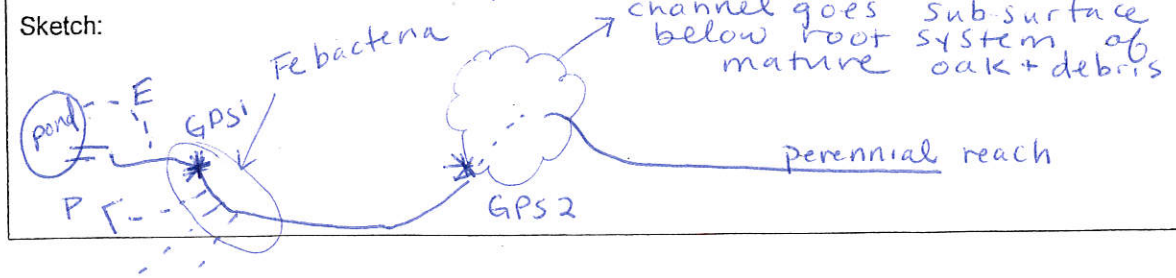
B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	0.5	(0)
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 12)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	← (3)
21. Aquatic Mollusks	0	1	(2) →	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	0	0.5	(1)	1.5
26. Wetland plants in streambed	~~FACW = 0.75; OBL = 1.5 Other = 0~~			

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

Notes: chironomids (many), mayfly (1), blackfly (1)
mollusks/snails (many)

Sketch:



intermittent reach inbetween GPS 1 + GPS 2.
P = pipe
E = ephemeral ditch

NC DWQ Stream Identification Form Version 4.11

Date: 1-6-17	**Project/Site:** Key Mill	**Latitude:** 36.397605°
Evaluator: Alea Tuttle	**County:** Surry Co.	**Longitude:** -80.601595°
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* UT3/3A upper

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	2	(3)
14. Leaf litter	1.5	1	0.5	(0)
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	3	(2)	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	0	(1)	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	~~FACW = 0.75; OBL = 1.5 Other = 0~~			

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

Notes: no macroinvertebrate benthos found after several habitats sampled. mostly leaf pack/riffle and undercut banks in root wads.

Sketch:

Appendix 4 – Existing, Proposed, and Reference Reach Geomorphic Data

Key Mill Mitigation Site

Key Mill Mitigation Site
Existing Conditions Geomorphic Parameters

Parameter	Notation	Units	Bull Creek Reach 1A[1]		Bull Creek Reach 1B[1]		Bull Creek Reach 2[1]		Bull Creek Reach 3		UT1B[2]		UT1C[2]	
			min	max	min	max	min	max	min	max	min	max	min	max
stream type			F3		F3		F3		F3/G3c		G4c		G4	
drainage area	DA	sq mi	1.63		1.68		1.79		2.02		0.16		0.16	
bankfull cross-sectional area	A_{bkf}	SF	18.7	21.6	18.7	21.6	18.7	21.6	26.2	39.5	3.9	6.8	3.9	6.8
avg velocity during bankfull event	v_{bkf}	fps	4.8	4.9	4.8	4.9	4.8	4.9	4.2	4.3	3.5	5.0	3.5	5.0
width at bankfull	w_{bkf}	feet	16.2	19.1	16.2	19.1	16.2	19.1	18.0	25.4	5.6	7.0	5.6	7.0
maximum depth at bankfull	d_{max}	feet	1.8	2.1	1.8	2.1	1.8	2.1	1.6	2.7	1.0	1.5	1.0	1.5
mean depth at bankfull	d_{bkf}	feet	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.1	0.7	1.0	0.7	1.0
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14.1	16.8	14.1	16.8	14.1	16.8	8.5	22.5	7.3	8.1	7.3	8.1
low bank height		feet	7.6	7.8	7.6	7.8	7.6	7.8	4.8	5.6	7.5	7.7	7.5	7.7
bank height ratio	BHR	-	3.7	4.1	3.7	4.1	3.7	4.1	1.9	2.8	5.0	7.9	5.0	7.9
floodprone area width	w_{fpa}	feet	21	25	21	25	21	25	27	53	14	17	14	17
entrenchment ratio	ER	-	1.3	1.3	1.3	1.3	1.3	1.3	1.3	2.9	2.4	2.5	2.4	2.5
max pool depth at bankfull	d_{pool}	feet	4.9		4.9		4.9		1.5	2.3	2.6		2.6	
pool depth ratio	d_{pool}/d_{bkf}	-	4.5		4.5		4.5		0.9	0.9	2.6	3.7	2.6	3.7
pool width at bankfull	w_{pool}	feet	14.6		14.6		14.6		28.7	46.2	12.8		12.8	
pool width ratio	w_{pool}/w_{bkf}	-	0.8	0.9	0.8	0.9	0.8	0.9	1.9	1.6	1.8	2.3	1.8	2.3
Bankfull pool cross-sectional area	A_{pool}	SF	44.4		44.4		44.4		41.2	56.7	16.4		16.4	
pool area ratio	A_{pool}/A_{bkf}	-	2.1	2.4	2.1	2.4	2.1	2.4	1.3	1.2	2.4	4.2	2.4	4.2
pool-pool spacing	p-p	feet	52		52		52		N/A	N/A	48	262	48	262
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$	-	2.7	3.2	2.7	3.2	2.7	3.2	N/A	N/A	8.5	37.4	8.5	37.4
valley slope	S_{valley}	feet/foot	0.010		0.012		0.027		0.008		0.024		0.037	
channel slope	$S_{channel}$	feet/foot	0.013		0.009		0.016		0.008		0.014		0.044	
sinuosity	K	-	1.24		1.16		1.21		1.19		1.07		1.30	
belt width	w_{blt}	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
meander width ratio	w_{blt}/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
meander length	L_m	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
meander length ratio	L_m/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
linear wavelength	LW	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
linear wavelength ratio	LW/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
radius of curvature	R_c	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
radius of curvature ratio	R_c/ w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. Cross-sections analyzed for Bull Creek Reach 1B considered to be representative of Bull Creek Reach 1A and Reach 2.

2. Cross-sections analyzed for UT1C reach considered to be representative of UT1B.

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

Key Mill Mitigation Site

Existing Conditions Geomorphic Parameters

Parameter	Notation	Units	UT2[1]		UT2A[1]		UT2B[1]		UT2C		UT3B[2]		UT3C	
			min	max	min	max	min	max	min	max	min	max	min	max
stream type			G4		G5		G5c		G5		G5		G5c	
drainage area	DA	sq mi	0.01		0.04		0.05		0.05		0.07		0.07	
bankfull cross-sectional area	A_{bkf}	SF	5.7	7.4	5.7	7.4	5.7	7.4	5.7	7.4	2.8	4.1	2.8	4.1
avg velocity during bankfull event	v_{bkf}	fps	1.9	2.2	1.9	2.2	1.9	2.2	1.9	2.2	4.0	4.2	4.0	4.2
width at bankfull	w_{bkf}	feet	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	3.9	5.7	3.9	5.7
maximum depth at bankfull	d_{max}	feet	1.9	2.0	1.9	2.0	1.9	2.0	1.9	2.0	0.8	1.2	0.8	1.2
mean depth at bankfull	d_{bkf}	feet	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	0.7	0.7	0.7	0.7
bankfull width to depth ratio	w_{bkf}/d_{bkf}		3.7	4.8	3.7	4.8	3.7	4.8	3.7	4.8	5.4	7.8	5.4	7.8
low bank height		feet	2.7	3.7	2.7	3.7	2.7	3.7	2.7	3.7	3.1	3.3	3.1	3.3
bank height ratio	BHR	-	1.4	1.9	1.4	1.9	1.4	1.9	1.4	1.9	2.7	3.8	2.7	3.8
floodprone area width	w_{fpa}	feet	84	112	84	112	84	112	84	112	9	14	9	14
entrenchment ratio	ER	-	16.0	21.2	16.0	21.2	16.0	21.2	16.0	21.2	1.6	3.5	1.6	3.5
max pool depth at bankfull	d_{pool}	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pool depth ratio	d_{pool}/d_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pool width at bankfull	w_{pool}	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pool width ratio	w_{pool}/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull pool cross-sectional area	A_{pool}	SF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pool area ratio	A_{pool}/A_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pool-pool spacing	p-p	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
valley slope	S_{valley}	feet/foot	0.064		0.029		0.031		0.019		0.036		0.016	
channel slope	$S_{channel}$	feet/foot	0.047		0.022		0.017		0.020		0.023		0.017	
sinuosity	K	-	1.07		1.20		1.17		1.07		1.51		1.19	
belt width	w_{blt}	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
meander width ratio	w_{blt}/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
meander length	L_m	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
meander length ratio	L_m/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
linear wavelength	LW	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
linear wavelength ratio	LW/w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
radius of curvature	R_c	feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
radius of curvature ratio	R_c/ w_{bkf}	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. Cross-sections analyzed for reach UT2C considered to be representative of UT2, UT2A, and UT2B.

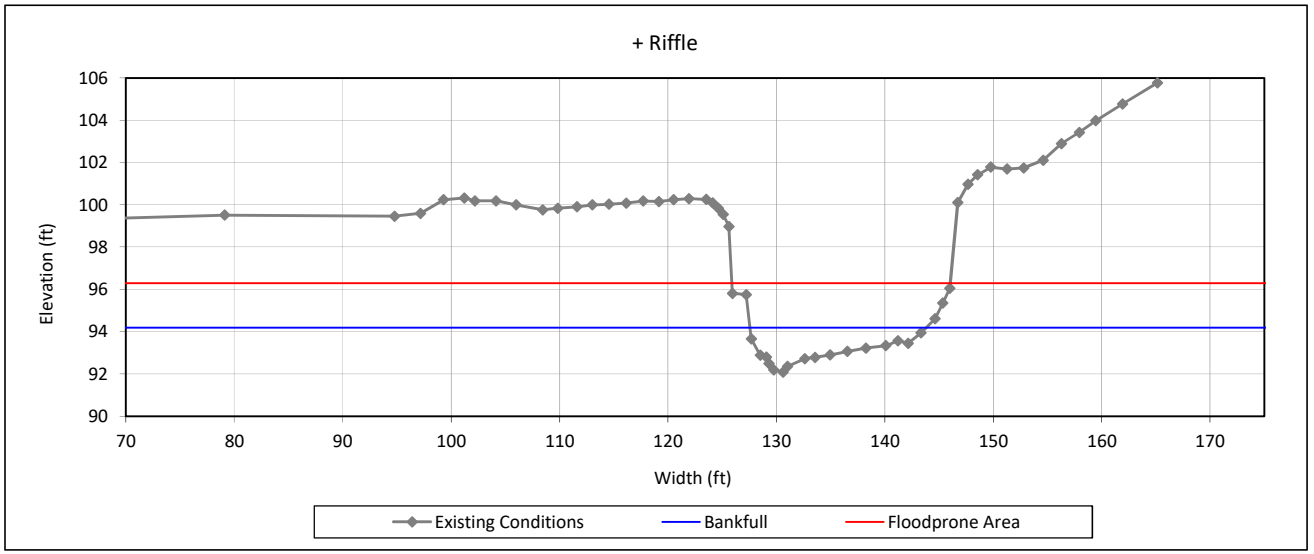
2. Cross-sections analyzed for reach UT3C considered to be representative of UT3, UT3A, and UT3B.

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

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS1 Riffle 1-Bull Creek Reach 1



Bankfull Dimensions	
18.7	x-section area (ft.sq.)
16.2	width (ft)
1.1	mean depth (ft)
2.1	max depth (ft)
17.6	wetted perimeter (ft)
1.1	hydraulic radius (ft)
14.1	width-depth ratio
20.8	W flood prone area (ft)
1.3	entrenchment ratio
3.7	low bank height ratio

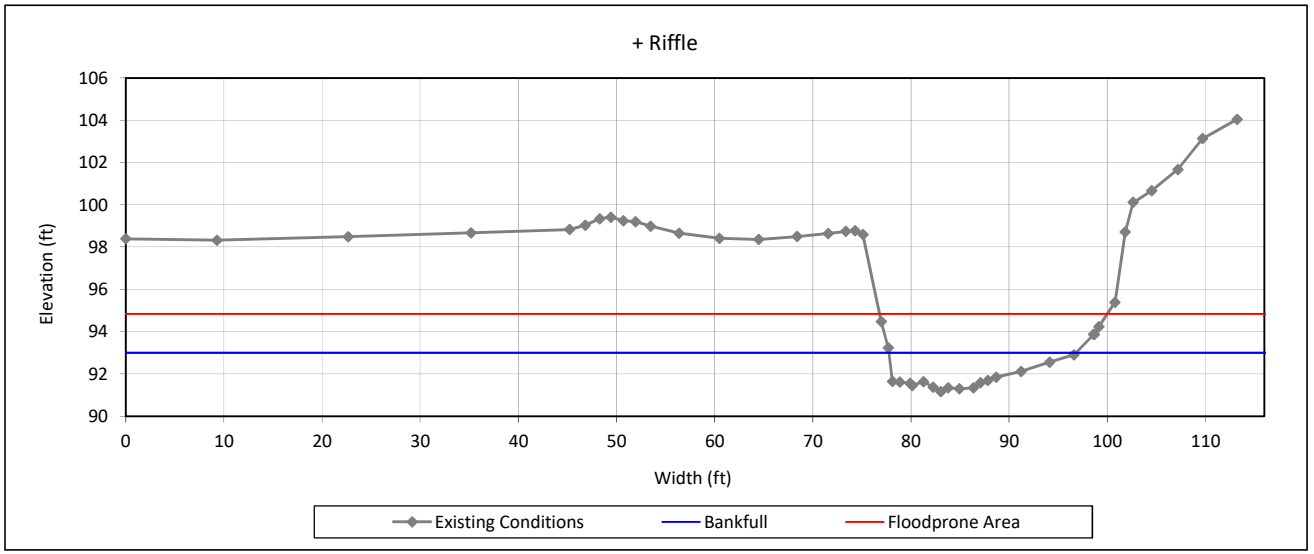
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS2 Riffle 2-Bull Creek Reach 1



Bankfull Dimensions	
21.6	x-section area (ft.sq.)
19.1	width (ft)
1.1	mean depth (ft)
1.8	max depth (ft)
20.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
16.8	width-depth ratio
25.1	W flood prone area (ft)
1.3	entrenchment ratio
4.1	low bank height ratio

