# PROSPECTUS FOR

# CUB CREEK MITIGATION BANK

**SUBMITTED BY**

UT EXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

**MARCH 2023**

## 1.0 OWNER AND AGENTS

The University of Tennessee's Institute of Agriculture proposes to develop and sponsor the Cub Creek Mitigation Bank in Hardeman County, Tennessee. The bank site is located on the University of Tennessee's 1,200-acre Lone Oaks Farm and an adjoining private property in Hardeman County, TN. The sponsor proposes to restore and protect approximately 21,084 linear feet of stream and 50 acres of wetland habitat in the Cub Creek watershed. The existing streams and wetland habitats are degraded due to decades of impoundment, mowing, channelization, unrestricted cattle access, and cleared riparian buffers. Cub Creek is on the Tennessee Department of Environment and Conservation's Division of Water Pollution Control 303(d) list for low flow alterations, physical substrate habitat alterations, alteration in stream-side or littoral vegetative covers, and iron. Known pollutant sources include upstream impoundments, channelization, and grazing in riparian or shoreline zones.

The sponsor is partnering with the West Tennessee River Basin Authority (WTRBA), Tennessee Wildlife Federation, and Civil and Environmental Consultants, Inc. (CEC) on project design and construction. Together, the project partners have implemented over 17 miles of stream restoration and over 1,000 acres of wetland restoration in Tennessee. This prospectus provides a brief description of the site, current stream and wetland conditions, proposed improved ecological stream and wetland functions, and conceptual plan for stream and wetland mitigation activities. A more detailed mitigation design plan, performance standards, credit release schedule, financial assurances, adaptive management plan, property assessment and warranty, and monitoring and maintenance plan will be provided in the mitigation banking instrument for the project, pending review of this proposal by the IRT.

## 2.0 PROJECT LOCATION

The proposed site is situated in the Southeastern Plains Physiographic Province and Ecoregion (65) in Hardeman County. The site location is described more specifically in **Table 1**.

Table 1. Cub Creek Stream Mitigation Bank Summary

| | |
|---|---|
| **Level III Ecoregion:** | Southeastern Plains (65) |
| **Watershed (8-digit HUC):** | Lower Hatchie River (HUC 08010208) |
| **Watershed (12-digit HUC):** | Cub Creek (HUC 0 HUC 080102080204) |
| **Location:** | 10000 Lake Hardeman Road, Middleton, TN 38052 |
| **303(d) Status:** | Cub Creek is listed (see Section 1.0) |
| **Existing Total Length (feet)** | 21,084 |
| **Proposed Total Length (feet)** | 27,979 |
| **Mitigation Area:** | Approximately 100 acres |
| **Coordinates (Centroid):** | 35.127; -88.973 |

## 3.0 PROPERTY ACCESS

The project site is located on public property managed by the University of Tennessee's Institute of Agriculture, and an adjoining private property. Permission to access the property is located in **Appendix 1**.

## 4.0 PROJECT GOALS AND OBJECTIVES

The goals of the project are to restore a functional stream and wetland ecosystem within the Cub Creek subwatershed of the Hatchie River, provide compensatory stream mitigation to offset permitted impacts to waters of the United States as authorized under Section 404 of the Clean Water Act, and offer educational opportunities to the STEM education curricula at Lone Oaks Farm. The existing streams and wetlands are degraded from impoundment, channelization, channel modifications, excessive sediment due to bank erosion, unrestricted cattle access, and riparian buffers being managed for hay and pasture. Past land use and management activities have contributed to the physical, chemical, and biological degradation of stream and wetland ecological functions within the mitigation area. The following maps are located in **Appendix 2**.

- Locator Map of the Project within the 8-digit HUC and Service Area
- Aerial Photo with Existing Aquatic Resources
- Historic Aerial Photo
- Land Use/Land Cover in the Surrounding Area
- National Wetlands Inventory Map
- NRCS Soil Mapping Units and Soil Sampling Locations
- USGS Topographic Map
- Proposed Treatments and Baseline Soil and Hydrologic Monitoring Locations Map
- Aerial Photo with Site Photo Locations
- Parcel Map

The objectives of the stream mitigation are to improve aquatic and riparian habitat, reduce sediment inputs, decrease bank erosion, and provide for the recovery of natural stream functions. Function-based goals for the stream restoration components of the project include improving stream hydrology, promoting more frequent floodplain inundation and storage of flood waters, supporting sediment transport continuity, and providing for riparian forest succession. Project objectives aim to improve stream function-based parameters that include groundwater/surface water exchange, floodplain connectivity, lateral stability, bedform diversity, and riparian vegetation. See **Table 2** for quantitative objectives. Proposed activities that will be implemented to address the causes of stream degradation and achieve project objectives include:

- Re-construct dynamically stable stream channels in order to improve bedform diversity, lateral stability, and floodplain connectivity along project streams that have been channelized and trampled by livestock;

- Remove hydrologic modifications (impoundments) in order to improve overland and subsurface water exchange and sediment transport continuity;
- Increase channel sinuosity in order to reduce flow velocities, promote the formation of natural riffles and pools, and improve lateral and vertical stability;
- Permanent cessation of mowing and livestock production activities from the mitigation area in order to reduce excessive nutrients and pollutants;
- Re-establish riparian buffers on both banks of all project streams, to be composed of planted native bottomland hardwood forest species;
- Permanently protect the mitigation area with land use restrictions.

Table 2. Cub Creek Mitigation Bank Quantitative Objectives

| Functional Category | Goal | Objectives | Metric Method |
|---|---|---|---|
| Hydrology | Increase lag time of flood wave | Create more opportunity for infiltration in the floodlpain and reduce flooding impacts downstream by creating longer flow duration at a lower magnitude. | Stream Depth Monitoring |
| Hydraulics | Improve floodplain connectivity and vertical stability | Reconnect channel to the floodplain by constructing new channel with appropriate dimensions and grade; Reduce BHR to 1 and increase entrenchment ratio to >2.2 | BHR and Entrenchment Ratio; Connection Frequency from Gauging |
| Geomorphology | Improve bedform diversity | Install structures for bed stability and increase pool depth ratio from <1.5 to >1.5; establish riffles, runs, pools and glides, restore meander patterns and increase belt width | Stream Survey - X Sections and Long. Profile; As-built, 3yr, 5yr. |
| | Improve lateral stability | Reduce dominant BEHI score from high to moderate or less | BEHI Score or We could use Ft/Yr and use benchmarked cross sections. |
| | Improve riparian vegetation buffer width and protection | Increase RBP buffer width scores from 1 to 8 and vegetation protection scores from 1 to 8. | Buffer Width Score |
| | Restore Natural Sinuosity | Return channelized stream segments to a natural plan and profile. Target sinuosity 1.5 > k > 1.1 | Sinuosity>1.1, Based on Relationship of Valley Slope and Stream Friction Slope (WTNRC) |
| Biology | Improve reach connectivity | Reduce the impact of vertical grade separation through installation of engineered structures that allow for passage of aquatic organisms. Including removal of two culverts and alterations to the Cub Creek flood control structure. | Visual assessment of removed obstacles. Fish sampling at reconnected reaches. |

The objectives of the wetland mitigation are to rehabilitate wetlands to palustrine, forested seasonally flooded/saturated wetlands within the project boundary. The wetland mitigation area is degraded from historic habitat alterations, stream channelization, spoiled material, unrestricted cattle access, and riparian buffers managed for hay and pasture. Decades of such land uses and management activities are the primary causes of the physical, chemical, and biological degradation of wetland ecological functions within the project boundaries. Rehabilitation will be accomplished by returning natural hydrology and native, hydrophytic vegetation to wetland areas that are highly degraded by current land uses and loss of hydraulic connection resulting from channel incision.

## 5.0 SITE CONTRAINTS

A TVA transmission line bisects the project area. No mitigation credits will produced from restored streams or wetlands within the easement right of way of the power line.

## 6.0 BASELINE CONDITIONS

### 6.1 Proposed Service Area

The proposed primary service area for the bank includes the Lower Hatchie River watershed (HUC 08010208). The proposed secondary service area includes the following watersheds: Wolf River (HUC 08010210), Loosahatchie River (HUC 08010209), Horn Lake – Nonconnah Creek (HUC 08010211), Upper Hatchie River (HUC 08010207), and Lower Mississippi River (HUC 08010100). The primary threats to aquatic resources throughout this geographic service area include incompatible agricultural practices in the floodplain of the service area's major rivers, channelization of streams, and urbanization in close proximity to large urban areas.

### 6.2 Summary of Site Selection Criteria

The following characteristics were evaluated as part of a watershed approach to siting a project in the Lower Hatchie River watershed:

- Location of 303(d) listed streams.
- Ability to accomplish aquatic resource goals outlined in the Lower Hatchie River Watershed Management Plan (TDEC 2003).
- Opportunities to restore stream habitat within the same landscape setting and aquatic resource type as recently impacted streams or planned development projects.
- Compatibility of the site with surrounding land uses, including hydrologic and terrestrial connectivity.
- Potential of degraded aquatic resources to achieve significant ecological value.
- Effect the mitigation project will have on ecologically important habitats or rare species.
- The extent to which the site has potential to contribute to the protection or restoration of watershed processes and improve water quality.
- The potential of the site to accommodate timely implementation with few constraints.

## **6.3** Existing Conditions and Land Use

Land uses in the floodplain and riparian zone in the mitigation area are highly degraded from historic channelization, mowing, impoundments, and active livestock production activities. The streams proposed for restoration flows into a lake built by NRCS in the 1960's. Land use in the immediate surrounding area is an equal mix of livestock production in the lower elevations and forested habitat in the uplands. Land use/land cover within the watershed is composed of pasture/agriculture, hardwood forest and some low-density rural residential development. Bank erosion and sediment deposition are pervasive throughout the mitigation area. Historic channelization, dredging, realignment and straightening have left the streams unstable with vertical, eroding banks, poor bed form diversity, unstable patterns and incised conditions that have disconnected the stream reaches from their floodplains.