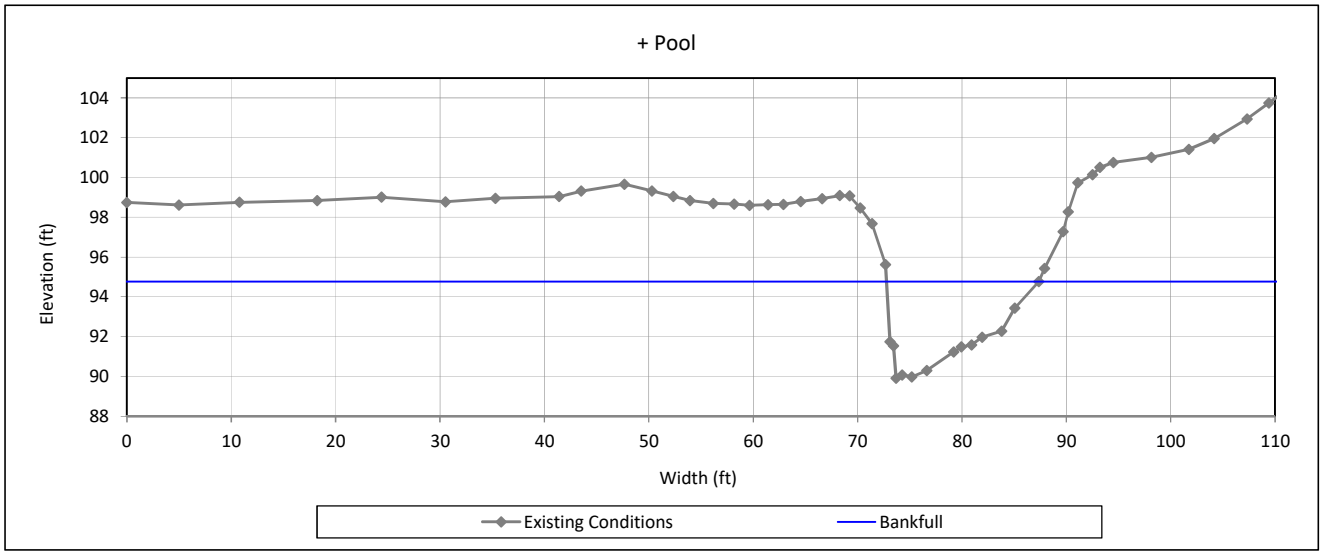
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS3 Pool-Bull Creek Reach 1



Bankfull Dimensions	
44.4	x-section area (ft.sq.)
14.6	width (ft)
3.0	mean depth (ft)
4.9	max depth (ft)
19.9	wetted perimeter (ft)
2.2	hydraulic radius (ft)
4.8	width-depth ratio

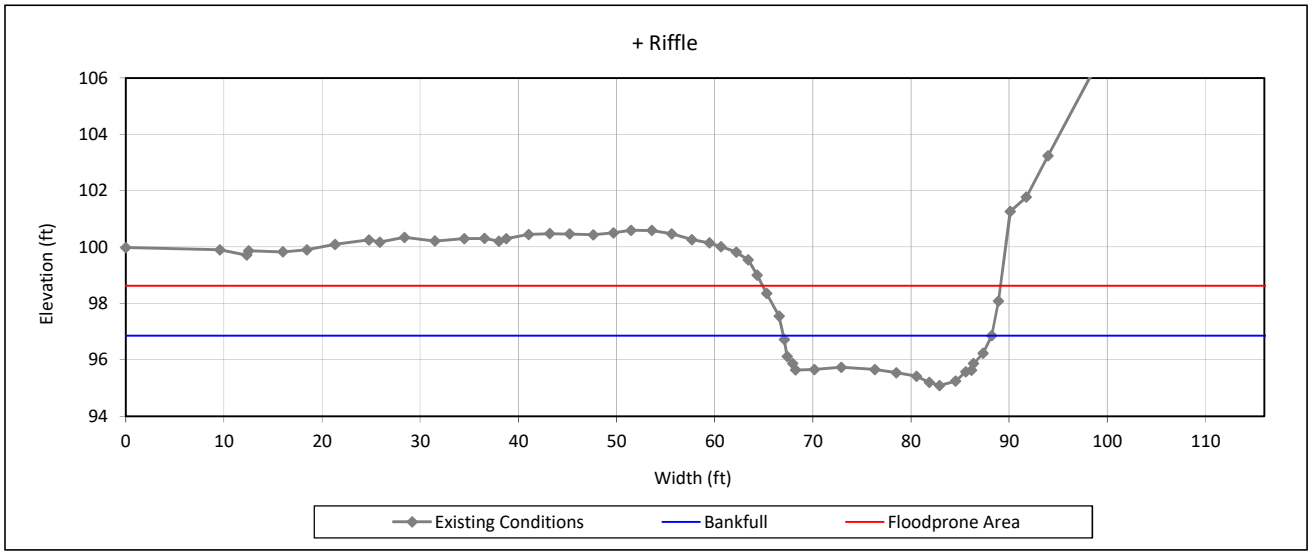
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS4 Riffle 1-Bull Creek Reach 3



Bankfull Dimensions	
26.2	x-section area (ft.sq.)
21.2	width (ft)
1.2	mean depth (ft)
1.8	max depth (ft)
22.3	wetted perimeter (ft)
1.2	hydraulic radius (ft)
17.2	width-depth ratio
49.0	W flood prone area (ft)
2.3	entrenchment ratio
2.8	low bank height ratio

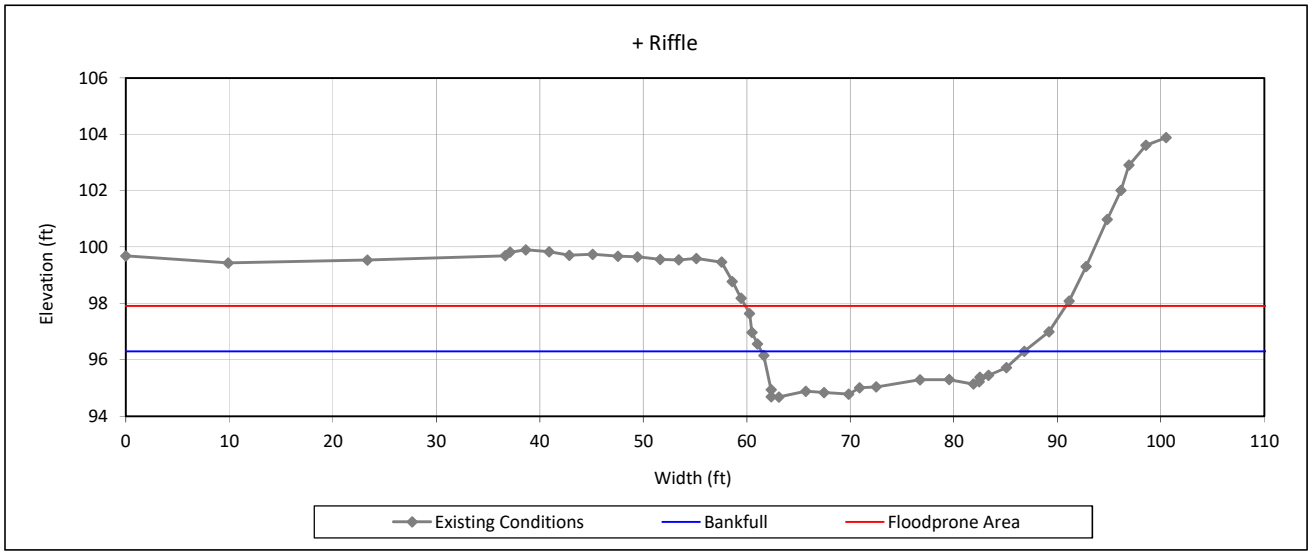
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS5 Riffle 2-Bull Creek Reach 3



Bankfull Dimensions	
28.7	x-section area (ft.sq.)
25.4	width (ft)
1.1	mean depth (ft)
1.6	max depth (ft)
26.8	wetted perimeter (ft)
1.1	hydraulic radius (ft)
22.5	width-depth ratio
32.6	W flood prone area (ft)
1.3	entrenchment ratio
3.0	low bank height ratio

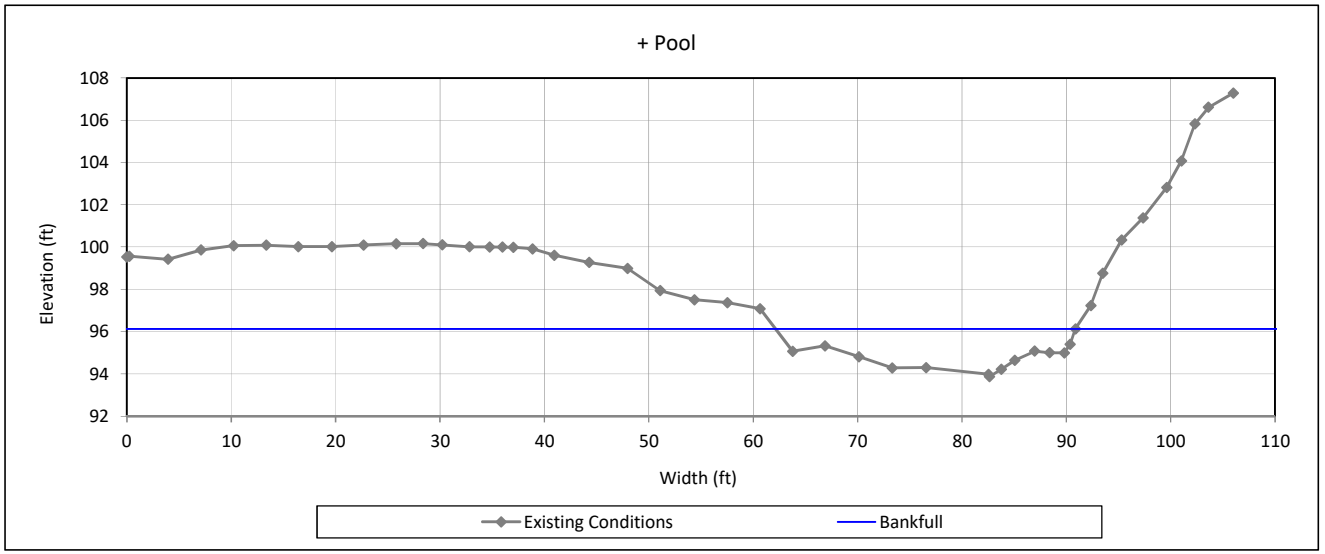
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS6 Pool-Bull Creek Reach 3



Bankfull Dimensions	
41.2	x-section area (ft.sq.)
28.7	width (ft)
1.4	mean depth (ft)
2.3	max depth (ft)
29.9	wetted perimeter (ft)
1.4	hydraulic radius (ft)
20.0	width-depth ratio

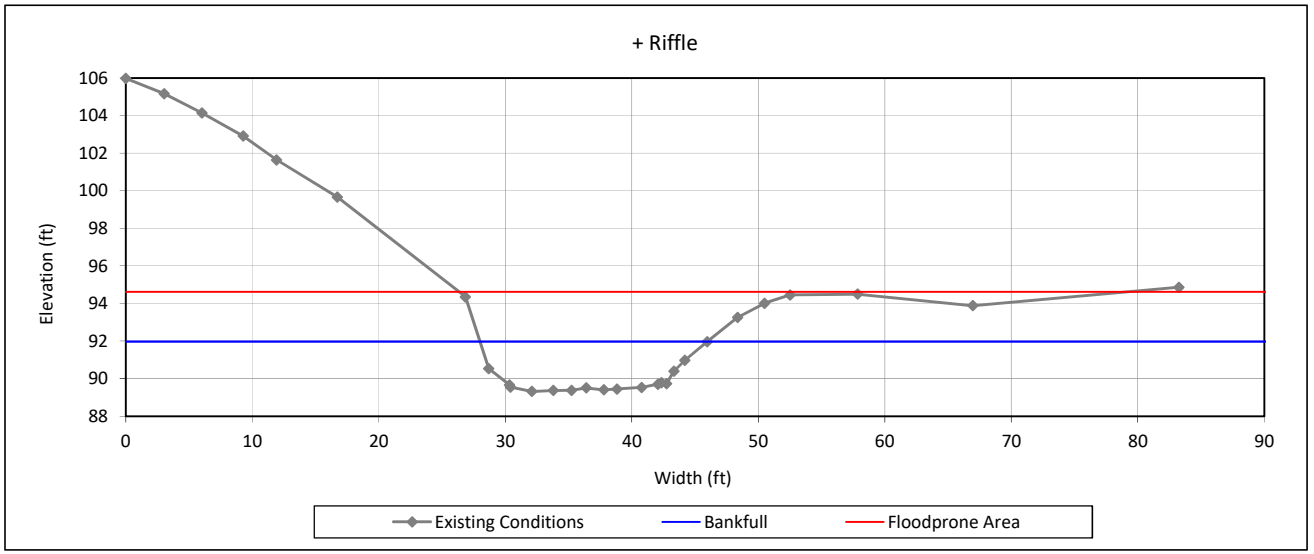
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS7 Riffle 3-Bull Creek Reach 3



Bankfull Dimensions	
37.8	x-section area (ft.sq.)
18.0	width (ft)
2.1	mean depth (ft)
2.7	max depth (ft)
19.9	wetted perimeter (ft)
1.9	hydraulic radius (ft)
8.5	width-depth ratio
52.9	W flood prone area (ft)
2.9	entrenchment ratio
1.9	low bank height ratio

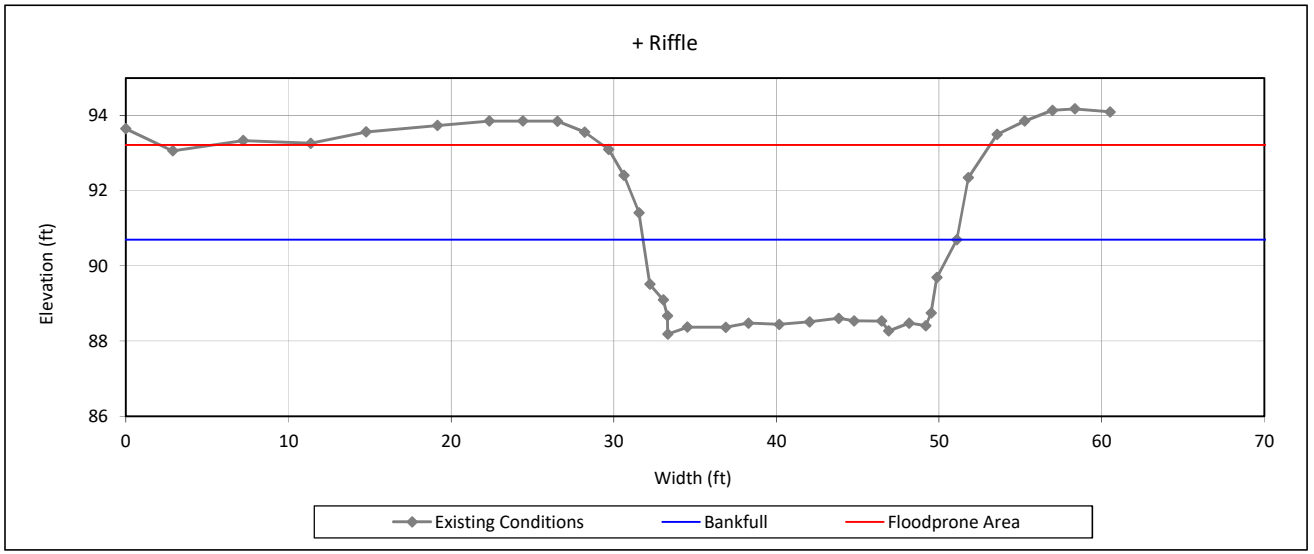
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS8 Riffle 4-Bull Creek Reach 3



Bankfull Dimensions	
39.5	x-section area (ft.sq.)
19.3	width (ft)
2.0	mean depth (ft)
2.5	max depth (ft)
22.2	wetted perimeter (ft)
1.8	hydraulic radius (ft)
9.4	width-depth ratio
27.0	W flood prone area (ft)
1.4	entrenchment ratio
2.3	low bank height ratio

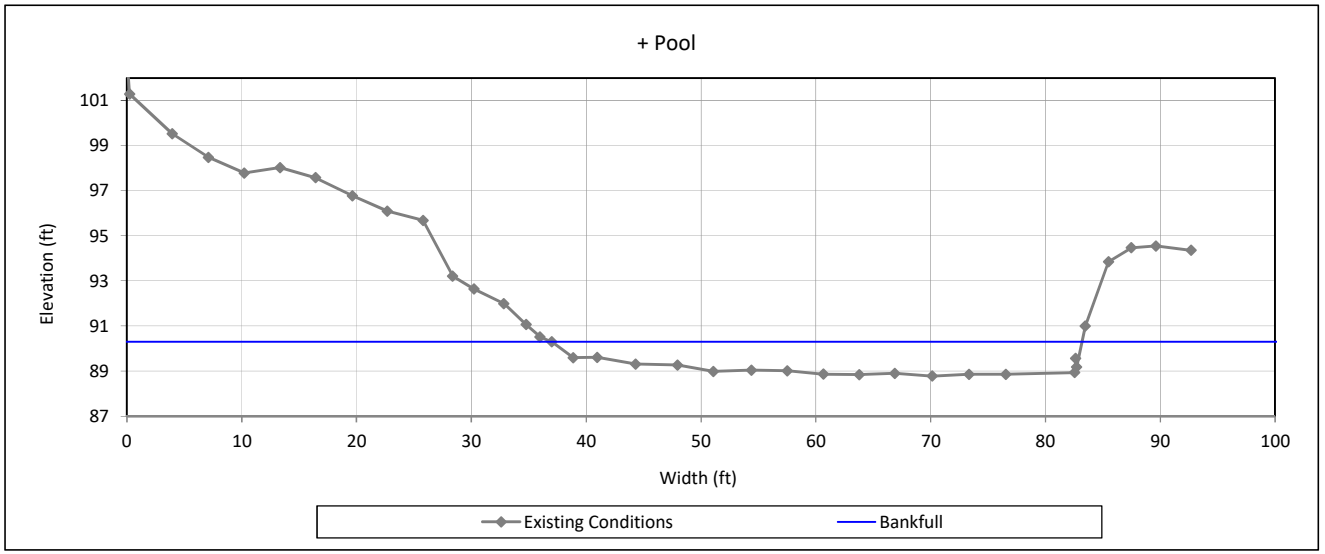
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS9 Pool-Bull Creek Reach 3



Bankfull Dimensions	
56.7	x-section area (ft.sq.)
46.2	width (ft)
1.2	mean depth (ft)
1.5	max depth (ft)
48.0	wetted perimeter (ft)
1.2	hydraulic radius (ft)
37.6	width-depth ratio

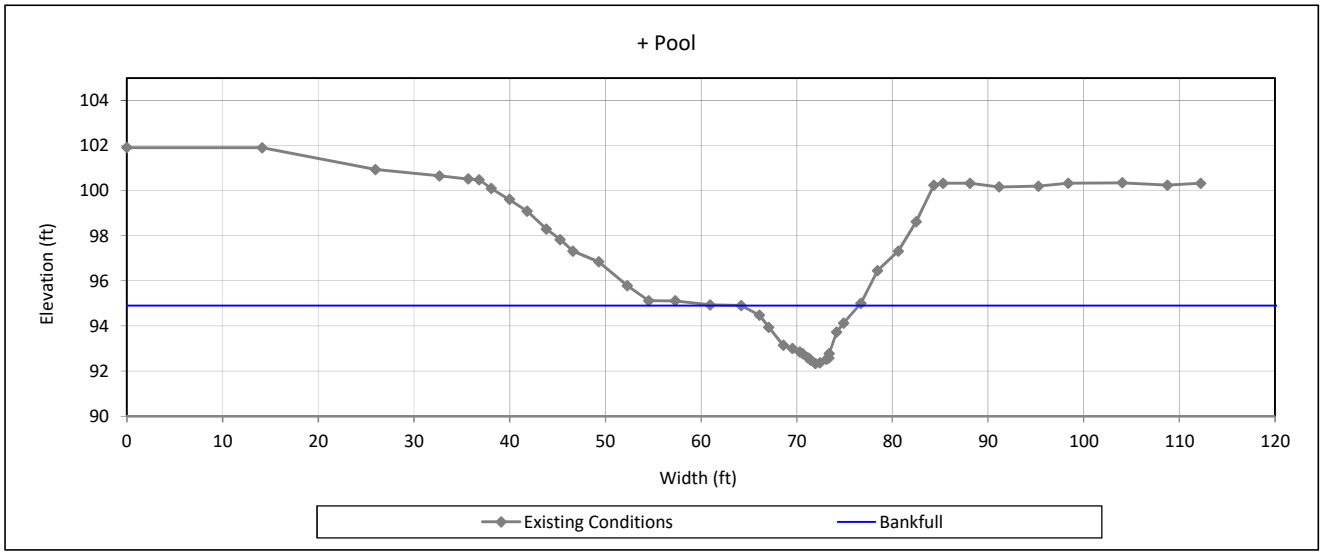
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS16 Pool-UT1



Bankfull Dimensions	
16.4	x-section area (ft.sq.)
12.8	width (ft)
1.3	mean depth (ft)
2.6	max depth (ft)
14.2	wetted perimeter (ft)
1.2	hydraulic radius (ft)
10.0	width-depth ratio

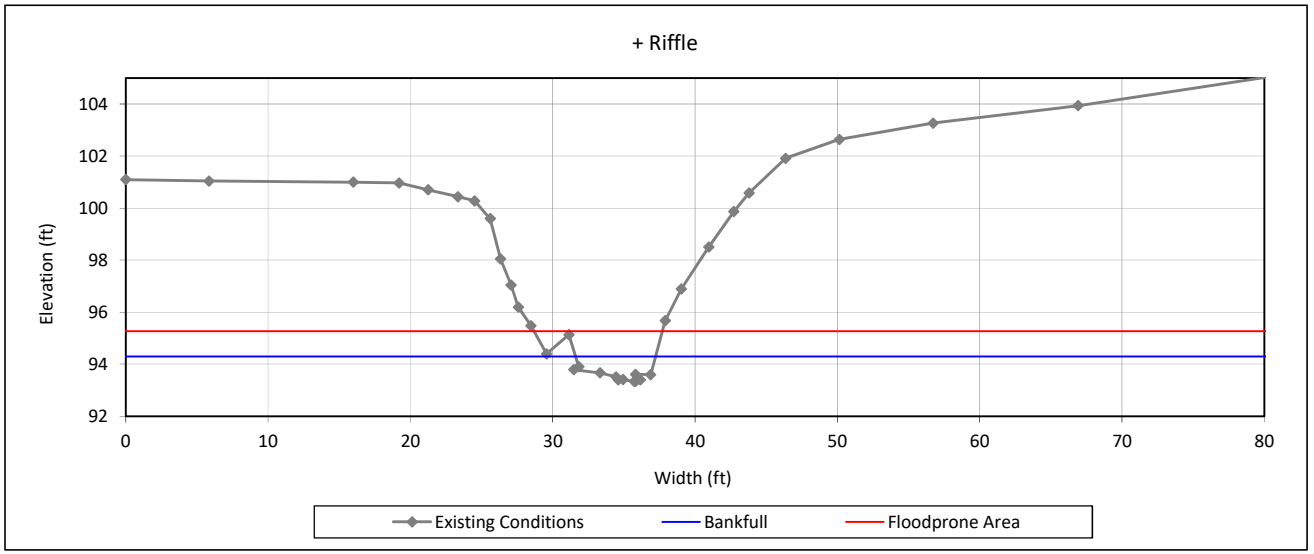
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS10 Riffle 1-UT1



Bankfull Dimensions	
3.9	x-section area (ft.sq.)
5.6	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
7.8	wetted perimeter (ft)
0.5	hydraulic radius (ft)
8.1	width-depth ratio
14.0	W flood prone area (ft)
2.5	entrenchment ratio
7.9	low bank height ratio

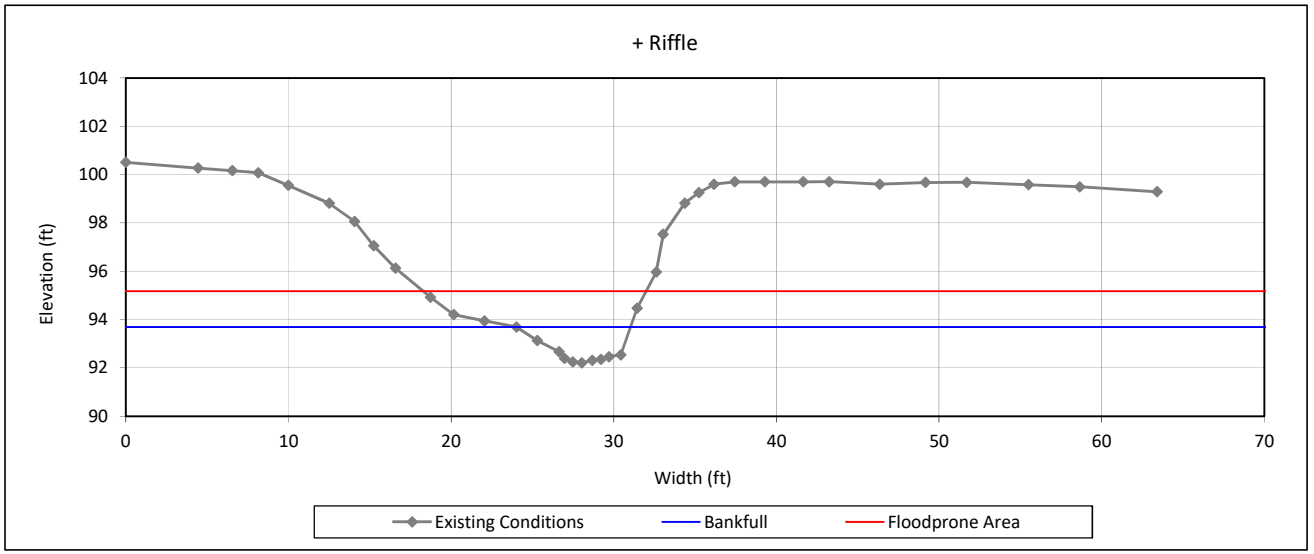
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS11 Riffle 2-UT1



Bankfull Dimensions	
6.8	x-section area (ft.sq.)
7.0	width (ft)
1.0	mean depth (ft)
1.5	max depth (ft)
8.1	wetted perimeter (ft)
0.8	hydraulic radius (ft)
7.3	width-depth ratio
17.1	W flood prone area (ft)
2.4	entrenchment ratio
5.0	low bank height ratio

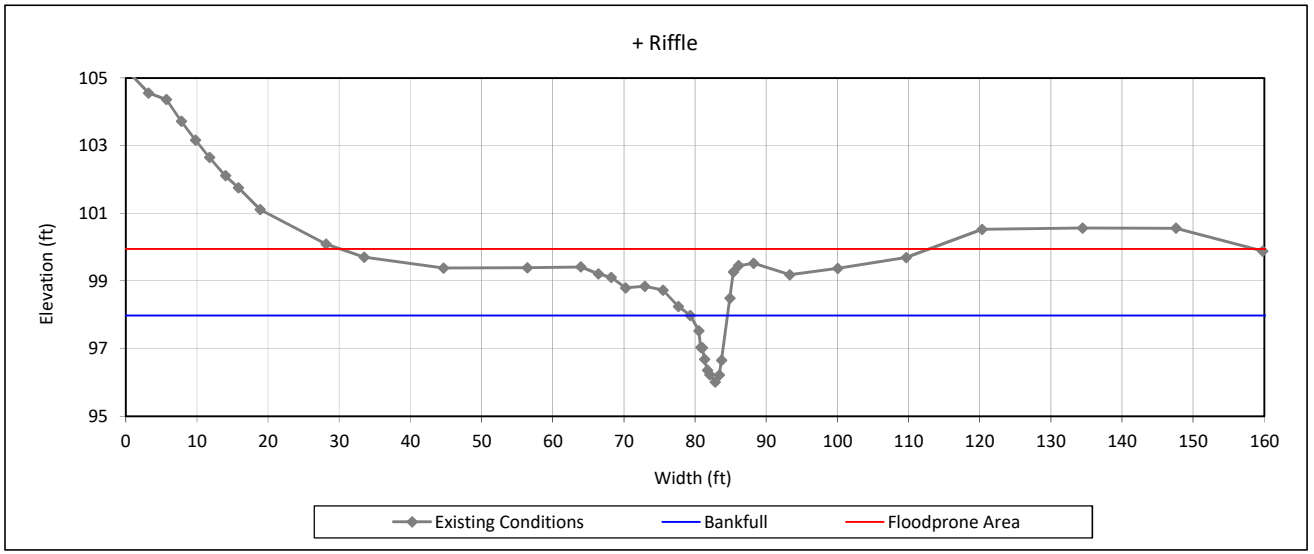
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS12 Riffle 1-UT2



Bankfull Dimensions	
5.7	x-section area (ft.sq.)
5.3	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
6.9	wetted perimeter (ft)
0.8	hydraulic radius (ft)
4.8	width-depth ratio
84.1	W flood prone area (ft)
16.0	entrenchment ratio
1.4	low bank height ratio