The mitigation area contains 21,256 linear feet of stream mostly located in a low slope, alluvial valley with a wide floodplain (**Table 3**). A map showing the location of each stream reach is located in **Appendix 2**. The existing stream types are generally indicative of C and E channels according to the Rosgen classification system. The lower limit of the project has a drainage area of approximately 1.66 square miles. A summary of the USGS Flow Statistics for the project area and a FEMA FIRM Panel are located in **Appendix 3**. The likely channel evolution sequence suggests that without restoration efforts, the streams will remain unstable and continue to contribute excessive sediment loads to the Hatchie River system for the foreseable future.

Field investigations revealed palustrine emergent and palustrine forested jurisdictional wetlands in the mitigation area (**Table 3**). Twelve wetlands totaling 50.0 acres were delineated within the mitigation area (see map in **Appendix 2**). Wetland hydrology is generally maintained by ponding of water in the project area and subsurface flow originating from the toe of slope of the surrounding hillsides in places where the groundwater has not been lowered by incision. The palustrine, emergent, seasonally flooded (PEM) wetland areas are dominated by sedges (*Carex* sp.). Palustrine, forested, seasonally flooded wetland areas (PFO) are dominated by sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), and red maple (*Acer rubrum*).

According to the Hardeman County Soil Survey (NRCS 1997), soils in the mitigation area are predominantly mapped as the Iuka silt loam (Iu), Nugent silt loam (Nu), and Luverne and Smithdale silt loam (LSE3, LSD3, and LSF). These soils are occasionally flooded and typically found along floodplains of secondary streams. A detailed NRCS soil report is located in **Appendix 4**. Numerous soil samples were examined to determine the presence of hydric characteristics. Soils sampled in wetland areas mostly in the Iuka silt loam had low soil chroma scores within the upper 12 inches (10 YR 4/2) and contained redox features (7.5 YR 4/3).

More detail for each stream reach and wetland community in the project area is provided with site photos, hydrologic and wetland determination data forms, and Stream Quantification Tool workbook are located in **Appendix 5**.

Table 3. Streams and Wetlands in the Mitigation Area

| ID | Feature | Flow Regime/Cowardin Class | Coordinates | Area (acres) | Length (l.f.) |
|---|---|---|---|---|---|
| STR-1 | Stream | Perennial | BEG: 35.122631; -88.980040<br>END: 35.132915; -88.964900 | | 6556 |
| STR-2 | Stream | Intermittent/Perennial | BEG: 35.131685; -88.972127<br>END: 35.130851; -88.968844 | | 1084 |
| STR-2A | Stream | Intermittent | BEG: 35.130718; -88.971092<br>END: 35.131268; -88.970485 | | 280 |
| STR-3 | Stream | Intermittent | BEG: 35.126138; -88.970296<br>END: 35.129754; -88.970708 | | 1663 |
| STR-3A | Stream | Intermittent | BEG: 35.126250; -88.971160<br>END: 35.126804; -88.971157 | | 200 |
| STR-4 | Stream | Intermittent/Perennial | BEG: 35.131211; -88.977337<br>END: 35.128743; -88.972204 | | 2603 |
| STR-4A | Stream | Intermittent | BEG: 35.129488; -88.972975<br>END: 35.129218; -88.972292 | | 221 |
| STR-4B | Stream | Intermittent/Perennial | BEG: 35.131730; -88.976450<br>END: 35.131618; -88.976330 | | 49 |
| STR-5 | Stream | Perennial | BEG: 35.130186; -88.983201<br>END: 35.128092; -88.973086 | | 3545 |
| STR-6 | Stream | Intermittent/Perennial | BEG: 35.123284; -88.972235<br>END: 35.126900; -88.974181 | | 1747 |
| STR-7 | Stream | Intermittent/Perennial | BEG: 35.122599; -88.979783<br>END: 35.124610; -88.978742 | | 910 |
| STR-8 | Stream | Intermittent/Perennial | BEG: 35.125355; -88.982046<br>END: 35.124561; -88.978967 | | 1108 |
| STR-8A | Stream | Intermittent/Perennial | BEG: 35.124423; -88.981619<br>END: 35.124545; -88.981057 | | 200 |
| STR-8B | Stream | Intermittent/Perennial | BEG: 35.125323; -88.982300<br>END: 35.125309; -88.981977 | | 104 |
| STR-9 | Stream | Intermittent/Perennial | BEG: 35.122930; -88.981816<br>END: 35.124145; -88.979309 | | 976 |
| WET-A | Wetland | PEM/PFO | 35.133637; -88.966536 | 25.16 | |
| WET-B | Wetland | PFO | 35.129477; -88.973417 | 3.31 | |
| WET-C | Wetland | PFO | 35.131655; -88.976690 | 0.58 | |
| WET-D | Wetland | PFO | 35.128341; -88.971354 | 3.25 | |
| WET-E | Wetland | PEM | 35.128309; -88.976420 | 0.87 | |
| WET-F | Wetland | PEM | 35.129108; -88.979491 | 1.86 | |
| WET-G | Wetland | PFO | 35.126918; -88.973262 | 1.12 | |
| WET-H | Wetland | PFO | 35.125485; -88.976805 | 3.77 | |
| WET-I | Wetland | PFO | 35.126912; -88.975755 | 1.36 | |
| WET-J | Wetland | PFO | 35.125646; -88.978070 | 0.07 | |
| WET-K | Wetland | PFO | 35.124759; -88.978099 | 0.36 | |
| WET-L | Wetland | PFO | 35.123421; -88.979840 | 9.29 | |
| **TOTAL** | | | | **50.0** | **21,256** |

## 7.0 MITIGATION APPROACH

The streams in the mitigation area have either been impounded, mowed, channelized, and/or grazed by cattle for decades, leaving the streams in unstable states and mostly devoid of woody riparian vegetation. As a result of these channel modifications, the streams are currently experiencing lateral and vertical migration evidenced by massive bed and bank erosion, and the deposition of bed and bank material on the floodplain or in the lake created by the impoundment. The project concept is a comprehensive restoration of the entire floodplain, with functional uplifts from improved stream and wetland hydrology, channel hydraulics and sediment transport, riparian buffers, and aquatic and terrestrial habitats.

The project site has a high likelihood of success for the following reasons:

- Relatively long reaches and sufficient space to address pattern deficiencies;
- Rural landscape that is relatively free of site constraints;
- Lone Oaks Farm will maintain a full-time caretaker for the site;
- Invasive plant species are not abundant in the mitigation area.

### 7.1 Stream Restoration

The approach for each of the streams will focus on improving degraded aquatic habitats, floodplain connectivity, bedform diversity, vertical and lateral stability, and riparian buffers. Restoration practices on the streams within the mitigation area will include removal of impoundments, construction of new, off-line channel segments, bank sloping, installation of grade control structures to maintain connectivity to the floodplain, invasive species removal, riparian buffer re-establishment, and livestock exclusion. These practices will improve channel hydraulics, sediment transport, floodplain connectivity, bedform diversity and provide for the recovery of natural stream functions.

The stream design approach will focus on creating natural stream and floodplain conditions during storm events at or below the 2-yr, 24-hour threshold. Stream restoration measures will be designed using a combination of analytical data and reference reaches from one or more stable reaches with similar geomorphic conditions and valley slopes. An additional objective is reconnection of isolated biological populations that have been separated since the construction of the NRCS lake in the 1960’s. The lake itself will be reconfigured to allow the western half to function as a natural stream and floodplain instead of an impoundment.

To facilitate restoration of the stream in the impoundment area a structure will be installed through the existing embankment to eliminate the impoundment of water and restore bankfull flows. This structure will allow for fish and sediment passage at base flow conditions to restore ecological connectivity of the stream. Construction of this feature will help to return a natural bankfull flow to the abandoned valley while preserving the flood protection benefits of the watershed embankment during high intensity events. The outlet of this structure will connect to a restored meander that joins a previous stream restoration project on the same property.

Riparian buffer re-establishment will be accomplished by planting live stakes on the banks, and bare root trees and shrubs within the riparian buffer. These plantings will help increase wood and other organic matter inputs to the system. Cessation of mowing and livestock production within the mitigation area will allow for riparian buffer re-establishment.

Sediment transport analyses will be performed on restored reaches in order to verify the ability of the designed channels to transport the size and mass of sediment supplied to each stream by its watershed. Bankfull dimensions and discharges will be evaluated based on site surveys, regional hydraulic geometry relationships and hydraulic modeling.

Lift created through channel restoration and enhancement is estimated at 8,657 Functional Feet (**Table 4**). A 10% wetland buffer habitat enhancement will be applied where applicable generating approximately 866 additional functional feet. Creation of the outlet channel and dam removal are estimated to generate an additional enhancement of approximately 700 Functional Feet of lift. Total estimated stream credit generation is 10,222 Functional Feet. In addition the sponsor is coordinating with TDEC to determine the location of benthic sampling for input into the SQT during the draft MBI stage.

Table 4. Functional lift not including enhancements provided by wetlands, biological inputs, or dam removal

| Reach ID | Existing Length | Existing Score | Proposed Length | Proposed Score | Proposed Credits |
|---|---|---|---|---|---|
| STR1 - R1 | 1460.10 | 0.29 | 2168 | 0.48 | **617.00** |
| STR1 - R2 | 1824.84 | 0.20 | 1585 | 0.48 | **396** |
| STR1 - R3 | 1008.24 | 0.24 | 1124 | 0.58 | **307** |
| STR1 - R4 | 1289.65 | 0.26 | 354 | 0.58 | **-130** |
| STR1 - R5 | 983.12 | 0.23 | 2868 | 0.57 | **1409** |
| STR2 - R1 | 539.17 | 0.15 | 886 | 0.48 | **344** |
| STR2 - R2 | 287.48 | 0.40 | 463 | 0.48 | **107** |
| STR2 - R3 | 257.04 | 0.13 | 257.04 | 0.45 | **82** |
| STR2A | 280.16 | 0.27 | 280.16 | 0.27 | **0** |
| STR3 - R1 | 572.95 | 0.25 | 800 | 0.55 | **297** |
| STR3 - R2 | 1090.40 | 0.50 | 1030 | 0.54 | **11** |
| STR3A | 199.81 | 0.48 | 199.81 | 0.49 | **2** |
| STR4 - R1 | 182.31 | 0.15 | 187 | 0.5 | **66** |
| STR4 - R2 | 436.05 | 0.31 | 1676 | 0.54 | **770** |
| STR4 - R3 | 330.17 | 0.40 | 582 | 0.52 | **171** |
| STR4 - R4 | 393.23 | 0.37 | 607 | 0.52 | **170** |
| STR4 - R5 | 394.51 | 0.38 | 454 | 0.52 | **86** |
| STR4 - R6 | 374.49 | 0.22 | 376 | 0.46 | **90** |
| STR4 - R7 | 319.56 | 0.48 | 322 | 0.49 | **3** |
| STR4A | 221.27 | 0.31 | 0 | 0.31 | **0** |
| STR4B | 49.02 | 0.26 | 0 | 0.26 | **0** |
| STR5 - R1 | 2006.26 | 0.31 | 2711 | 0.47 | **652** |
| STR5 - R2 | 1538.65 | 0.13 | 2152 | 0.47 | **811** |
| STR6 - R1 | 1180.72 | 0.25 | 1974 | 0.59 | **869** |
| STR6 - R2 | 566.28 | 0.48 | 566 | 0.48 | **23** |
| STR7 - R1 | 910.36 | 0.26 | 901 | 0.59 | **295** |
| STR8 - R1 | 500.34 | 0.31 | 772 | 0.57 | **280** |
| STR8 - R2 | 204.29 | 0.34 | 278 | 0.57 | **89** |
| STR8 - R3 | 403.56 | 0.20 | 700 | 0.55 | **304** |
| STR8A | 200.19 | 0.49 | 200.19 | 0.49 | **0** |
| STR8B | 103.99 | 0.46 | 103.99 | 0.47 | **1** |
| STR9 - R1 | 827.65 | 0.27 | 1232 | 0.59 | **503** |
| STR9 R2 | 148.27 | 0.46 | 170 | 0.59 | **32** |
| Existing Length | 21084.13 | Proposed Length | 27979.19 | Proposed Credits | **8657** |

## 7.2 Wetland Restoration

Westland restoration is the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. Restoration can be categorized as rehabilitation (a gain in aquatic resource function, but not a gain in aquatic resource area). The approach to wetland restoration for the project is to rehabilitate the riverine and slope wetland complex by lifting and hydraulically reconnecting streams to wetlands in the floodplain. The hydrology of wetland habitats proposed for restoration have been degraded by reduced hydraulic connectivity with nearby streams caused by excessive channel incision. Restoration of stream and wetland hydrodynamics will elevate wetland functions and services, such as improvement to water quality, flood storage, erosion control, and wildlife habitat. Mitigation credits will only be considered for rehabilitated wetland habitats outside of those areas proposed for enhancing stream mitigation credits. A summary of the wetland mitigation approach is outlined in **Table 5**.

Table 5. Summary of Wetland Mitigation Approach outside of the 50-foot stream buffer

| **Current Condition** | | **Desired Condition** | | | |
|---|---|---|---|---|---|
| *Classification* | *Acres* | *Treatment Type* | *Classification* | *Credit Ratio* | *Credits* |
| Palustrine Emergent (PEM)/Palustrine Forested (PFO) | 28 | Rehabilitation | PFO | 2:1 | 14 |
| Total Area | **28** | | | | **14** |

Wetland mitigation areas will be reforested using native riparian wetland trees, shrubs and perennial flora planted in appropriate zones after hydrologic modifications. Planted trees and shrubs will provide a diversity of forest structure, forage value, filtering capacity, soil stability, and riparian habitat. Planting zones on the site will mimic natural stream bank and floodplain communities and will consider the frequency and magnitude of flows experienced by the project streams. Planting will commence after project construction is completed to ensure that species are planted in suitable hydrologic regimes.

# 8.0 SITE PROTECTION AND LONG TERM MANAGEMENT

Site protections for the portion of the project area owned in fee by the State of Tennessee will be provided using land use restrictions. A sample of the restrictions is located in the **Appendix 6**. Site protections for the portion of the project area privately owned will be provided by a conservation easement held by the Tennessee Mitigation Fund. The Army Corps conservation easement template is located in **Appendix 6**. A Long-Term Management Fund will be established for future land management after performance standards have been met. Long term management activities include annual monitoring and may include replacing boundary signage and fencing.

## 9.0 HISTORIC PROPERTIES AND LISTED SPECIES

A Phase I Cultural Resource Assessment was performed at Lone Oaks Farm by the University of Tennessee's Archeological Research Laboratory in September 2016. The study area included portions of the mitigation area. No historic structures or features were identified during this survey. A copy of the report is included in **Appendix 7**.

The following species are potentially affected by activities at the site:

- Indiana Bat (*Myotis sodalis)*
- northern Long-eared Bat (*Myotis septentrionalis)*
- tricolored bat *(Perimyotis subflavus)*
- alligator snapping turtle *(Macrochelys temminickii)*

There are no critical habitats designated for the site. A copy of the USFWS IPaC report for the site is included in **Appendix 7**.

# APPENDIX 1
# SITE ACCESS PERMISSION FORMS

## Appendix 1 - REQUEST FOR CORPS JURISDICTIONAL DETERMINATION (JD)

To: District Name Here Memphis District

- I am requesting a JD on property located at: 10000 Lake Hardeman Road
  (Street Address)
  City/Township/Parish: Middleton County: Hardeman State: Tennessee
  Acreage of Parcel/Review Area for JD: 115 acres
  Section: ______ Township: ______ Range: ______
  Latitude (decimal degrees): 35.14 Longitude (decimal degrees): 88.97
  (For linear projects, please include the center point of the proposed alignment.)
- Please attach a survey/plat map and vicinity map identifying location and review area for the JD.
- ☐ I currently own this property. ___ I plan to purchase this property.
  ☑ I am an agent/consultant acting on behalf of the requestor.
  ☐ Other (please explain): ______
- Reason for request: (check as many as applicable)
  ☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.
  ☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.
  ☐ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.
  ☑ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.
  ☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.
  ☐ A Corps JD is required in order to obtain my local/state authorization.
  ☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.
  ☐ I believe that the site may be comprised entirely of dry land.
  ☐ Other: ______
- Type of determination being requested:
  ☑ I am requesting an approved JD.
  ☐ I am requesting a preliminary JD.
  ☐ I am requesting a "no permit required" letter as I believe my proposed activity is not regulated.
  ☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

By signing below, you are indicating that you have the authority, or are acting as the duly authorized agent of a person or entity with such authority, to and do hereby grant Corps personnel right of entry to legally access the site if needed to perform the JD. Your signature shall be an affirmation that you possess the requisite property rights to request a JD on the subject property.

*Signature: [signature] Date: 5/17/2019

- Typed or printed name: Chris Roberts
  Company name: Tennessee Wildlife Federation
  Address: 300 Orlando Avenue
  Nashville, TN 37209
  Daytime phone no.: 615-979-5840
  Email address: croberts@tnwf.org

***Authorities:** Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Program of the U.S. Army Corps of Engineers; Final Rule for 33 CFR Parts 320-332.
**Principal Purpose:** The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
**Routine Uses:** This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.
**Disclosure:** Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

## Appendix 1 - REQUEST FOR CORPS JURISDICTIONAL DETERMINATION (JD)

To: [redacted] District
Memphis

- I am requesting a JD on property located at: Hopecoate Land and Tim
  (Street Address)
  City/Township/Parish: Middleton County: Hardeman State: TN
  Acreage of Parcel/Review Area for JD: ____________
  Section: _______ Township: ________ Range: ________
  Latitude (decimal degrees): 35.123 Longitude (decimal degrees): -88.971
  (For linear projects, please include the center point of the proposed alignment.)
- Please attach a survey/plat map and vicinity map identifying location and review area for the JD.
- ☐ I currently own this property. ____ I plan to purchase this property.
  ☑ I am an agent/consultant acting on behalf of the requestor.
  ☐ Other (please explain): ______________________________.
- Reason for request: (check as many as applicable)
  ☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.
  ☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.
  ☑ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.
  ☐ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.
  ☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.
  ☐ A Corps JD is required in order to obtain my local/state authorization.
  ☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.
  ☐ I believe that the site may be comprised entirely of dry land.
  ☐ Other: ______________________________
- Type of determination being requested:
  ☑ I am requesting an approved JD.
  ☐ I am requesting a preliminary JD.
  ☐ I am requesting a "no permit required" letter as I believe my proposed activity is not regulated.
  ☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

By signing below, you are indicating that you have the authority, or are acting as the duly authorized agent of a person or entity with such authority, to and do hereby grant Corps personnel right of entry to legally access the site if needed to perform the JD. Your signature shall be an affirmation that you possess the requisite property rights to request a JD on the subject property.