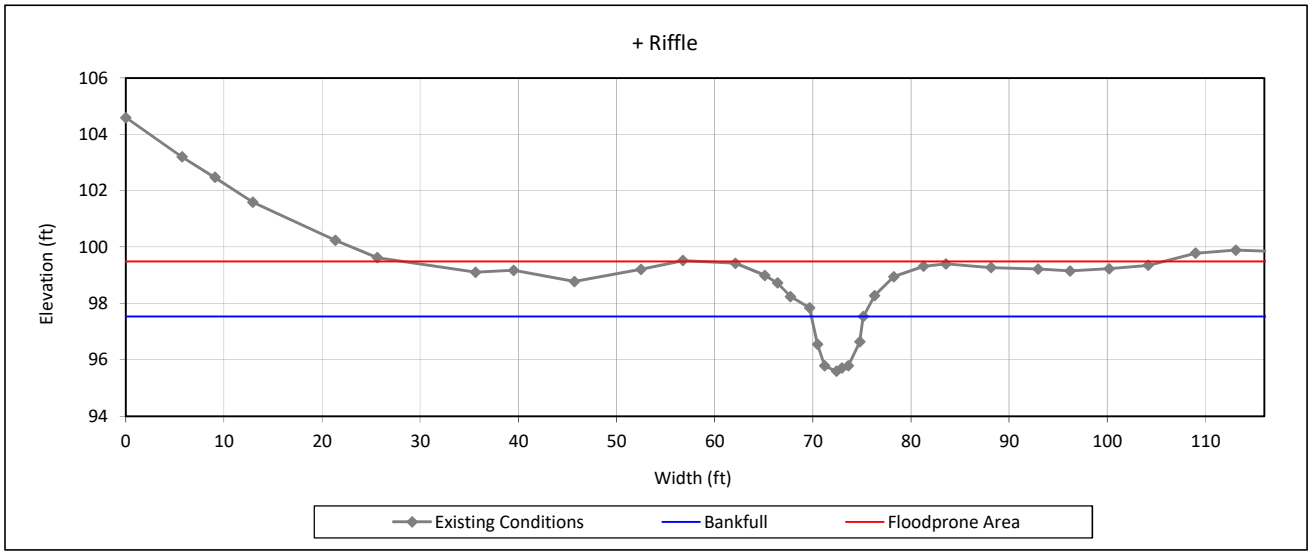
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS13 Riffle 2-UT2



Bankfull Dimensions	
7.4	x-section area (ft.sq.)
5.3	width (ft)
1.4	mean depth (ft)
1.9	max depth (ft)
7.1	wetted perimeter (ft)
1.1	hydraulic radius (ft)
3.7	width-depth ratio
111.5	W flood prone area (ft)
21.2	entrenchment ratio
1.9	low bank height ratio

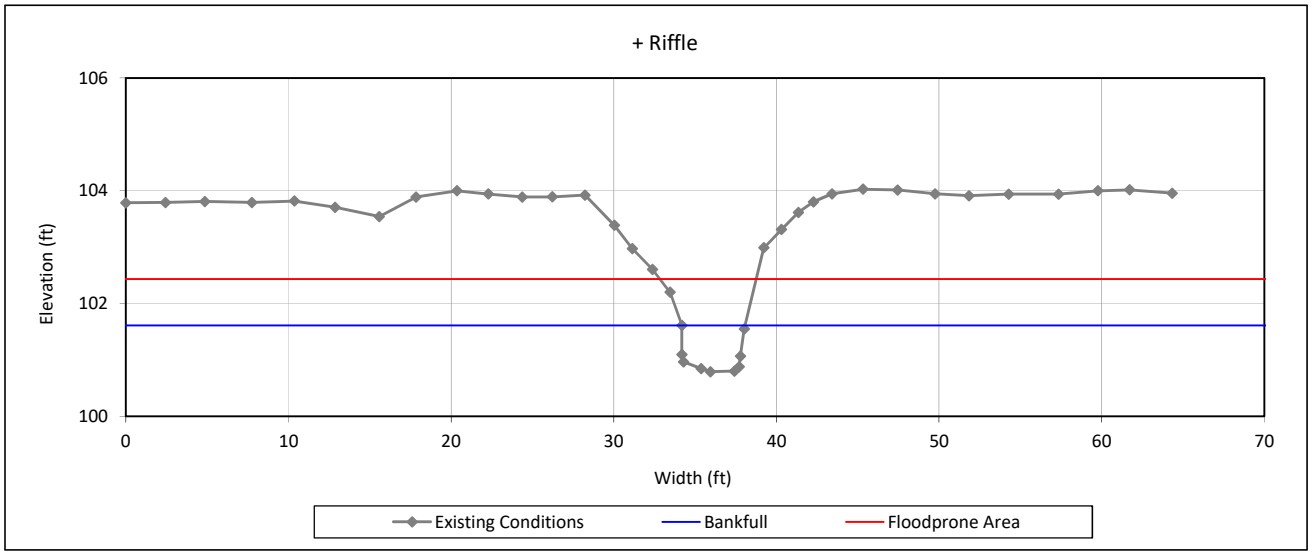
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS14 Riffle 1-UT3



Bankfull Dimensions	
2.8	x-section area (ft.sq.)
3.9	width (ft)
0.7	mean depth (ft)
0.8	max depth (ft)
4.9	wetted perimeter (ft)
0.6	hydraulic radius (ft)
5.4	width-depth ratio
13.7	W flood prone area (ft)
3.5	entrenchment ratio
3.8	low bank height ratio

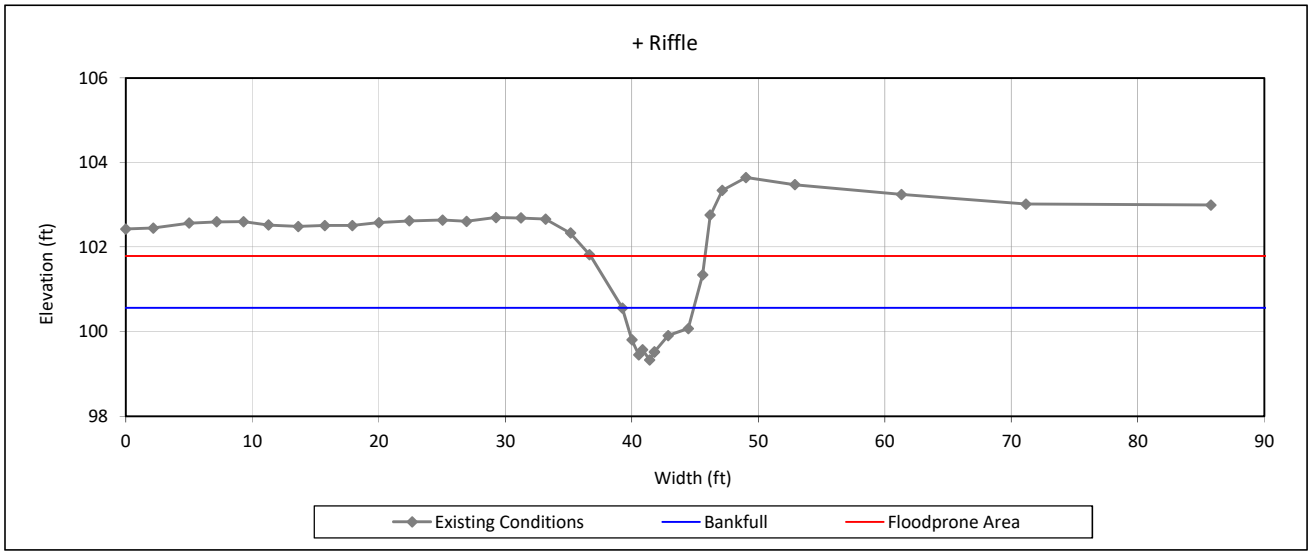
Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Key Mill Mitigation Site
NCDMS Project No. 100025
Existing Conditions - 2017

XS15 Riffle 2-UT3



Bankfull Dimensions	
4.1	x-section area (ft.sq.)
5.7	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
6.5	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.8	width-depth ratio
9.1	W flood prone area (ft)
1.6	entrenchment ratio
2.7	low bank height ratio

Survey Date: 12/2017
Field Crew: Wildlands Engineering

View Downstream

REFERENCE REACHES																						
Description	**Notation**	**Units**	**UT to Catawba R1**		**UT to Catawba R2**		**UT to Sandy Run**		**Box Creek**		**UT to Kelly Branch**		**UT to Gap Branch**		**UT to South Fork Catawba**		**Timber Trib**	
			min	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
stream type			E5		E3b/C3b		E4		C4		B4/B4a		B4a or A4		B4c		B4	
drainage area	DA	*sq mi*	1.60		1.60		0.15		2.13		0.08		0.04		0.23		0.05	
design discharge	Q	*cfs*	80		80		20		99		23		18.7		26	32	17	
bankfull cross-sectional area	A_{bkf}	*SF*	11.4	17.5	13.2		5.7	6.2	28.9		5.7		3.8		10.7	11.1	4.6	
average velocity during bankfull event	v_{bkf}	*fps*	5.5		6.1		3.4		3.4		5.9		5.0		2.7		3.7	
Cross-Section																		
width at bankfull	w_{bkf}	*feet*	9.7	12.4	12.3		7.3	7.8	23.5		7.9		6.2		8.2	11.2	8.9	
maximum depth at bankfull	d_{max}	*feet*	1.7		1.7		1.1	1.4	1.9		1.1		1.0		1.5	1.6	0.7	
mean depth at bankfull	d_{bkf}	*feet*	1.2	1.4	1.1		0.7	0.8	1.2		0.7		0.6		1.0	1.4	0.5	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		8.1	8.9	11.5		6.6	9.8	19.1		10.9		10.1		6.0	11.7	17.0	17.5
depth ratio	d_{max}/d_{bkf}	*feet*	1.2	1.4	1.6		1.6	1.8	3.6		1.3		1.7		2.1		1.3	1.4
bank height ratio	BHR		0.9	1.4	0.8	1.3	1.7	2.6	1.5		2.5		1.0		1.8	2.1	1.0	2.4
floodprone area width	w_{fpa}	*feet*	52.0	79.0	53.0		12.2	15.6	76.3		9.1		20.9		14.7	18.5	13.6	
entrenchment ratio	ER		5.4	6.4	4.3		1.6	2.1	3.3		1.2		3.4		1.5	1.9	1.5	
Slope																		
valley slope	S_{valley}	*feet/ foot*	0.0106		0.0290		0.0200		0.0225		0.0491		N/A		0.0080		0.0322	
channel slope	S_{chnl}	*feet/ foot*	0.0046		0.0270		0.0150		0.0084		0.0300 - 0.0650		0.0680		0.0067		N/A	
Profile																		
riffle slope	S_{riffle}	*feet/ foot*	0.0114	0.0605	0.0142	0.3451	0.0036	0.0420	0.0063	0.0770	N/A		0.0110	0.1400	0.0120	0.0320	0.0230	0.1700
riffle slope ratio	S_{riffle}/S_{chnl}		2.5	13.3	0.5	12.8	0.2	2.8	0.8	9.2	N/A		0.2	2.1	1.8	4.8	0.7	5.2
pool slope	S_p	*feet/ foot*	0.0012	0.0030	0.0025	0.0221	0.0000	0.0070	0.0210	0.0810	N/A		0.0041	0.0610	0.0000	0.0090	0.0000	0.0370
pool slope ratio	S_p/S_{chnl}		0.3	0.7	0.1	0.8	0.0	0.5	1.2	3.8	N/A		0.1	0.9	0.0	1.3	0.0	1.1
pool-to-pool spacing	L_{p-p}	*feet*	31	60	19	46	9	55	29	88	N/A		18	27	36	149	13	49
pool spacing ratio	L_{p-p}/w_{bkf}		2.8	5.4	1.6	3.8	1.3	7.0	1.2	3.8	N/A		3.0	4.4	3.7	15.3	1.4	5.6
pool cross-sectional area	A_{pool}	*SF*	18.1		N/A		5.5	8.7	49.9		N/A		7.1		15.0		N/A	
pool area ratio	A_{pool}/A_{bkf}		1.0	1.6	N/A		1.0	1.4	1.7		N/A		1.9		1.4		N/A	
maximum pool depth	d_{pool}	*feet*	2.5		N/A		1.3	1.5	4.4		N/A		1.5		2.4		N/A	
pool depth ratio	d_{pool}/d_{bkf}		1.8	2.1	N/A		1.9	1.9	3.6		N/A		2.5		2.1		N/A	
pool width at bankfull	w_{pool}	*feet*	10.4		N/A		7.6	9.2	18.8		N/A		6.1		10.0		N/A	
pool width ratio	w_{pool}/w_{bkf}		0.8	1.1	N/A		1.0	1.2	0.8		N/A		1.0		1.0		N/A	
Pattern																		
sinuosity	K		1.1		1.1		1.6		1.3		1.2		---		1.31		N/A	
belt width	w_{blt}	feet	55		23		24	60	62	88	18	34	N/A		25	56	N/A	
meander width ratio	w_{blt}/w_{bkf}		4.4	5.7	1.8		3.3	7.6	2.6	3.7	2.3	4.3	N/A		2.6	5.8	N/A	
linear wavelength (formerly meander length)	L_m	feet	65	107	52	79	63	72	39	76	27	94	N/A		54	151	N/A	
linear wavelength ratio (formerly meander length ratio)	L_m/w_{bkf}		6.7	8.6	4.2	6.4	8.6	9.2	1.7	3.2	N/A	N/A	N/A		5.6	15.6	N/A	
meander length		feet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A		N/A	N/A	N/A	
meander length ratio			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A		N/A	N/A	N/A	
radius of curvature	R_c	feet	31	56	29	52	14	29	7	38	8	26	N/A		9	28	N/A	
radius of curvature ratio	R_c/ w_{bkf}		2.8	5.1	2.4	4.2	1.9	3.8	0.3	1.6	N/A		N/A		0.9	2.9	N/A	
Particle Size Distribution from Reach-wide Pebble																		
d50 Description																		
	d_{16}	mm	0.3		0.5		0.062		4.1		N/A		0.37		8.9		0.49	
	d_{35}	mm	0.4		29.8		1		11		N/A		8		27		3.5	
	d_{50}	mm	1.8		75.9		19		22		N/A		19.02		38		6.5	
	d_{84}	mm	12.8		170.8		76		50		N/A		102.3		71		48.0	
	d_{95}	mm	25.2		332.0		150		78		N/A		256		150		83.0	
	d_{100}	mm	90.0		2048.0		N/A		N/A		N/A		>2048		---		128.0	