*Signature: [signature] Date: 3/27/2023

- Typed or printed name: Chris Roberts

  Company name: Tennessee Wildlife Federation

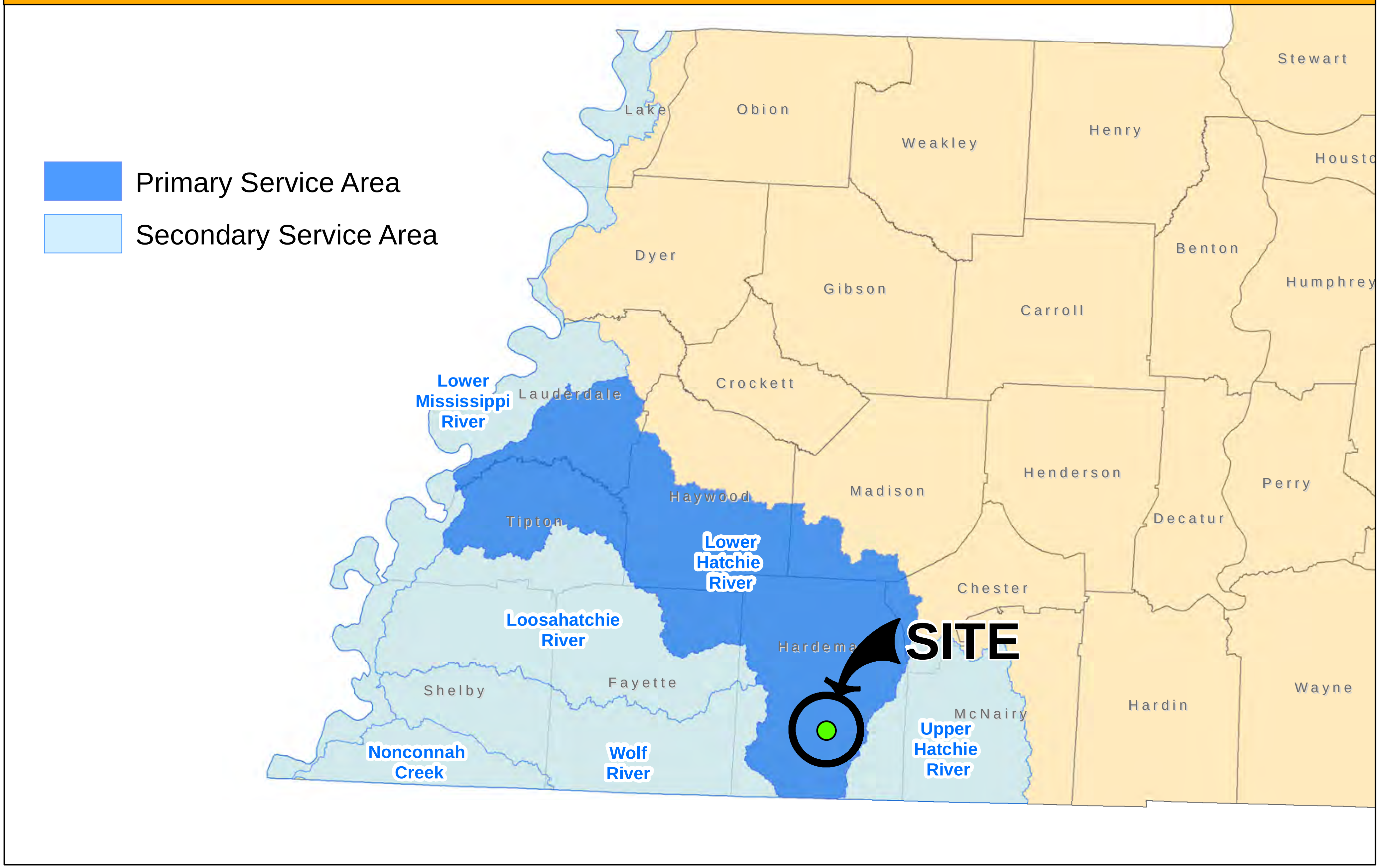
  Address: 300 Orlando Avenue
  Nashville, TN 37209

  Daytime phone no.: 615-979-5840

  Email address: croberts@tnwf.org

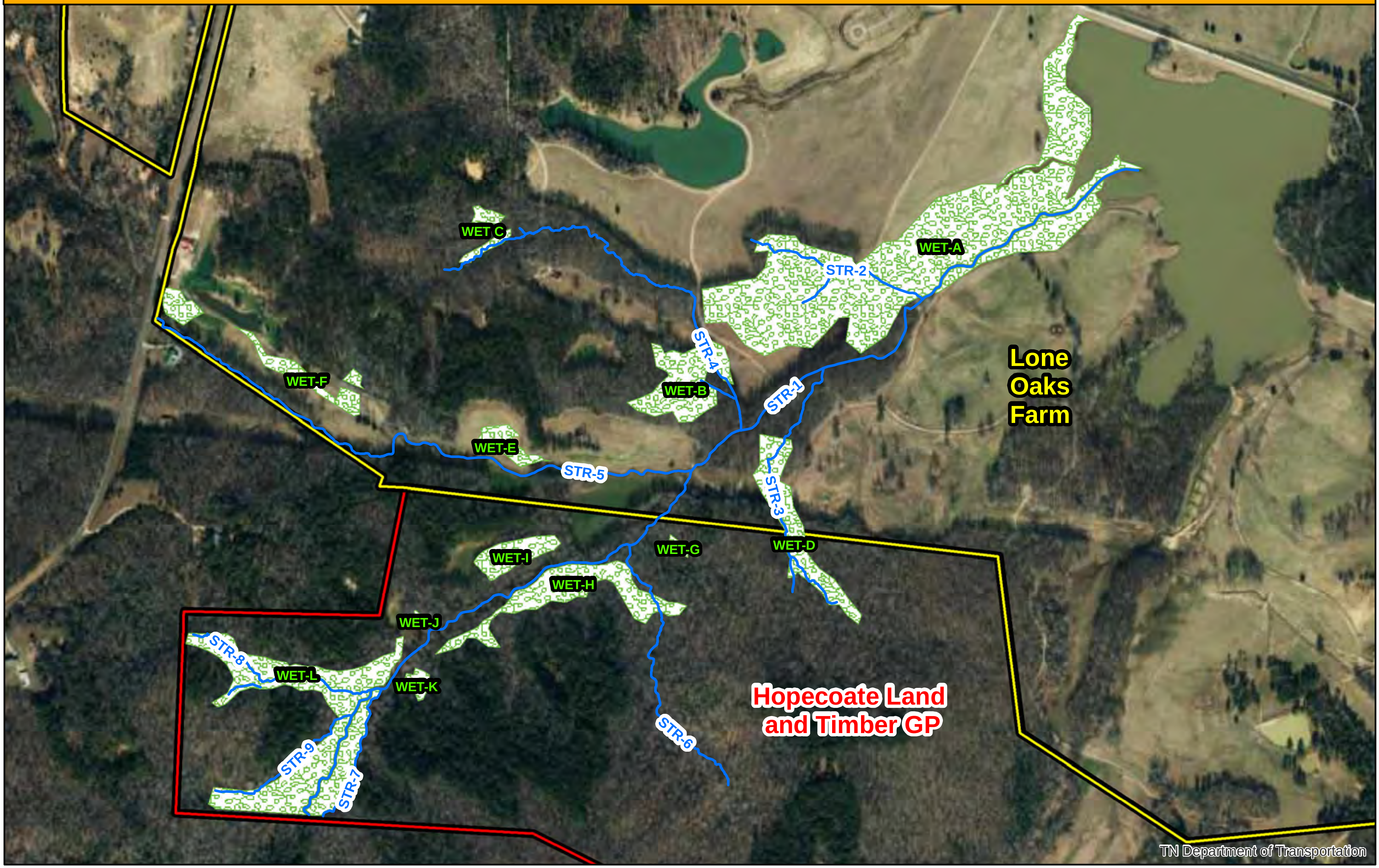
***Authorities:** Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Program of the U.S. Army Corps of Engineers; Final Rule for 33 CFR Parts 320-332.
**Principal Purpose:** The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
**Routine Uses:** This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.
**Disclosure:** Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

# APPENDIX 2
# SITE MAPS



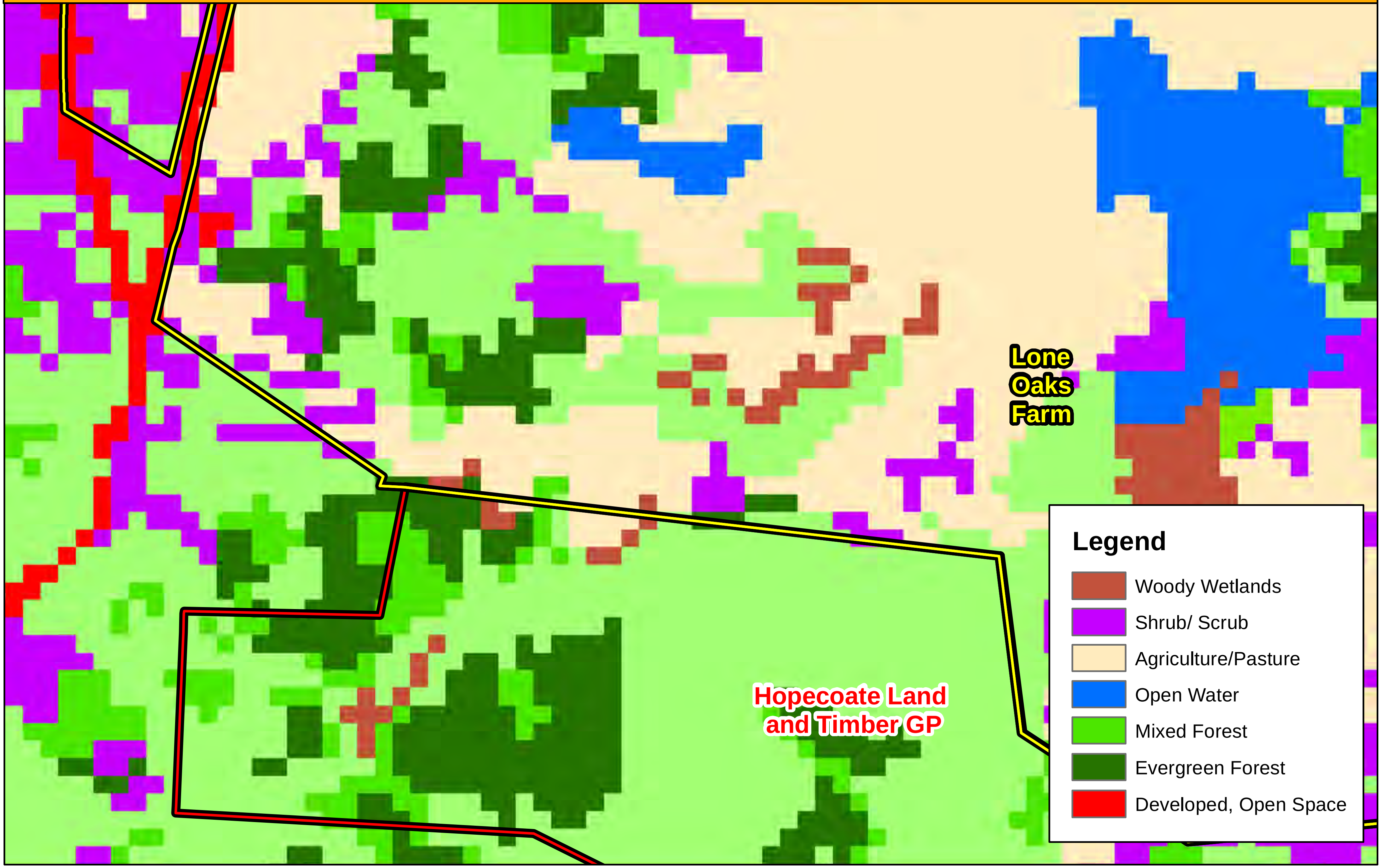
Primary Service Area
Secondary Service Area
Lake
Obion
Weakley
Henry
Stewart
Housto
Dyer
Gibson
Carroll
Benton
Humphrey
Crockett
Lauderdale
Lower
Mississippi
River
Haywood
Madison
Henderson
Perry
Tipton
Decatur
Lower
Hatchie
River
Chester
Loosahatchie
River
Hardema
SITE
Shelby
Fayette
McNairy
Hardin
Wayne
Upper
Hatchie
River
Nonconnah
Creek
Wolf
River

# Cub Creek Mitigation Bank
# Hardeman County, TN
# Existing Aquatic Resources

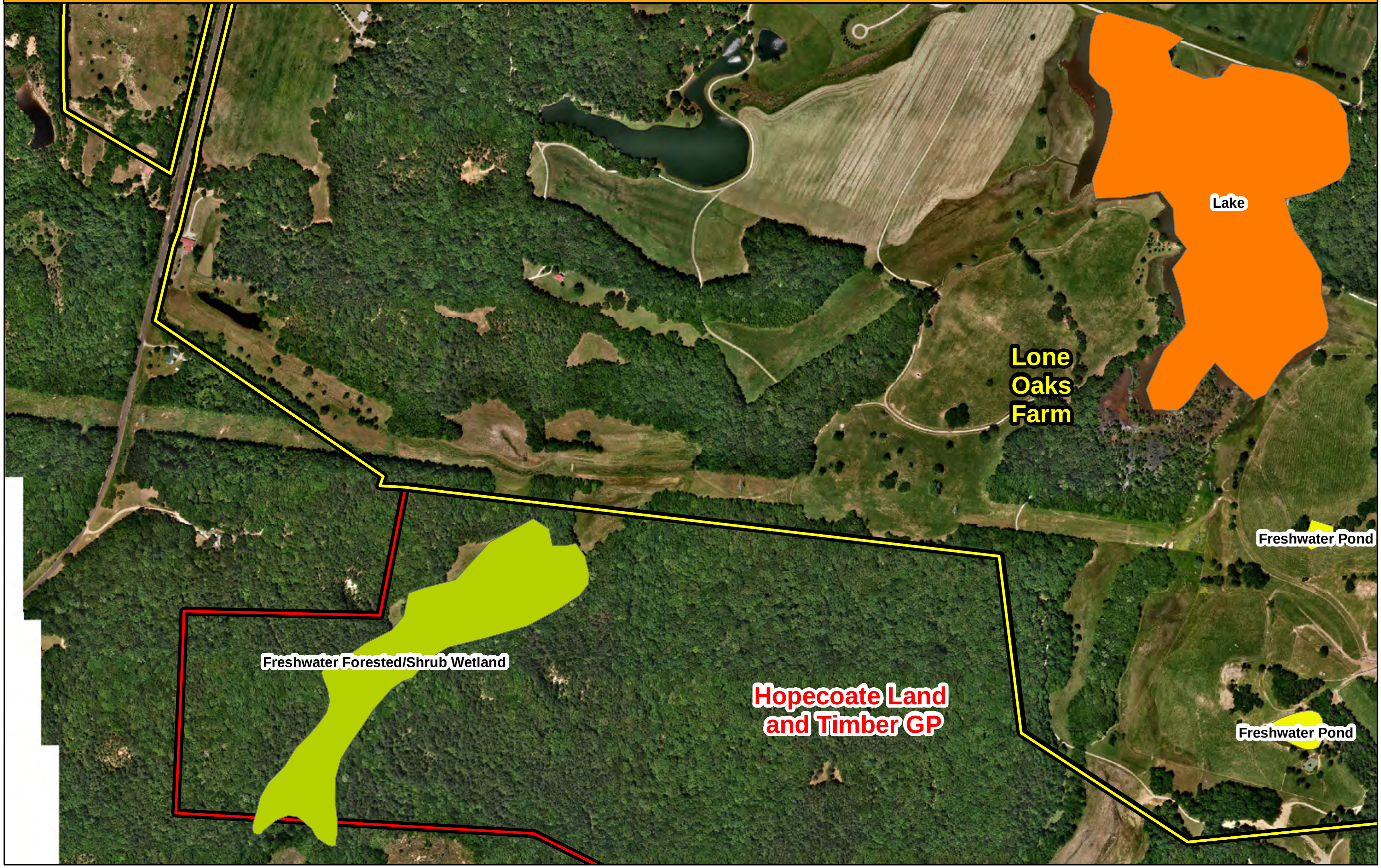


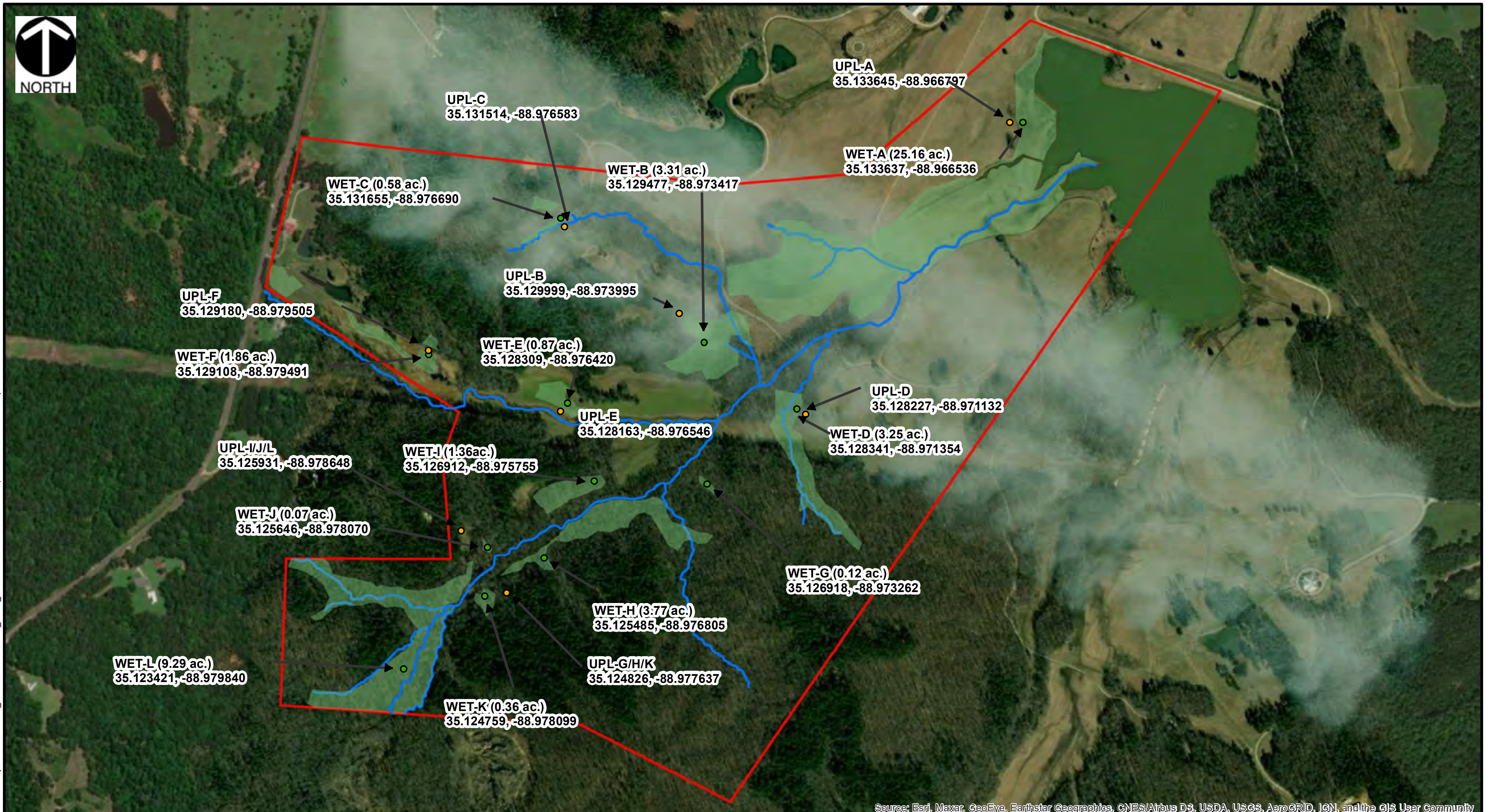
# Cub Creek Mitigation Bank
# Hardeman County, TN
# Historic Aerial (1997)

# Cub Creek Mitigation Bank
# Hardeman County, TN
# Land Use/Land Cover (TN GAP 2011)



# Cub Creek Mitigation Bank
# Hardeman County, TN
# NWI Data






**LEGEND**

**Test Pits**
- UPL
- WET

- Wetlands
- Intermittent/Perennial
- Study Boundary

Feet
0 1,000 2,000

**REFERENCE**
TDOT AERIAL IMAGERY
GO TO ARCGIS ON TNMAP.TN.GOV/BASEMAPS/IMAGERY
ACCESSED 10/6/2022

CEC
Civil & Environmental Consultants, Inc.
2704 Cherokee Farm Way, Suite 101 - Knoxville, TN 37920
865-977-9997 • 800-365-2324
www.cecinc.com