Design Morphology Paramaters			Bull Creek Reach 1A		Bull Creek Reach 1B		Bull Creek Reach 2		Bull Creek Reach 3		UT1B		UT1C	
	Notation	Units	Designed Conditions		Designed Conditions		Designed Conditions		Designed Conditions		Designed Conditions		Designed Conditions	
			min	max	min	max	min	max	min	max	min	max	min	max
stream type			C3		C3		C3b		C3		B4		B4a	
drainage area	DA	sq mi	1.63		1.68		1.79		2.02		0.16		0.16	
bankfull design discharge	Q_{bkf}	cfs	90.0		90.0		99.0		116.0		19.0		19.0	
Cross-Section Features														
bankfull cross-sectional area	A_{bkf}	SF	30.2		23.2		19.3		31.1		5.3		4.8	
side slopes	H:V	ft/ft	3.0		3.0		3.0		3.0		3.0		3.0	
channel bottom width	b_{bkf}	feet	5.1		6.1		5.8		9.0		3.7		4.1	
bankfull wetted perimeter	WP_{bkf}	feet	20.3		18.1		16.6		21.7		8.8		8.5	
bankfull hydraulic radius	r_{bkf}	feet	1.5		1.3		1.2		1.4		0.6		0.6	
mannings 'n'			0.050		0.050		0.050		0.050		0.050		0.050	
average velocity during bankfull event	v_{bkf}	fps	3.2		3.9		5.2		3.9		3.8		4.1	
width at bankfull	w_{bkf}	feet	19.5		17.5		16.0		21.0		8.5		8.3	
mean depth at bankfull	d_{bkf}	feet	1.6		1.3		1.2		1.5		0.6		0.6	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		12.6		13.2		13.3		14.2		13.8		14.5	
max depth at bankfull	d_{max}	feet	2.0	2.8	1.7	2.4	1.4	1.9	1.8	2.4	0.7	1.0	0.7	1.1
max depth ratio	d_{max}/d_{bkf}		1.3	1.8	1.3	1.8	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.9
bank height ratio	BHR		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
floodprone area width	w_{fpa}	feet	42.9	97.5	38.5	87.5	35.2	80.0	46.2	105.0	12.0	19.0	12.0	18.0
entrenchment ratio	ER		2.2	4.6	>2.2		6.3	7.8	>2.2		2.8	3.3	2.7	2.9
Slope														
valley slope	S_{valley}	feet/ foot	0.0086		0.0150		0.0295		0.0118		0.0335		0.0458	
channel slope	$S_{channel}$	feet/ foot	0.0069		0.0123		0.0242		0.0076	0.0114	0.0316		0.0425	
Riffle Features														
riffle slope	S_{riffle}	feet/ foot	0.0100	0.0148	0.0162	0.0203	0.0172	0.0318	0.0103	0.0171	0.0314	0.0801	0.0080	0.0526
riffle slope ratio	$S_{riffle}/S_{channel}$		1.5	2.2	1.3	1.7	0.7	1.3	1.4	2.1	1.0	2.5	1.0	1.2
Pool Features														
pool slope	S_{pool}	feet/ foot	0.0000	0.0014	0.0000	0.0023	0.0000	0.0059	0.0000	0.0034	0.0000	0.0127	0.0000	0.0170
pool slope ratio	$S_{pool}l/S_{channel}$		0.00	0.20	0.00	0.19	0.00	0.24	0.00	0.30	0.00	0.38	0.00	0.40
pool-to-pool spacing	L_{p-p}	feet	96.0	111.0	80.0	101.0	74.6	76.7	55.8	149.0	20.0	54.0	20.0	27.0
pool spacing ratio	L_{p-p}/w_{bkf}		4.9	5.7	4.6	5.8	4.7	4.8	2.7	7.1	2.3	6.4	2.4	3.3
maximum pool depth at bankfull	d_{pool}	feet	4.0	5.6	3.5	4.8	3.2	3.2	3.9	6.5	1.3	1.8	1.7	1.7
pool depth ratio	d_{pool}/d_{bkf}		2.6	3.6	2.7	3.7	2.7	2.7	2.6	4.3	2.1	3.0	2.8	2.8
pool width at bankfull	w_{pool}	feet	29.0	29.0	25.0	25.0	23.0	23.0	29.0	29.0	10.5	10.5	10.0	10.0
pool width ratio	w_{pool}/w_{bkf}		1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.2	1.2	1.2	1.2
Pattern Features														
sinuosity	K		1.3		1.2		1.2		1.3		1.1		1.1	
belt width	w_{blt}	feet	68.8	89.4	53.4	81.3	45.0	69.2	39.0	108.4	12.0	16.0	11.0	18.0
meander width ratio	w_{blt}/w_{bkf}		3.5	4.6	3.1	4.6	2.8	4.3	1.9	5.2	1.4	1.9	1.3	2.1
linear wavelength	LW	feet	140.3	181.4	146.4	172.1	110.8	161.5	125.0	229.0	42.0	78.0	42.0	50.0
linear wavelength ratio	LW/w_{bkf}		7.2	9.3	8.4	9.8	6.9	10.1	6.0	10.9	4.9	9.2	5.1	6.0
meander length	L_m	feet	192.2	207.2	179.2	199.8	149.3	171.4	177.0	312.4	41.0	77.0	41.0	48.0
meander length ratio	L_m/w_{bkf}		9.9	10.6	10.2	11.4	9.3	10.7	8.4	14.9	4.8	9.1	4.9	5.8
radius of curvature	R_c	feet	35.0	50.0	32.0	50.0	30.0	50.5	36.0	85.6	12.0	25.0	10.0	25.0
radius of curvature ratio	R_c/ w_{bkf}		1.8	2.6	1.8	2.9	1.9	3.2	1.7	4.1	1.4	2.9	1.2	3.0

Design Morphology Paramaters			UT2		UT2A		UT2B		UT2C		UT3B		UT3C	
	Notation	Units	Designed Conditions		Designed Conditions		Designed Conditions		Designed Conditions		Designed Conditions		Designed Conditions	
			min	max	min	max	min	max	min	max	min	max	min	max
stream type			B4		B4		C4b		C4		B4		C4	
drainage area	DA	sq mi	0.01		0.04		0.05		0.05		0.07		0.07	
bankfull design discharge	Q_{bkf}	cfs	3.0		7.0		7.0		7.0		12.0		12.0	
Cross-Section Features														
bankfull cross-sectional area	A_{bkf}	SF	0.9		2.7		2.6		3.2		3.6		4.7	
side slopes	H:V	ft/ft	3.0		2.0		2.0		2.0		3.0		2.7	
channel bottom width	b_{bkf}	feet	1.7		4.0		4.0		2.3		2.8		2.6	
bankfull wetted perimeter	WP_{bkf}	feet	3.6		6.2		6.2		7.1		7.2		7.8	
bankfull hydraulic radius	r_{bkf}	feet	0.2		0.6		0.4		0.5		0.5		0.6	
mannings 'n'			0.050		0.050		0.050		0.050		0.050		0.050	
average velocity during bankfull event	v_{bkf}	fps	3.0		2.7		2.4		2.2		3.3		2.4	
width at bankfull	w_{bkf}	feet	3.5		6.0		6.0		6.8		7.0		7.5	
mean depth at bankfull	d_{bkf}	feet	0.2		0.5		0.5		0.5		0.5		0.6	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14.2		13.3		13.3		12.9		13.7		12.0	
max depth at bankfull	d_{max}	feet	0.3	0.4	0.5	0.7	0.5	0.7	0.6	0.8	0.6	0.8	0.8	1.0
max depth ratio	d_{max}/d_{bkf}		1.2	1.6	1.2	1.6	1.2	1.5	1.2	1.6	1.2	1.6	1.2	1.6
bank height ratio	BHR		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
floodprone area width	w_{fpa}	feet	5.0	8.0	8.0	13.0	13.0	30.0	15.0	34.0	10.0	15.0	16.5	37.5
entrenchment ratio	ER		1.4	2.2	2.8	5.7	5.0	7.5	5.1	6.6	3.1	6.0	>2.2	
Slope														
valley slope	S_{valley}	feet/ foot	0.0731		0.0272		0.0234		0.0179		0.0329		0.0153	
channel slope	$S_{channel}$	feet/ foot	0.0681		0.0229	0.0387	0.0200		0.0135		0.0304	0.0363	0.0121	0.0146
Riffle Features														
riffle slope	S_{riffle}	feet/ foot	0.0457	0.0681	0.0287	0.0414	0.0135	0.0409	0.0135	0.0449	0.0385	0.0488	0.0198	0.0266
riffle slope ratio	$S_{riffle}/S_{channel}$		0.7	1.0	1.0	1.8	0.7	2.0	1.0	3.3	1.1	1.5	1.6	2.0
Pool Features														
pool slope	S_{pool}	feet/ foot	0.0000	0.0000	0.0000	0.0092	0.0000	0.0080	0.0000	0.0000	0.0000	0.0145	0.0000	0.0081
pool slope ratio	$S_{pool}/S_{channel}$		0.00	0.00	0.00	0.40	0.00	0.40	0.00	0.00	0.00	0.40	0.00	0.40
pool-to-pool spacing	L_{p-p}	feet	21.0	21.0	22.0	33.0	23.0	44.0	30.0	47.0	24.0	29.0	31.0	58.0
pool spacing ratio	L_{p-p}/w_{bkf}		5.7	5.7	3.6	5.5	3.9	7.4	4.4	7.0	3.4	4.1	4.1	7.7
maximum pool depth at bankfull	d_{pool}	feet	1.6	1.6	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.9	1.9
pool depth ratio	d_{pool}/d_{bkf}		8.0	8.0	2.6	2.6	2.8	2.8	2.9	2.9	3.2	3.2	3.2	3.2
pool width at bankfull	w_{pool}	feet	4.3	4.3	7.5	7.5	8.0	8.0	8.5	8.5	8.5	8.5	11.0	11.0
pool width ratio	w_{pool}/w_{bkf}		1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.5	1.5
Pattern Features														
sinuosity	K		N/A*		1.1		1.2		1.3		1.1		1.2	
belt width	w_{blt}	feet	N/A	N/A	10.0	18.0	19.0	26.0	23.0	34.0	11.0	19.0	17.2	44.8
meander width ratio	w_{blt}/w_{bkf}		N/A	N/A	1.7	3.0	3.2	4.3	3.3	4.9	1.6	2.7	2.2	6.0
linear wavelength	LW	feet	N/A	N/A	47.0	56.0	50.0	65.0	60.0	70.0	44.0	52.0	63.8	91.0
linear wavelength ratio	LW/w_{bkf}		N/A	N/A	7.8	9.3	8.3	10.8	8.9	10.2	6.3	7.4	8.5	12.1
meander length	L_m	feet	N/A	N/A	48.0	65.0	56.0	76.0	73.0	90.0	48.0	54.0	65.2	118.0
meander length ratio	L_m/w_{bkf}		N/A	N/A	8.0	10.8	9.3	12.7	10.8	13.2	6.8	7.7	8.7	15.7
radius of curvature	R_c	feet	N/A	N/A	13.0	18.0	12.0	15.0	13.0	17.0	10.0	25.0	12.0	22.0
radius of curvature ratio	R_c/w_{bkf}		N/A	N/A	2.2	3.0	2.0	2.5	1.9	2.5	1.4	3.6	1.6	2.9

*Reach too short for pattern features to be calculated.

Appendix 5 – Categorical Exclusion and Resource Agency Correspondence

Key Mill Mitigation Site

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Key Mill Mitigation Site
County Name:	Surry County
EEP Number:	100025
Project Sponsor:	Wildlands Engineering, Inc
Project Contact Name:	Andrea S. Eckardt
Project Contact Address:	1430 South Mint Street, Suite 104, Charlotte, NC 28203
Project Contact E-mail:	aeckardt@wildlandseng.com
EEP Project Manager:	Matthew Reid

Project Description

The Key Mill Mitigation Site is a stream mitigation project located approximately 7 miles south of the Town of Mt. Airy and 8 miles northeast of the Town of Pilot Mountain in Surry County, NC. The project includes Bull Creek and four unnamed tributaries to Bull Creek for a total of 8,155 linear feet of stream. Historically the site has been used for cattle and other agricultural uses. The site is currently used for grazing cattle. The project will provide stream mitigation units to the Division of Mitigation Services in the Yadkin River Basin (03040101).

For Official Use Only

Reviewed By:

9/25/2017
Date


EEP Project Manager

Conditional Approved By:

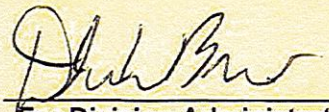
Date

For Division Administrator
FHWA

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

Final Approval By:

9-22-17
Date


For Division Administrator
FHWA

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

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

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

Key Mill Mitigation Site
Categorical Exclusion

SUMMARY

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

As the Key Mill Mitigation Site is a full-delivery project; an EDR Radius Map Report with Geocheck was ordered for the site through Environmental Data Resources, Inc on July 21, 2017. Neither the target property nor the adjacent properties were listed in any of the Federal, State, or Tribal environmental databases searched by the EDR. The assessment revealed no evidence of any "recognized environmental conditions" in connection with the target property. The Executive Summary of the EDR report is included in the Appendix. The full report is available if needed.

National Historic Preservation Act (Section 106)

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

Wildlands Engineering, Inc. (Wildlands) requested review and comment from the State Historic Preservation Office (SHPO) with respect to any archeological and architectural resources related to the Key Mill Mitigation Site on July 24, 2017. SHPO responded on August 10, 2017 and stated they were aware of "no historic resources which would be affected by the project" and would have no further comment. All correspondence related to Section 106 is included in the Appendix.

Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)

These acts, collectively known as the Uniform Act, provide for uniform and equitable treatment of persons displaced from their homes, businesses, non-profit associations, or farms by federal and federally-assisted programs, and establish uniform and equitable land acquisition policies.

Key Mill Mitigation Site is a full-delivery project that includes land acquisition. Notification of the fair market value of the project property and the lack of condemnation authority by Wildlands was included in the signed Option Agreement for the project property. A copy of the relevant section of the Option Agreement is included in the Appendix.

Endangered Species Act (ESA)

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.

The Surry County listed endangered species includes the Northern long-eared bat (NLEB) (*Myotis septentrionalis*), the Small Whorled pogonia (*Isotria medeoloides*), Schweinitz's sunflower (*Helianthus schweinitzii*), and the Bog turtle (*Glyptemys muhlenbergii*). The USFWS does not currently list any Critical Habitat Designations for the Federally-listed species within Surry County nor are there any known occurrences of the NLEB documented within the County (https://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html). The project site is over 70 miles from the nearest known hibernaculum for the NLEB.

A pedestrian survey conducted on September 14, 2017, indicated that the Site provides suitable habitat for Schweinitz's sunflower, small whorled pogonia, and summer roosting habitat for the Northern long-eared bat but no species were identified on the site. Therefore, due to the absence of the listed species on the site, the project has been determined by Wildlands to have "no effect" on the Schweinitz's sunflower and small whorled pogonia and is "may effect" the Northern long-eared bat.

Wildlands requested review and comment from the United States Fish and Wildlife Service (USFWS) on July 24, 2017 in respect to the Key Mill Mitigation Site and its potential impacts on threatened or endangered species. Included in this request was a completed NLEB 4(d) Rule Streamlined Consultation Form. USFWS has not responded at this time. All documents submitted to the USFWS are included in the Appendix.

Farmland Protection Policy Act (FPPA)

The FPPA requires that, before taking or approving any federal action that would result in conversion of farmland, the agency must examine the effects of the action using the criteria set forth in the FPPA, and, if there are adverse effects, must consider alternatives to lessen them.

The Key Mill Mitigation Site includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resources Conservation Service (NRCS). The completed form and correspondence documenting its submittal is included in the Appendix.

Fish and Wildlife Coordination Act (FWCA)

The FWCA requires consultation with the USFWS and the appropriate state wildlife agency on projects that alter or modify a water body. Reports and recommendations prepared by these agencies document project effects on wildlife and identify measures that may be adopted to prevent loss or damage to wildlife resources.

The Key Mill Mitigation Site includes stream restoration. Wildlands requested comment on the project from both the USFWS and the North Carolina Wildlife Resources Commission (NCWRC) on July 24, 2017. NCWRC responded on August 11, 2017 and stated that the project would "not impact wild trout resources or other known significant aquatic resources". USFWS has not responded at this time. All correspondence with the two agencies is included in the Appendix.