UNIVERSITY OF TENNESSEE FOUNDATION
CUB CREEK STREAM MITIGATION BANK
PHASE TWO
MIDDLETON, TN

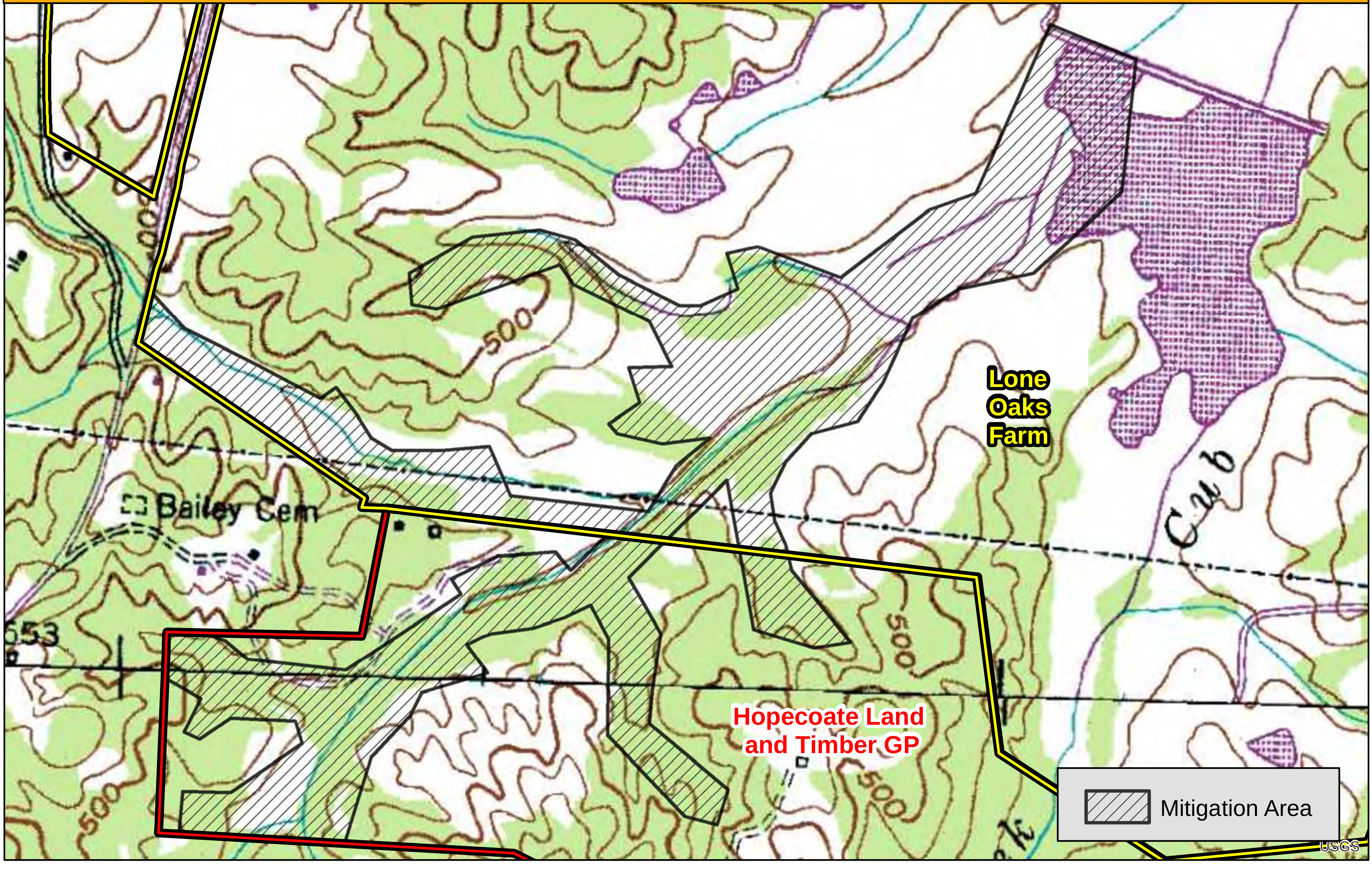
HYDROLOGIC FEATURES - WETLANDS

| DRAWN BY: DRS | CHECKED BY: GSB | APPROVED BY: GSB | FIGURE NO: 3 |
|---|---|---|---|
| DATE: 10/6/2022 | SCALE: 1 " = 600 ' | PROJECT NO: 322-520 | |

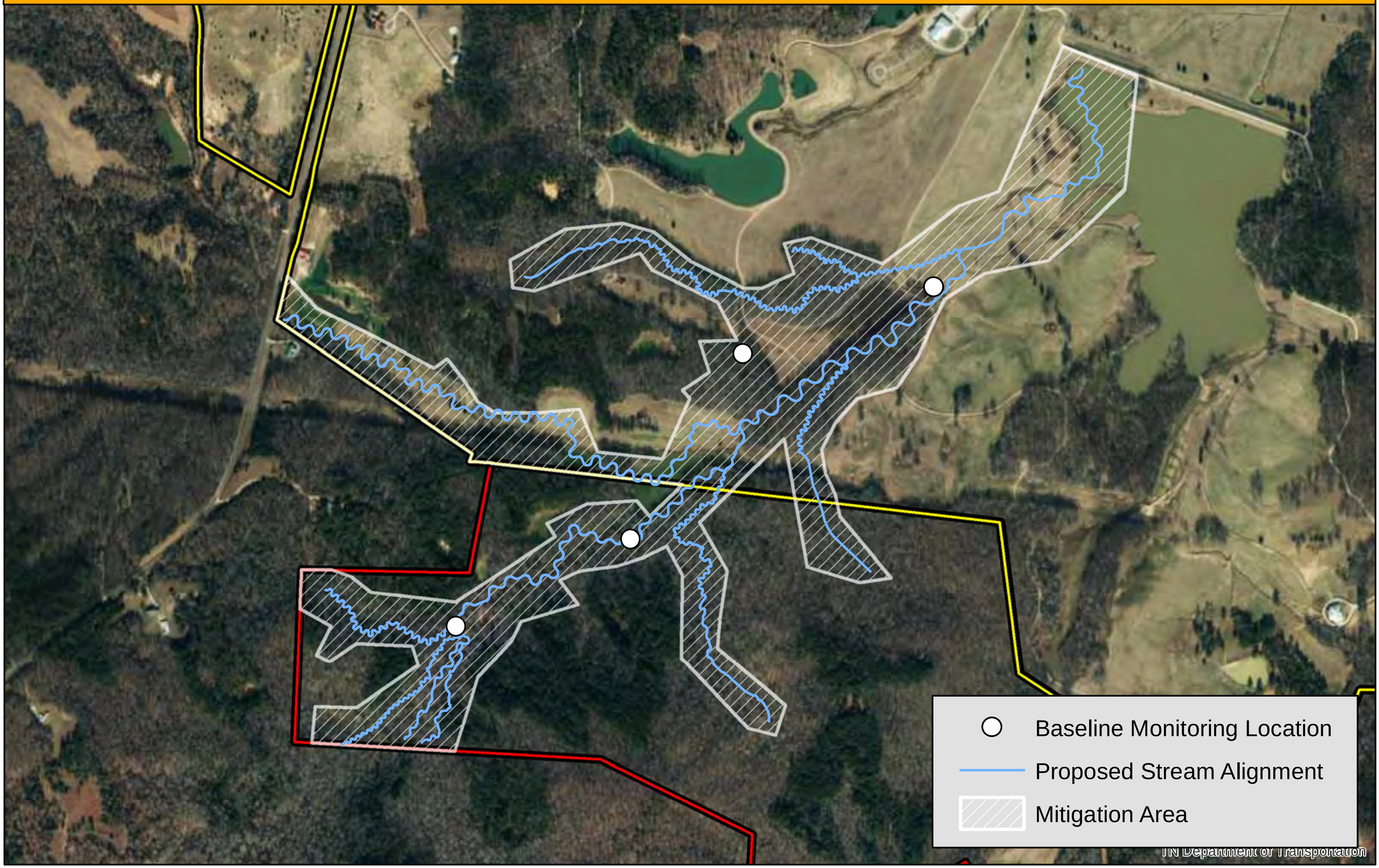
\\SVR-KNOXVILLE\P:\320-000\322-520\-GIS\Maps\PJD\322-520_Cub Creek Phase 2_FIG 3_HYDRO FEATURES-WET.mxd (10/6/2022 6:50:10 AM)

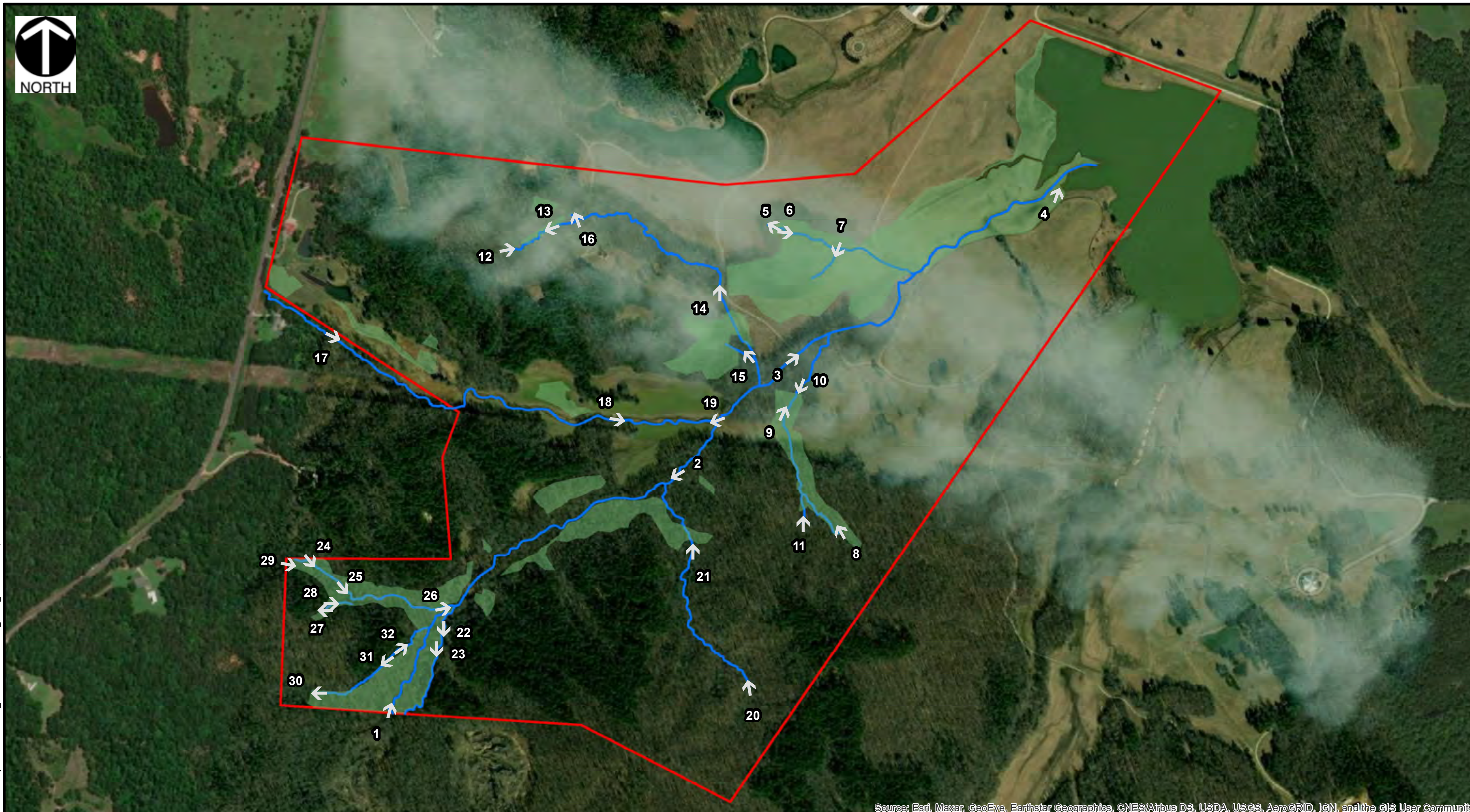
# Cub Creek Mitigation Bank
# Hardeman County, TN
# NRCS Soils Data