Migratory Bird Treaty Act (MBTA)

The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute a taking.

Wildlands requested comment on the Key Mill Stream Mitigation Site from the USFWS in regards to migratory birds on June 24, 2017. The USFWS has not responded at this time. All correspondence with USFWS is included in the Appendix.

Key Mill Mitigation Site
Categorical Exclusion

APPENDIX

Key Mill
Key Road
Ararat, NC 27007

Inquiry Number: 5000150.6s
July 21, 2017

EDR Summary Radius Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

KEY ROAD
ARARAT, NC 27007

COORDINATES

Latitude (North):	36.3958850 - 36˚ 23' 45.18''
Longitude (West):	80.6033900 - 80˚ 36' 12.20''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	535566.9
UTM Y (Meters):	4027730.8
Elevation:	1104 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	TP
Source:	U.S. Geological Survey

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140524
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
KEY ROAD
ARARAT, NC 27007

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION

NO MAPPED SITES FOUND

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

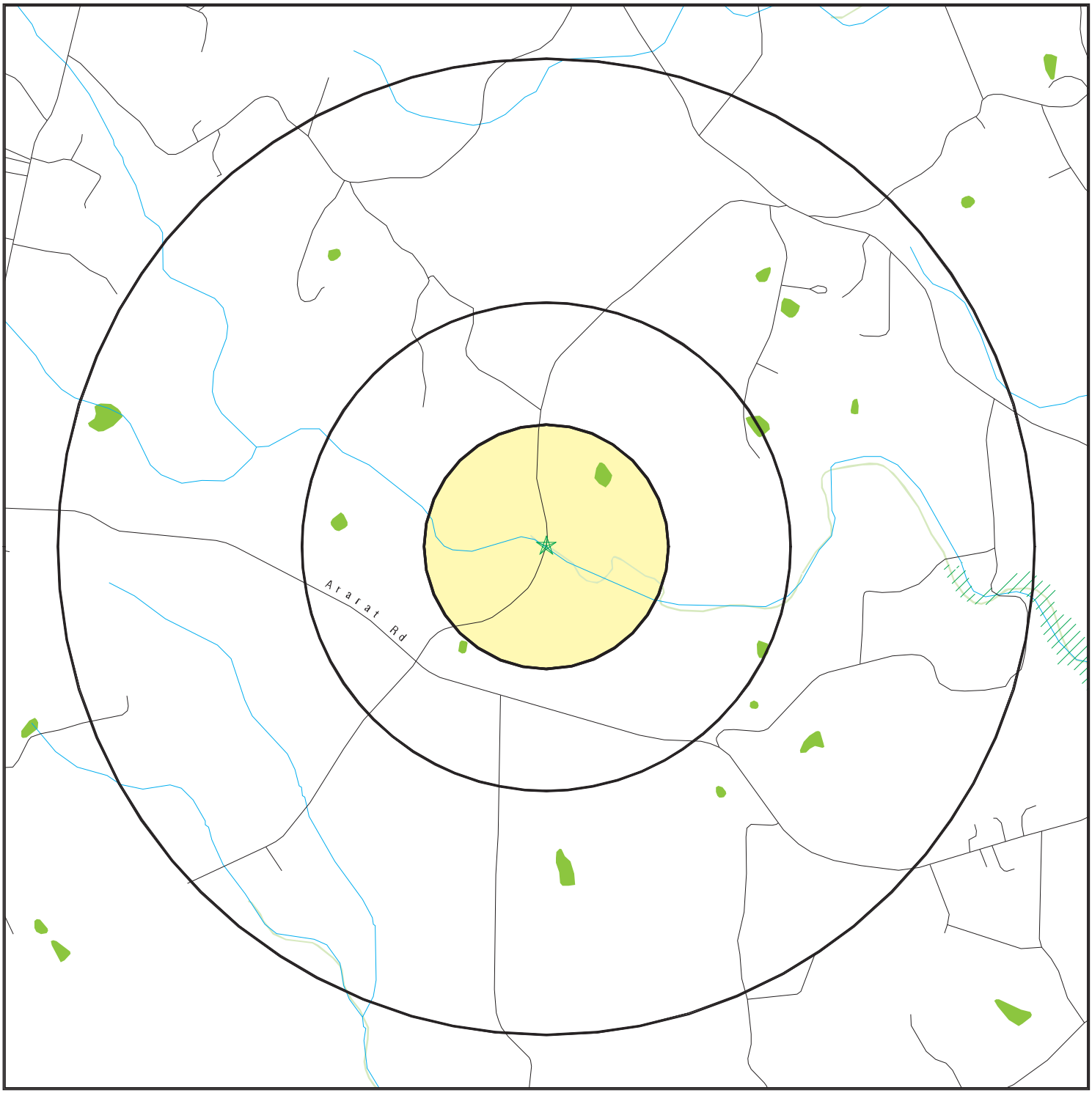
Unmappable (orphan) sites are not considered in the foregoing analysis.

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

OVERVIEW MAP - 5000150.6S



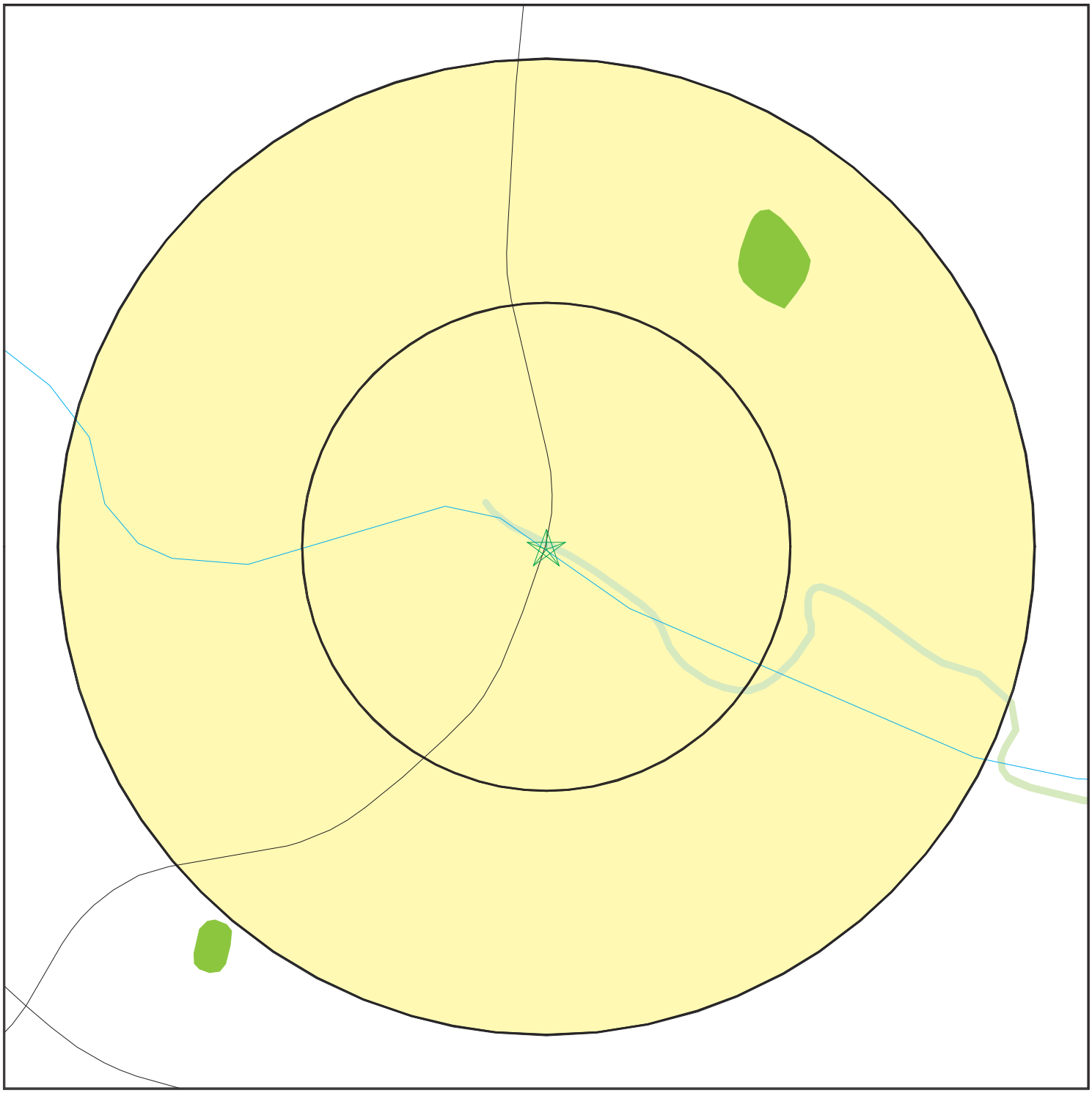
0 1/4 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Upgradient Area
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Key Mill ADDRESS: Key Road Ararat NC 27007 LAT/LONG: 36.395885 / 80.60339	CLIENT: Wildlands Eng, Inc. CONTACT: Lucie Law INQUIRY #: 5000150.6s DATE: July 21, 2017 10:53 am

DETAIL MAP - 5000150.6S



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

0 1/16 1/8 1/4 Miles

- Indian Reservations BIA
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Key Mill ADDRESS: Key Road Ararat NC 27007 LAT/LONG: 36.395885 / 80.60339	CLIENT: Wildlands Eng, Inc. CONTACT: Lucie Law INQUIRY #: 5000150.6s DATE: July 21, 2017 10:56 am

MAP FINDINGS SUMMARY

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

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.500		0	0	0	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

WILDLANDS
ENGINEERING

July 24, 2017

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: Key Mill Mitigation Site
Surry County, North Carolina

Dear Ms. Gledhill-Earley,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the Key Mill Mitigation Site. A USGS Topographic Map and an Overview Site Map with approximate project areas are enclosed.

The Key Mill Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on Bull Creek and several unnamed tributaries to Bull Creek. The site has historically been disturbed due to agricultural use, including both cattle and row crops.

We ask that you review this site based on the attached information to determine the presence of any historic properties.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the project.

Sincerely,

Lucie Law
Environmental Scientist

Attachment:
USGS Topographic Map
Overview Site Map

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

August 10, 2017

Lucie Law
Wildlands Engineering
430 South Mint Street, Suite 104
Charlotte, NC 28203
llaw@wildlandseng.com

Re: Key Mill Mitigation Site, on Bull Creek and several tributaries, Surry County (ER 17-1345)

Dear Ms. Law:

Thank you for your letter of July 24, 2017, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or renee.gledhill-earley@ncdcr.gov. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Ramona M. Bartos

With a copy to:

Michael Key	and	Jason & Marsh Smith
mkey@triad.rr.com		jsmith@southlandtransportation.com

Notice of change of address shall be given by written notice in the manner described in this paragraph.

3.3 **Assignment.** Buyer has the right to assign this agreement without the consent of Seller. No assignment shall be effective unless the assignee has delivered to Seller a written assumption of Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

3.4 **Value of Conservation Easement; No Power of Eminent Domain.** In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer hereby notifies Seller that: (i) Buyer believes that the fair market value of the Conservation Easement is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

3.5 **Modification; Waiver.** No amendment of this agreement will be effective unless it is in writing and signed by the parties. No waiver of satisfaction of a condition or failure to comply with an obligation under this agreement will be effective unless it is in writing and signed by the party granting the waiver, and no such waiver will constitute a waiver of satisfaction of any other condition or failure to comply with any other obligation.

3.6 **Attorneys' Fees.** If either party commences an action against the other to interpret or enforce any of the terms of this agreement or because of the breach by the other party of any of the terms of this agreement, the losing party shall pay to the prevailing party reasonable attorneys' fees, expenses, court costs, litigation costs and any other expenses incurred in connection with the prosecution or defense of such action, whether or not the action is prosecuted to a final judgment.

3.7 **Memorandum of Option Agreement.** Concurrently with the signing of this agreement, Buyer and Seller agree to sign a Memorandum of Option that will be recorded against the Property in the Register of Deeds in the County stated in paragraph A within five days after the Effective Date.

3.8 **Tax Deferred Exchange**. If Seller desires to implement a tax-deferred exchange (the "**Exchange**") in connection with Buyer's purchase of the Conservation Easement, the parties agree to cooperate in affecting the Exchange. Seller is responsible for all additional costs associated with the Exchange and Buyer shall not have any additional liability with respect to the Exchange. The parties will execute any additional documents required for the Exchange at no cost to Buyer.

3.9 **Brokers**. Shawn D. Wilkerson and Robert W. Bugg are North Carolina Real Estate Brokers. Neither Buyer nor Seller has incurred any liability for any brokerage fee, commission or finder's fee in connection with this agreement or the transactions contemplated by this agreement.

3.10 **Entire Agreement.** Each party acknowledges they are not relying on any statements made by the other party, other than in this agreement, regarding the subject matter of this agreement. Neither party will have a basis for bringing any claim for fraud in connection with any such statements.

3.11 **Mutual Agreement.** This is a mutually negotiated agreement and regardless of which party was more responsible for its preparation, this agreement shall be construed neutrally between the parties.

Buyer
Seller

WILDLANDS
ENGINEERING

July 24, 2017

Marella Buncick
US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801

Subject: Key Mill Mitigation Site
Surry County, North Carolina

Dear Ms. Buncick,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to endangered species, migratory birds, or other trust resources associated with the proposed Key Mill Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Mount Airy South, 7.5-Minute USGS Topographic Quadrangles.

The Key Mill Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on Bull Creek and several unnamed tributaries to Bull Creek. The site has historically been disturbed due to agricultural use, including both cattle and crops.

According to your website (https://www.fws.gov/raleigh/species/cntylist/surry.html) the threatened or endangered species for Surry County are: the Small Whorled pogonia (*Isotria medeoloides*), Schweinitz's sunflower (*Helianthus schweinitzii*), Bog turtle (*Glyptemys muhlenbergii*), and the Northern long-eared bat (*Myotis septentrionalis)*. Due to the recent listing of the bat, we have also included a completed Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form as additional documentation.

If we have not heard from you in 30 days, we will assume that you do not have any comments regarding associated laws and that you do not have any information relevant to this project at the current time.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Lucie Law
Environmental Scientist

Attachment:
USGS Topographic Map and Overview Site Map

Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form

Federal agencies should use this form for the optional streamlined consultation framework for the northern long-eared bat (NLEB). This framework allows federal agencies to rely upon the U.S. Fish and Wildlife Service's (USFWS) January 5, 2016, intra-Service Programmatic Biological Opinion (BO) on the final 4(d) rule for the NLEB for section 7(a)(2) compliance by: (1) notifying the USFWS that an action agency will use the streamlined framework; (2) describing the project with sufficient detail to support the required determination; and (3) enabling the USFWS to track effects and determine if reinitiation of consultation is required per 50 CFR 402.16.

This form is not necessary if an agency determines that a proposed action will have no effect to the NLEB or if the USFWS has concurred in writing with an agency's determination that a proposed action may affect, but is not likely to adversely affect the NLEB (i.e., the standard informal consultation process). Actions that may cause prohibited incidental take require separate formal consultation. Providing this information does not address section 7(a)(2) compliance for any other listed species.

Information to Determine 4(d) Rule Compliance:	**YES**	**NO**
1. Does the project occur wholly outside of the WNS Zone[1]?	☐	☒
2. Have you contacted the appropriate agency[2] to determine if your project is near known hibernacula or maternity roost trees?	☒	☐
3. Could the project disturb hibernating NLEBs in a known hibernaculum?	☐	☒
4. Could the project alter the entrance or interior environment of a known hibernaculum?	☐	☒
5. Does the project remove any trees within 0.25 miles of a known hibernaculum at any time of year?	☐	☒
6. Would the project cut or destroy known occupied maternity roost trees, or any other trees within a 150-foot radius from the maternity roost tree from June 1 through July 31.	☐	☒

You are eligible to use this form if you have answered yes to question #1 **or** yes to question #2 **and** no to questions 3, 4, 5 and 6. The remainder of the form will be used by the USFWS to track our assumptions in the BO.

Agency and Applicant[3] (Name, Email, Phone No.): FHWA, Donnie Brew, donnie.brew@dot.gov, 919-747-7017; Andrea Eckardt, aeckardt@wildlandseng.com, 704-332-7754 ext 101

Project Name: Key Mill Mitigation Site

Project Location (include coordinates if known): 36.3958850 (N), 80.6033900 (W)

Basic Project Description (provide narrative below or attach additional information):
The Key Mill Mitigation Site is a stream mitigation project located approximately 7 miles south of the Town of Mt. Airy and 8 miles northeast of the Town of Pilot Mountain in Surry County, NC. The project includes Bull Creek and four unnamed tributaries to Bull Creek for a total of 8,155 linear feet of stream. Historically the site has been used for cattle and other agricultural uses. The site is currently used for grazing cattle. The project will provide stream mitigation units to the Division of Mitigation Services in the Yadkin River Basin (03040101). Construction of the stream restoration project will include some tree removal (>3"DBH) – approximately 1.75 acres.

---

[1] http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf
[2] See http://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html
[3] If applicable - only needed for federal actions with applicants (e.g., for a permit, etc.) who are party to the consultation.

General Project Information	YES	NO
Does the project occur within 0.25 miles of a known hibernaculum?	☐	☒
Does the project occur within 150 feet of a known maternity roost tree?	☐	☒
Does the project include forest conversion[4]? (if yes, report acreage below)	☒	☐
Estimated total acres of forest conversion	1.75 ac	
If known, estimated acres[5] of forest conversion from April 1 to October 31	1.00 ac	
If known, estimated acres of forest conversion from June 1 to July 31[6]		
Does the project include timber harvest? (if yes, report acreage below)	☐	☒
Estimated total acres of timber harvest		
If known, estimated acres of timber harvest from April 1 to October 31		
If known, estimated acres of timber harvest from June 1 to July 31		
Does the project include prescribed fire? (if yes, report acreage below)	☐	☒
Estimated total acres of prescribed fire		
If known, estimated acres of prescribed fire from April 1 to October 31		
If known, estimated acres of prescribed fire from June 1 to July 31		
Does the project install new wind turbines? (if yes, report capacity in MW below)	☐	☒
Estimated wind capacity (MW)		

Agency Determination:

By signing this form, the action agency determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule.

If the USFWS does not respond within 30 days from submittal of this form, the action agency may presume that its determination is informed by the best available information and that its project responsibilities under 7(a)(2) with respect to the NLEB are fulfilled through the USFWS January 5, 2016, Programmatic BO. The action agency will update this determination annually for multi-year activities.

The action agency understands that the USFWS presumes that all activities are implemented as described herein. The action agency will promptly report any departures from the described activities to the appropriate USFWS Field Office. The action agency will provide the appropriate USFWS Field Office with the results of any surveys conducted for the NLEB. Involved parties will promptly notify the appropriate USFWS Field Office upon finding a dead, injured, or sick NLEB.

Signature: _____ Date Submitted: 9-21-17

[4] Any activity that temporarily or permanently removes suitable forested habitat, including, but not limited to, tree removal from development, energy production and transmission, mining, agriculture, etc. (see page 48 of the BO).
[5] If the project removes less than 10 trees and the acreage is unknown, report the acreage as less than 0.1 acre.
[6] If the activity includes tree clearing in June and July, also include those acreage in April to October.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*		Date Of Land Evaluation Request 08/03/2017	
Name of Project Key Mill Mitigation Site		Federal Agency Involved NC Division of Mitigation Services	
Proposed Land Use Stream Restoration		County and State Surry County, NC	
PART II *(To be completed by NRCS)*		Date Request Received By NRCS 08/03/2017	Person Completing Form: Milton Cortes, NRCS NC
Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☐ NO ☐	Acres Irrigated none	Average Farm Size 101 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 54% % 187, 236 acres	Amount of Farmland As Defined in FPPA Acres: 44.8 % % 155,337 acres	
Name of Land Evaluation System Used Surry Co. NC LESA	Name of State or Local Site Assessment System N/A	Date Land Evaluation Returned by NRCS August 11, 2017 by eMail	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	19.3			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	19.3	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	12.40			
B. Total Acres Statewide Important or Local Important Farmland	0			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.0080			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	12%			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)	58			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	15			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	12			
4. Protection Provided By State and Local Government	(20)	20			
5. Distance From Urban Built-up Area	(15)	15			
6. Distance To Urban Support Services	(15)	10			
7. Size Of Present Farm Unit Compared To Average	(10)	10			
8. Creation Of Non-farmable Farmland	(10)	0			
9. Availability Of Farm Support Services	(5)	5			
10. On-Farm Investments	(20)	10			
11. Effects Of Conversion On Farm Support Services	(10)	0			
12. Compatibility With Existing Agricultural Use	(10)	0			
TOTAL SITE ASSESSMENT POINTS	160	107	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	58	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	107	0	0	0
TOTAL POINTS ***(Total of above 2 lines)***	260	165	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

Andrea Eckardt

From: Andrea Eckardt
Sent: Thursday, September 14, 2017 1:18 PM
To: 'milton.cortes@nc.usda.gov'
Subject: FW: Request for AD1006 Form - Key Mill Mitigation Site- Surry County, NC
Attachments: Key Mill AD1006.pdf

Importance: High

Milton
Attached is the completed AD1006 form for the Key Mill Mitigation Site for your files.

Thanks for your help.

Andrea

Andrea S. Eckardt | *Senior Environmental Planner*
704.332.7754 x101

From: Lucie Law
Sent: Thursday, September 14, 2017 1:15 PM
To: Andrea Eckardt <aeckardt@wildlandseng.com>
Subject: FW: Request for AD1006 Form - Key Mill Mitigation Site- Surry County, NC
Importance: High

From: Cortes, Milton - NRCS, Raleigh, NC [mailto:Milton.Cortes@nc.usda.gov]
Sent: Thursday, August 10, 2017 8:41 PM
To: Lucie Law <llaw@wildlandseng.com>
Subject: RE: Request for AD1006 Form - Key Mill Mitigation Site- Surry County, NC
Importance: High

Ms. Law;

Please find attached the Farmland Impact Rating evaluation for the Key Mill Mitigation Site- Surry County, NC

If we can be of further assistance please let us know.

Cordially;

Milton Cortes
Assistant State Soil Scientist
USDA Natural Resources Conservation Service
4407 Bland Rd, Suite 117
Raleigh, NC 27609
Phone: 919-873-2171
milton.cortes@nc.usda.gov

From: Lucie Law [mailto:llaw@wildlandseng.com]
Sent: Thursday, August 03, 2017 8:16 AM
To: Cortes, Milton - NRCS, Raleigh, NC <Milton.Cortes@nc.usda.gov>
Subject: Request for AD1006 Form - Key Mill Mitigation Site- Surry County, NC

Hi Milton,

I have a request for a completed AD-1006 form for a NCDENR Division of Mitigation Services (DMS) stream restoration project (Key Mill Mitigation Site) located in Surry County. Please find a Vicinity map and Soils Map attached in addition to the AD-1006 form with Parts I and III filled out. The soil breakdown is included on the soil map.

Thank you for your assistance and please let me know if you need any additional information.

Lucie Law | *Environmental Scientist*
O: 704.332.7754 x107
M: 276.492.8709

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

WILDLANDS
ENGINEERING

July 24, 2017

Shannon Deaton
North Carolina Wildlife Resource Commission
Division of Inland Fisheries
1721 Mail Service Center
Raleigh, NC 27699

Subject: Key Mill Mitigation Site
Surry County, North Carolina

Dear Ms. Deaton,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with the proposed Key Mill Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Mount Airy South, 7.5-Minute USGS Topographic Quadrangles.

The Key Mill Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on Bull Creek and several unnamed tributaries to Bull Creek. The site has historically been disturbed due to agricultural use, including both cattle and row crops.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Lucie Law
Environmental Scientist

Attachment:
USGS Topographic Map
Overview Site Map

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

August 11, 2017

Lucy Law
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

SUBJECT: Key Mill Mitigation Site

Dear Ms. Law:

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) received your July 24, 2017 letter regarding plans for a stream restoration project on Bull Creek and unnamed tributaries in Surry County. You requested review and comment on the project. Our comments on this project are offered for your consideration under provisions of the Clean Water Act of 1977 (33 U.S.C. 466 et. seq.) and Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d).

The project will involve the restoration of approximately 8,155 feet of degraded streams. This project should not impact wild trout resources or other known significant aquatic resources.

We recommend that riparian buffers that are to be reestablished be as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams to maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat.

Thank you for the opportunity to review and comment on this project. Please contact me at (828) 558-6011 if you have any questions about these comments.

Sincerely,

Andrea Leslie
Mountain Region Coordinator
Habitat Conservation Program

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

MEETING NOTES

MEETING:	Post-Contract IRT Site Walk **KEY MILL Mitigation Site** Yadkin 03040101; Surry County, NC DEQ Contract No. 7180 DMS Project No. 100025 Wildlands Project No. 005-02165
DATE:	Monday, August 14, 2017
LOCATION:	515 Key Road Ararat, NC

Attendees

Todd Tugwell, USACE	Paul Wiesner, DMS	Christine Blackwelder, Wildlands
Andrea Leslie, USFWS	Matthew Reid, DMS	
Mac Haupt, DWR	Shawn Wilkerson, Wildlands	

Materials

- Wildlands Engineering Technical Proposal dated 2/15/2017 in response to DMS RFP 16-006993

Meeting Notes

The meeting began at 1 pm. Shawn presented an overview of the project at the parking location. From there, the group proceeded to walk the entire site in the following order: Bull Creek Reach 2, Bull Creek Reach 3, wetland BMP, UT2, UT3, Bull Creek Reach 1, UT1. The meeting concluded at 4:30 PM. For organizational purposes, the meeting notes are arranged by stream reach, from upstream to downstream.

1. **Bull Creek**
    - **Reach 1**
        - Bull Creek Reach 1 will be primarily constructed offline, into the right floodplain on the upstream half of the reach and into the left floodplain on the downstream half of the reach.
        - IRT members expressed concern over legacy sediments that may exist behind the old mill dams. They pointed to crack between soil layers in a cut bank and noted that the backwater from the old dams may have extended far upstream. Wildlands will shoot survey grades on top of the old dams and compare to soil layers during existing conditions analysis. Shawn also noted that the legacy sediments seemed consolidated and have been in place for 80 years since the last mill dam breach.

- **Reach 2/Wetland BMP**
  - Bull Creek Reach 2 will be restored and moved into the left floodplain, off the right valley wall. Group agreed with this approach. The group noted that Bull Creek Reach 2 (downstream of Key Road) has bank height ratios around 2 and is eroded.
  - Wetland BMP – This wetland is designed to treat agricultural drainage from a defined valley that does not have a flowing stream. Some discussion over whether a stream once ran here and had been buried. Todd asked if there is a pipe which outlets into Bull Creek – there is not. No direct credit has been requested for BMP.
- **Reach 3**
  - Within the woods, Bull Creek Reach 3 has eroded, high banks, and privet dominates the understory. Approximately halfway down the reach, the bank heights drop, invasive species are small and sporadic, and the banks are more stable.
    - IRT team members do not consider the first half of this reach to be preservation quality.
    - Paul/Shawn remarked that, due to the restrictions set forth in the RFP, only 81 SMUs are requested for the 1,460 LF stretch, which equates to an 18:1 ratio.
    - Todd, Andrea, Mac agreed that they like the lower half of the project for preservation. Discussion about potentially proposing the lower half at a 10:1 credit, and conserving the upper half of Bull Creek Reach 3 at no credit.
    - Discussion about potentially extending restoration into the woods for a distance. Wildlands is agreeable to extending the P1 restoration a few hundred feet and tying into the preservation section.
    - Several solutions are possible here. If the IRT is agreeable we will select final approach after survey and preliminary design.

2. **UT1 -**The group agreed with the approximate break between restoration and enhancement II on UT1.
3. **UT2/UT2A -** UT2 and UT2A approaches were reviewed and approved by the group. Discussion about UT2 where it hits the flat floodplain of Bull Creek and whether the creek would have naturally splayed into a wetland. This area is heavily trampled by cattle and is growing over with aquatic vegetation, but has fast flow. Wildlands will review the stream type during design.
4. **UT3 -** The group agreed on the approximate break between restoration and enhancement II on UT3. Although incised, the stream in the enhancement II section is not eroding, and with the upstream pond controlling peak watershed flows, the stream is unlikely to see flashy, eroding flows. Where restoration is proposed, the banks are actively eroding and migrating, and restoration is appropriate.
5. **Ratios -** The group agreed upon the credit ratios presented in the Proposal and below
   - Restoration, 1:1
   - Enhancement II, 2.5:1
   - Preservation, 10:1
6. **Stream Crossings** - All crossings are internal, which allows legal recourse if crossing restrictions are not observed.

- **Bull Creek/Key Road Crossing (#1 on proposal figure 6):** Todd asked for Wildlands to explain this crossing in detail. The farmer currently rotates cattle between fields upstream and downstream of Key Road. Cattle are moved through the Key Road culvert. This is the only way the farmer can move cattle between fields, so Wildlands has proposed an internal crossing upstream and downstream of the road, which allows the farmer to move the cattle through the stream. Andrea expressed concern about cattle entering the easement during crossing events. Temporary fence will be strung during crossing events to prevent cattle from entering the remainder of the easement.
- **UT1 – upstream crossing (#3 on proposal figure 6):** Todd asked if this crossing could move upstream of the conservation easement. No - the farmer cannot gain access to his upper fields by crossing the stream above the project because the right valley wall is too steep to traverse.
- **UT1 - downstream crossing (#4 on proposal figure 6):** Todd asked if this crossing could be eliminated. No – the farmer needs this crossing to gain access to his lower fields.