# Cub Creek Mitigation Bank
# Hardeman County, TN
# Topographic Map



*Cub Creek Mitigation Bank*
*Hardeman County, TN*
*Proposed Treatments with Baseline Monitoring Locations*






**LEGEND**

- Photo Locations
- Wetlands
- Intermittent/Perennial
- Study Boundary

Feet

0 1,000 2,000

**REFERENCE**

TDOT AERIAL IMAGERY
GO TO ARCGIS ON TNMAP.TN.GOV/BASEMAPS/IMAGERY
ACCESSED 10/6/2022

CEC

Civil & Environmental Consultants, Inc.
2704 Cherokee Farm Way, Suite 101 - Knoxville, TN 37920
865-977-9997 • 800-365-2324
www.cecinc.com

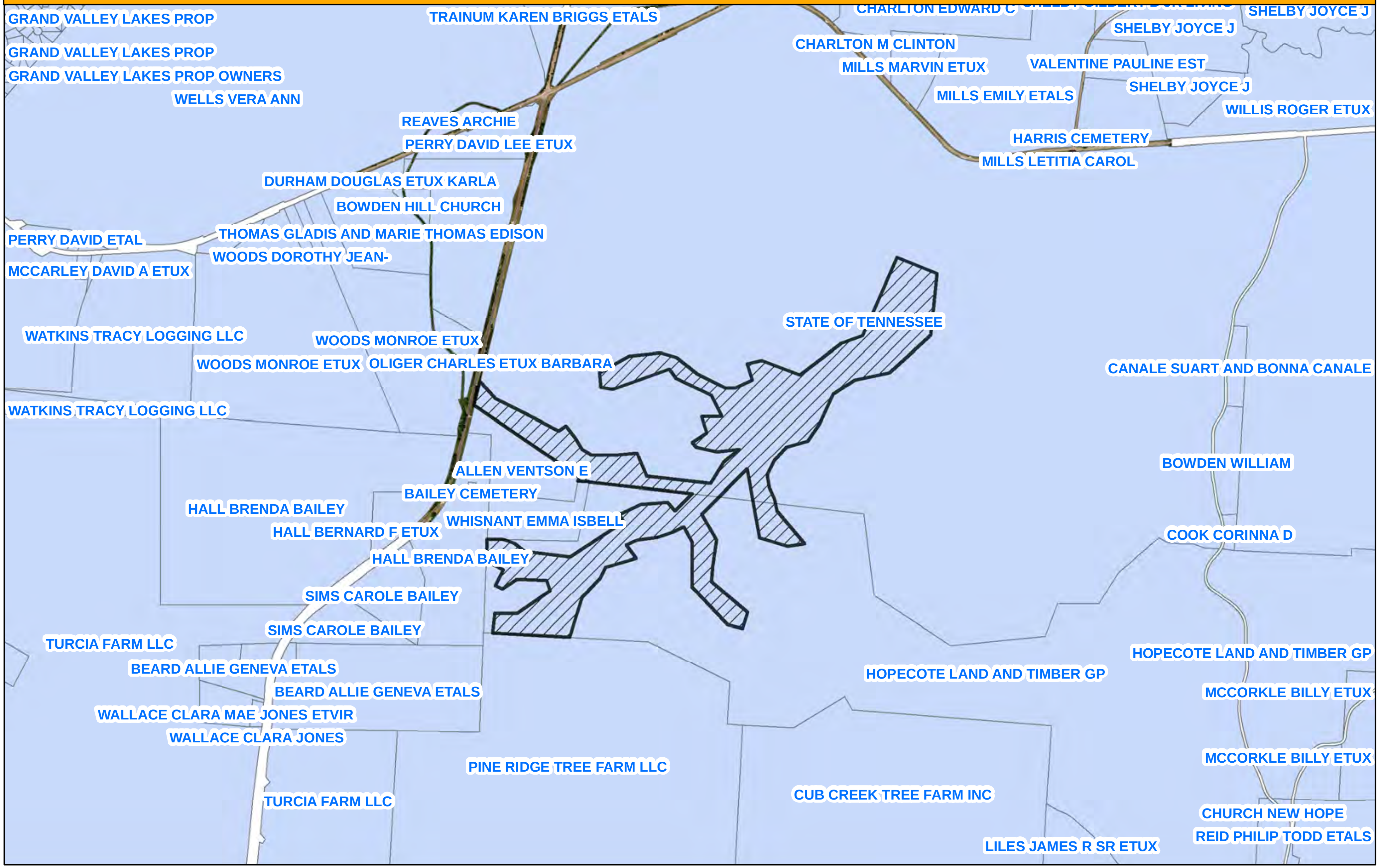
UNIVERSITY OF TENNESSEE FOUNDATION
CUB CREEK STREAM MITIGATION BANK
PHASE TWO
MIDDLETON, TN

PHOTO LOCATION MAP

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DRAWN BY: | DRS | CHECKED BY: | GSB | APPROVED BY: | GSB | FIGURE NO: | 4 |
| DATE: | 10/6/2022 | SCALE: | 1 " = 600 ' | PROJECT NO: | 322-520 | | |

\\SVR-KNOXVILLE\ P:\320-000\322-520\-GIS\Maps\PJD\322-520_Cub Creek Phase 2_FIG 4_PHOTO.mxd (10/6/2022 6:52:42 AM)

# Cub Creek Mitigation Bank
# Hardeman County, TN
# Parcel Map



# APPENDIX 3
# USGS STREAMSTATS AND FEMA FIRM PANEL

## NOTES TO USERS

e is for use in administering the National Flood Insurance Program. It does ssarily identify all areas subject to flooding, particularly from local drainage of small size. The **community map repository** should be consulted for updated or additional flood hazard information.

more detailed information in areas where **Base Flood Elevations** (BFEs) **oodways** have been determined, users are encouraged to consult the Flood and Floodway Data and/or Summary of Stillwater Elevations tables d within the Flood Insurance Study (FIS) report that accompanies this FIRM. ould be aware that BFEs shown on the FIRM represent rounded whole-foot s. These BFEs are intended for flood insurance rating purposes only and ot be used as the sole source of flood elevation information. Accordingly, vation data presented in the FIS report should be utilized in conjunction with l for purposes of construction and/or floodplain management.

**Base Flood Elevations (BFEs)** shown on this map apply only landward of h American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should e that coastal flood elevations are also provided in the Summary of Stillwater s table in the Flood Insurance Study report for this jurisdiction. Elevations the Summary of Stillwater Elevations table should be used for construction oodplain management purposes when they are higher than the elevations n this FIRM.

es of the **floodways** were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with requirements of the National Flood Insurance Program. Floodway widths r pertinent floodway data are provided in the Flood Insurance Study report risdiction.

areas not in Special Flood Hazard Areas may be protected by **flood control es.** Refer to Section 2.4 "Flood Protection Measures" of the Flood e Study report for information on flood control structures for this jurisdiction.

**jection** used in the preparation of this map was Universal Transverse (UTM) zone 16. The **horizontal datum** was NAD83, GRS1980 spheroid. es in datum, spheroid, projection or UTM zones used in the production of or adjacent jurisdictions may result in slight positional differences in map across jurisdiction boundaries. These differences do not affect the accuracy RM.

evations on this map are referenced to the North American Vertical Datum of hese flood elevations must be compared to structure and ground elevations ed to the same **vertical datum**. For information regarding conversion the National Geodetic Vertical Datum of 1929 and the North American Datum of 1988, visit the National Geodetic Survey website at w.ngs.noaa.gov/ or contact the National Geodetic Survey at the following

Reference System Division
Geodetic Survey, NOAA
ring Metro Center
st-West Highway
ring, Maryland 20910
3-3191

n current elevation, description, and/or location information for **bench marks** n this map, please contact the Information Services Branch of the National Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

**ap** information shown on this FIRM was provided in digital format by the Tennessee. This information was photogrammetrically compiled at scales of and 1"=400' from aerial photography.