7. **General suggestions/recommendations of the IRT**
   - Overall, members of the IRT would like to see the proposed approach (restoration, enhancement, preservation) presented in the Mitigation Plan in the context of evolutionary stage.

These meeting minutes were prepared by Christine Blackwelder and reviewed by Shawn Wilkerson on August 15, 2017, and represent the authors' interpretation of events. Please report and discrepancies or corrections within 5 business days of receipt of these minutes.

Appendix 6 – Invasive Species Plan

Key Mill Mitigation Site

Appendix 6 Invasive Species Plan

Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. These site inspections may identify the presence of invasive vegetation. If, during the monitoring period, invasive species threaten the survivability of planted woody vegetation in an area that exceeds 1% of the planted easement acreage, the invasive species shall be treated. Smaller areas may be treated at the discretion of the project engineer and biologist, if deemed in the best interest of the Site. Generally, the treatment plan shall follow the below guidelines in Table 1 for common invasive species found in riparian areas; however, the treatment may be changed based on the professional judgement of the project engineer and biologist. For invasive species not listed in the below table that threaten the survivability of the planted woody vegetation, Wildlands shall notify DMS of the invasive species observed and the plan for treatment prior to treating the species. All invasive species treatment will be reported in the following year's monitoring plan.

Table 1. Invasive Species Treatment – *Key Mill Mitigation Site*

Invasive Species	Recommended Removal Technique
Honeysuckle (*Lonicera japonica*)	Small infestations of *L. japonica* can be pulled by hand. Monitor to remove any re-sprouts. Care should be taken to bag and remove the plants, including mature fruits to prevent re-establishment. Large infestations of *L. japonica* will usually require a combination of cut stump and foliar herbicide treatments. Where vines have grown into the tree canopy, cut each stem as close to the ground as possible. Treat the freshly cut surface of the rooted stem with a 25 percent solution of glyphosate or triclopyr. Remove the twining vines to prevent them from girdling and killing desirable vegetation. Groundcovers of *L. japonica* can be treated with a foliar solution of 2 percent glyphosate or triclopyr plus a 0.5 percent non-ionic surfactant to thoroughly wet all the leaves.
Kudzu (*Pueraria montana*)	Small patches of *P. montana* that are not well-established can usually be eliminated by persistent weeding, mowing, or grazing during the growing season. The spread of a well-established infestation of *P. montana* can be controlled the same way, but cutting will typically not kill the roots of larger plants. For vines in tree canopies, cut the vines near the ground and apply a 50 percent solution of triclopyr to the stumps. This procedure remains effective at lower temperatures as long as the ground is not frozen. Large infestations can be effectively controlled with a foliar solution of 2 to 3 percent glyphosate or triclopyr plus a 0.5 percent non-ionic surfactant to thoroughly wet all leaves. The ambient air temperature should be above 65 degrees Fahrenheit. After the above ground vegetation is controlled and it is possible to dig and cut into the central root crown, apply a 50 percent solution of glyphosate or triclopyr to the wound. The most successful chemical control of *P. montana* can be achieved with a foliar solution of 0.75 percent clopyralid plus a 0.5 percent non-ionic surfactant. Monitor all treatments in subsequent years for re-sprouting.
Porcelain berry (*Ampelopsis glandulosa var. brevipedunculata*)	The most effective chemical control of *A. brevipedunculata* has been achieved using triclopyr formulations toward the end of the growing season when plants are transporting nutrients to their roots. Apply a 2 percent solution of triclopyr plus a 0.5 percent non-ionic surfactant to the foliage. Or cut the plants first, allow time for re-growth, and then apply the herbicide mixture. *A. brevipedunculata* can also be killed with a mixture of 25 percent triclopyr and 75 percent mineral oil applied to the basal parts of the stem to a height of 2 to 3 feet from the ground. This method should be used judiciously since it takes a lot of chemical and can result in overspray. It has been used successfully in situations where no other technique is feasible, such as cliff faces or other exposed sites.

Invasive Species	Recommended Removal Technique
Japanese Hops (*Humulus japonicus*)	Pre-emergent herbicide containing sulfometuron methyl (Oust XP) applied in early spring causes minimal damage to established perennial vegetation. Mechanical control by cutting or mowing as close to the ground as possible beginning in late spring and recurring frequently until fall dieback is recommended. Post emergent herbicide treatment two times a year (mid and late summer) to prevent the fall seed set is recommended. Glyphosate provides good post-emergent chemical control. Hop seeds in the soil last up to three years. Repeat treatments for two to three years should be expected, or longer in areas subject to flooding that may receive influx of seeds from upstream infestations. Cultural control methods which favor fast-growing tall tree species to create dense shade in spring and summer and canopy closure will discourage infestations, as Japanese hop prefers direct sunlight and does not tolerate heavy shade. Establishing an early thick groundcover of hairy vetch, wheat, barley or rye can reduce hop germination and seedling survival. (National Park Service, Plant Conservation Alliance, Alien Plants Working Group, 2009)
Tree of Heaven (*Ailanthus altissima*)	Foliar Spray Method: This method should be considered for large thickets where risk to non-target species is minimal. Air temperature should be above 65Â°F to ensure absorption of herbicides. Glyphosate: Apply a 2% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Glyphosate is a non-selective systemic herbicide that may kill non-target partially-sprayed plants. Cut Stump Method: This control method should be considered when treating individual trees or where the presence of desirable species precludes foliar application. Stump treatments can be used if the ground is not frozen. Triclopyr: Horizontally cut stems at or near ground level. Immediately apply a 25% solution of triclopyr and water to the cut stump making sure to cover the outer 20% of the stump.
Johnson Grass (*Sorghum halepense*)	Recommended control procedures: Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (June to October with multiple applications applied to regrowth). • Recommendation for mature grass control: apply Outrider* as a broadcast spray at 0.75 to 2 ounces per acre (0.2 to 0.6 dry ounce per 3-gallon mix) plus a nonionic surfactant to actively growing Johnsongrass. For handheld and high-volume sprayers, apply 1 ounce of Outrider per 100 gallons of water plus a nonionic surfactant at 0.25 percent. Outrider is a selective herbicide that can be applied over the top of certain other grasses to kill Johnsongrass, or apply Plateau as a 0.25-percent solution (1 ounce per 3-gallon mix) when plants are 18 to 24 inches (45 to 60 cm) tall or larger. • Recommendation for seedling control: apply Journey as a 0.3-percent solution (1.2 ounces per 3-gallon mix) before Johnsongrass sprouts and when desirable species are dormant or apply a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) directed at the infestation.
Multiflora Rose (Rosa multiflora.)	Foliar Spray Method: Apply MSM at 1 ounce per acre between April and June. May to October apply a 4% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Glyphosate is a non-selective systemic herbicide that may kill non-target partially-sprayed plants. Cut Stump Method: This control method should be considered when treating individual stems or where the presence of desirable species precludes foliar application. Stump treatments can be used if the ground is not frozen. Glyphosate: Horizontally cut stems at or near ground level. Immediately apply a 20% solution of glyphosate and water to the cut stump making sure to cover the outer 50% of the stump.

Invasive Species	Recommended Removal Technique
Mimosa (*Albizia julibrissin)*	Trees: Make stem injections using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or Milestone in dilutions as specified on the herbicide label (anytime except March and April). For felled trees, apply the herbicides to stump tops immediately after cutting. ORTHO Brush-B-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps and available in retail garden stores (safe to surrounding plants). Saplings: Apply a basal spray to young bark using Garlon 4 as a 20-percent solution (5 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted); or undiluted Pathfinder II. Elsewhere, apply Stalker* as a 6- to 9-percent solution (1.5 to 2 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil, kerosene, or diesel fuel (where permitted). Resprouts and seedlings: Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: From June to August, either Escort XP at 1 ounce per acre (0.2 ounces per 3-gallon mix) plus a glyphosate herbicide as a 2-percent solution addition (8 ounces per 3-gallon mix) or Milestone VM Plus at 6 to 9 pints per acre (1.5 to 3 pints per 3-gallon mix and 10 gallons per acre). From July to September, Transline* † or Milestone as a 0.25-percent solution plus Garlon 3A as a 4-percent solution (1 ounce plus 5 ounces per 3-gallon mix).
Princess Tree (*Paulownia tomentosa*)	Foliar Spray Method: This method should be considered for large thickets of paulownia seedlings where risk to non-target species is minimal. Air temperature should be above 65Â°F to ensure absorption of herbicides. Glyphosate: Apply a 2% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Glyphosate is a non-selective systemic herbicide that may kill non-target partially-sprayed plants. Triclopyr: Apply a 2% solution of triclopyr and water plus a 0.5% non-ionic sur-factant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Triclopyr is a selective herbicide for broadleaf species. In areas where desirable grasses are growing under or around paulownia, triclopyr can be used without non-target damage. Cut Stump Method: This control method should be considered when treating individual trees or where the presence of desirable species precludes foliar application. Stump treatments can be used if the ground is not frozen. Glyphosate: Horizontally cut stems at or near ground level. Immediately apply a 25% solution of glyphosate and water to the cut stump making sure to cover the outer 50% of the stump. Triclopyr: Horizontally cut stems at or near ground level. Immediately apply a 50% solution of triclopyr and water to the cut stump making sure to cover the outer 20% of the stump. https://www.se-eppc.org/manual/princess.html

Invasive Species	Recommended Removal Technique
Chinese Privet (*Ligustrum sinense*)	Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a glyphosate herbicide as a 3-percent solution (12 ounces per 3-gallon mix) in the late fall or early winter when safety to surrounding vegetation is desired, or elsewhere, Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix). Backpack mist blowers can broadcast glyphosate as a 3-percent solution (12 ounces per 3-gallon mix) or Escort XP* at 1 ounce per acre (0.2 dry ounces per 3-gallon mix and 10 gallons per acre) during winter for safety to dormant hardwoods. Summer applications of glyphosate may not be as effective as other times and require a higher percent solution. The best time for Arsenal AC* and Escort XP* is summer to fall. For stems too tall for foliar sprays and when safety to surrounding vegetation is desired, apply a basal spray of Garlon 4 as a 20-percent solution (5 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted); or undiluted Pathfinder II. Elsewhere, apply Stalker* as a 6- to 9-percent solution (1.5 to 2 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted) to young bark as a basal spray making certain to treat all stems in a clump; or cut and immediately treat the stump tops with Arsenal AC* as a 5-percent solution (20 ounces per 3-gallon mix) or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stump tops and sides with Garlon 3A or with a glyphosate herbicide as a 20-percent solution (5 pints per 3-gallon mix) in water with a surfactant. ORTHO Brush-B-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps and available in retail garden stores (safe to surrounding plants). For large stems, make stem injections using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or a glyphosate herbicide using dilutions and cut-spacings specified on the herbicide label (anytime except March and April). An EZ-Ject tree injector can help to reach the lower part of the main stem; otherwise, every branching trunk must be hack-and-squirt injected.

Appendix 7 – Site Protection Instrument

Key Mill Mitigation Site

Appendix 7 Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the parcel listed in the table below. Wildlands Engineering, Inc. (Wildlands) executed an option to purchase a conservation easement on a portion of Linda Faye Key's property as identified below. Upon issuance of the nationwide permit for this project and prior to construction, Wildlands will record a conservation easement to encompass the restored, enhanced and preserved streams and their corresponding riparian buffers associated with this project. A temporary construction easement is also recorded on an upstream adjacent parcel to facilitate construction.

Table 1: Site Protection Instrument – Key Mill *Mitigation Site*

Current Landowner	PIN	County	Under Option to Purchase by Wildlands?	Memorandum of Option/Temporary Access and Conservation Easement Deed Book (DB) and Page Number (PG)	Acreage to be Protected
Linda Faye Key	592600777192	Surry	Yes	DB: 302 PG: 610	20.81
Zachary Neil Hardy*	592600666552	Surry	No	DB: 1169 PG: 387	N/A

*Agreement for temporary construction easement

The conservation easement template has been enclosed in this appendix. The site protection instrument requires 60-day advance notification to the USACE and or DMS before any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

STATE OF NORTH CAROLINA

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT

_____ COUNTY

SPO File Number:
DMS Project Number:

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this _____day of _____, 20__, by _____ *Landowner name goes here* , ("**Grantor**"), whose mailing address is _____ *Landowner address goes here* _____, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the

protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between *(insert name and address of full delivery contract provider)* and the North Carolina Department of Environment and Natural Resources, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environment and Natural Resources Purchase and Services Contract Number _____.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environment and Natural Resources, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in _____ Township, _____ County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately _____ acres and being conveyed to the Grantor by deed as recorded in **Deed Book _____ at Page ____** of the _____ County Registry, North Carolina; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of ***if known, insert name of stream, branch, river or waterway here***.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

Tracts Number _____ containing a total of _____ **acres** as shown on the plats of survey entitled "Final Plat, Conservation Easement for North Carolina Division of Mitigation Services, Project Name: _____, SPO File No._____, EEP Site No. _____, Property of _____," dated _____, 20__ by *name of surveyor*, PLS Number _____ and recorded in the _____ County, North Carolina Register of Deeds at **Plat Book _____ Pages _____.**

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat**.**

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. **Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the

power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the

obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

_____ (SEAL)

NORTH CAROLINA
COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that _____, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the _____ day of _____, 20__.

_____
Notary Public

My commission expires:

_____

Exhibit A

[INSERT LEGAL DESCRIPTION]

Appendix 8 – Maintenance Plan

Key Mill Mitigation Site

Appendix 8 Maintenance Plan

Wildlands will visit the site semi-annually and conduct a physical inspection at least once per year during the post-construction monitoring period and until performance standards are achieved. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected, most frequently in the first two years following site construction. Routine maintenance may include the following:

Table 1. Maintenance Plan – *Key Mill Mitigation Site*

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species requiring treatment per the Invasive Species Treatment Plan (Appendix 6) shall be treated in accordance with that plan and with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.
Beaver/Wildlife Management	If beaver dams are observed on site, Wildlands will remove the dams and attempt to remove the beavers from the site. If wildlife herbivory becomes a problem for the plantings, Wildlands will take measures to manage wildlife on the site.
Stream Crossings	Stream crossings shall be maintained to ensure stability and functionality when livestock are present. Routine maintenance and repair activities may include additional matting, gravel, and seeding for ford crossings. Maintenance and repair for culvert crossings used for livestock should be minimal but may require additional gravel and seeding to minimize runoff to the adjacent waterbody. Cattle exclusion fencing and gates where applicable shall be regularly inspected and maintained as needed.
BMP	Routine BMP maintenance may include removal of accumulated sediment from the bottom of the BMP. Stone and boulders may require adjustment to prevent scour. Wildlands will evaluate and determine whether sediment removal is necessary based on observations of the constructed sediment storage volume and volume remaining in subsequent monitoring years.

Appendix 9 – Financial Assurance

Key Mill Mitigation Site

Appendix 9 Financial Assurances

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