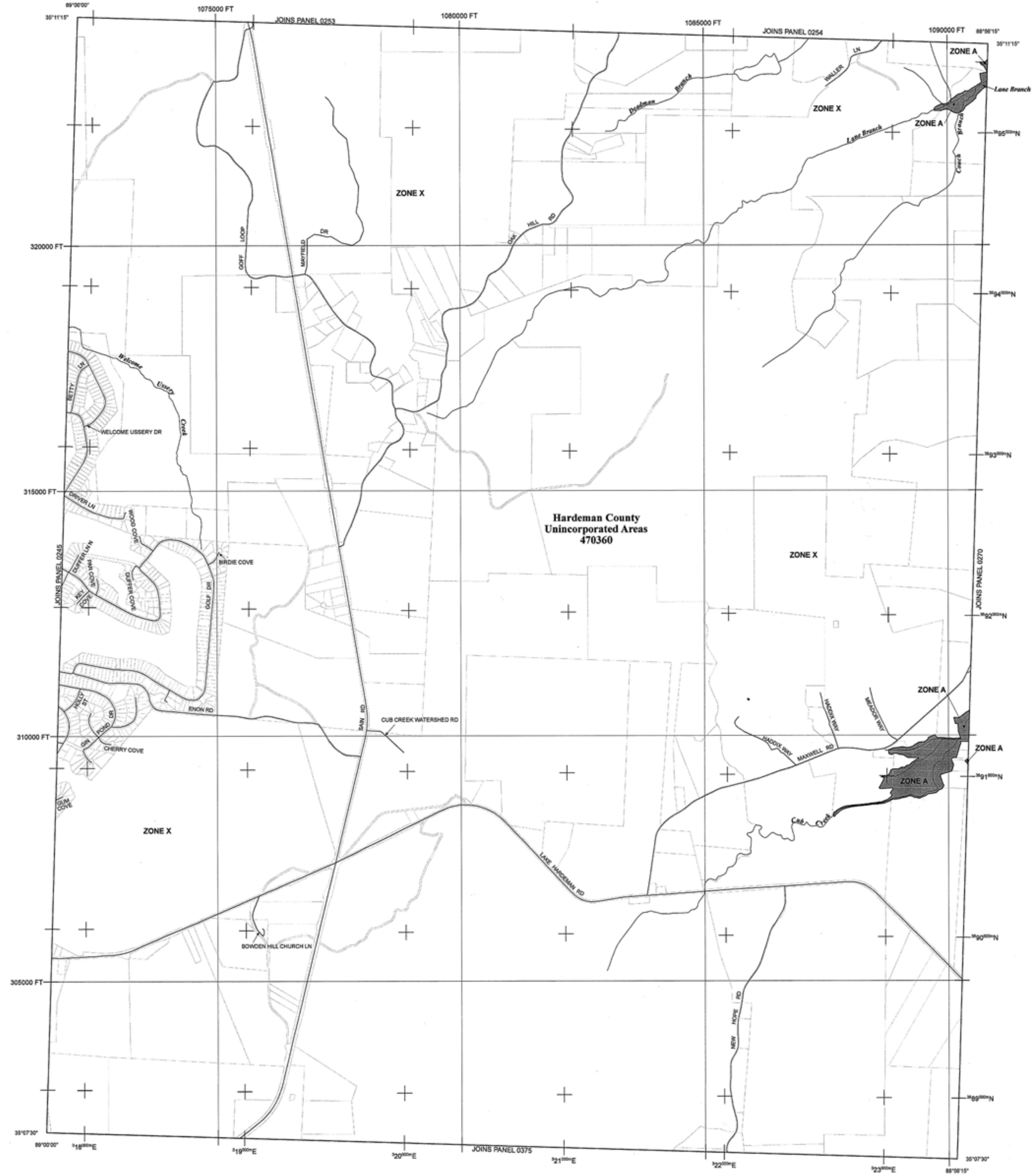
p reflects more detailed and up-to-date **stream channel configurations** se shown on the previous FIRM for this jurisdiction. The floodplains and s that were transferred from the previous FIRM may have been adjusted to to these new stream channel configurations. As a result, the Flood Profiles dway Data tables *in the Flood Insurance Study report (which contains tive hydraulic data)* may reflect stream channel distances that differ from hown on this map.

**te limits** shown on this map are based on the best data available at the time ation. Because changes due to annexations or de-annexations may have after this map was published, map users should contact appropriate ity officials to verify current corporate limit locations.

efer to the separately printed **Map Index** for an overview map of the county the layout of map panels; community map repository addresses; and a f Communities table containing National Flood Insurance Program dates for mmunity as well as a listing of the panels on which each community is

the **FEMA Map Service Center** at 1-800-358-9616 for information on products associated with this FIRM. Available products may include ly issued Letters of Map Change, *a Flood Insurance Study report*, and/or ersions of this map. The FEMA Map Service Center may also be reached by -800-358-9620 and its website at http://www.msc.fema.gov/.

**ave questions about this map** or questions concerning the National Flood e Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or FEMA website at http://www.fema.gov/.




## LEGEND

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJ INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the floo 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard in A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elev 1% annual chance flood.

| | |
|---|---|
| ZONE A | No Base Flood Elevation determined. |
| ZONE AE | Base Flood Elevations determined. |
| ZONE AH | Flood depths of 1 to 3 feet (usually areas of ponding); Base Floo determined. |
| ZONE AO | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); ave determined. For areas of alluvial fan flooding, velocities also determine |
| ZONE AR | Area of special flood hazard formerly protected from the 1% annual c event by a flood control system that was subsequently decertified indicates that the former flood control system is being restored protection from the 1% annual chance of greater flood event. |
| ZONE A99 | Areas to be protected from 1% annual chance flood event by a F protection system under construction; no Base Flood Elevations determ |
| ZONE V | Coastal flood zone with velocity hazard (wave action); no Base Floo determined. |
| ZONE VE | Coastal flood zone with velocity hazard (wave action); Base Floo determined. |

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be encroachment so that the 1% annual chance flood can be carried without substantial flood heights.

**OTHER FLOOD AREAS**

| | |
|---|---|
| ZONE X | Areas of 0.2% annual chance flood; areas of 1% annual chance flood w depths of less than 1 foot or with drainage areas less than 1 squa areas protected by levees from 1% annual chance flood. |

**OTHER AREAS**

| | |
|---|---|
| ZONE X | Areas determined to be outside the 0.2% annual chance floodplain. |
| ZONE D | Areas in which flood hazards are undetermined, but possible. |

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Are

| | |
|---|---|
| | Floodplain boundary |
| | Floodway boundary |
| | Zone D boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of di Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet |
| (EL 987) | Base Flood Elevation value where uniform within zon in feet* |

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

| | |
|---|---|
| (A)——(A) | Cross section line |
| (23)- - - -(23) | Transect line |
| 97°07'30", 32°22'30" | Geographic coordinates referenced to the Nort Datum of 1983 (NAD 83), Western Hemisphere |
| 4275000mE | 1000-meter Universal Transverse Mercator grid ticks, |
| 6000000 FT | 5000-foot grid values: Tennessee State Plane coordi (FIPSZONE = 4100), Lambert projection |
| DX5510 | Bench mark (see explanation in Notes to Users se FIRM panel) |
| • M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 28, 2007

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Com History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance a the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0265C

# FIRM

## FLOOD INSURANCE RATE

## HARDEMAN COUN

## TENNESSEE

### AND INCORPORATED A

### PANEL 265 OF 500

(SEE MAP INDEX FOR FIRM PANE

CONTAINS:

| COMMUNITY | NUMBER | PAN |
|---|---|---|
| HARDEMAN COUNTY | 470360 | 026 |

Notice to User: The **Map Number** shown below sh when placing map orders; the **Community Number** should be used on insurance applications for community.

**MAP NU**
**470690**

**EFFECTIVE**
**SEPTEMBER 2**

Federal Emergency Managemen

## NOTES TO USERS

p is for use in administering the National Flood Insurance Program. It does ssarily identify all areas subject to flooding, particularly from local drainage of small size. The **community map repository** should be consulted for updated or additional flood hazard information.

n more detailed information in areas where **Base Flood Elevations** (BFEs) **oodways** have been determined, users are encouraged to consult the Flood and Floodway Data and/or Summary of Stillwater Elevations tables d within the Flood Insurance Study (FIS) report that accompanies this FIRM. hould be aware that BFEs shown on the FIRM represent rounded whole-foot ns. These BFEs are intended for flood insurance rating purposes only and ot be used as the sole source of flood elevation information. Accordingly, vation data presented in the FIS report should be utilized in conjunction with M for purposes of construction and/or floodplain management.

**Base Flood Elevations (BFEs)** shown on this map apply only landward of h American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should e that coastal flood elevations are also provided in the Summary of Stillwater ns table in the Flood Insurance Study report for this jurisdiction. Elevations n the Summary of Stillwater Elevations table should be used for construction oodplain management purposes when they are higher than the elevations n this FIRM.

ies of the **floodways** were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with o requirements of the National Flood Insurance Program. Floodway widths r pertinent floodway data are provided in the Flood Insurance Study report urisdiction.

areas not in Special Flood Hazard Areas may be protected by **flood control es**. Refer to Section 2.4 "Flood Protection Measures" of the Flood e Study report for information on flood control structures for this jurisdiction.

**jection** used in the preparation of this map was Universal Transverse r (UTM) zone 16. The **horizontal datum** was NAD83, GRS1980 spheroid. ces in datum, spheroid, projection or UTM zones used in the production of or adjacent jurisdictions may result in slight positional differences in map across jurisdiction boundaries. These differences do not affect the accuracy IRM.

evations on this map are referenced to the North American Vertical Datum of These flood elevations must be compared to structure and ground elevations ed to the same **vertical datum**. For information regarding conversion the National Geodetic Vertical Datum of 1929 and the North American Datum of 1988, visit the National Geodetic Survey website at ww.ngs.noaa.gov/ or contact the National Geodetic Survey at the following :

Reference System Division
Geodetic Survey, NOAA
oring Metro Center
st-West Highway
oring, Maryland 20910
3-3191

n current elevation, description, and/or location information for **bench marks** n this map, please contact the Information Services Branch of the National c Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

**ap** information shown on this FIRM was provided in digital format by the Tennessee. This information was photogrammetrically compiled at scales of and 1"=400' from aerial photography.

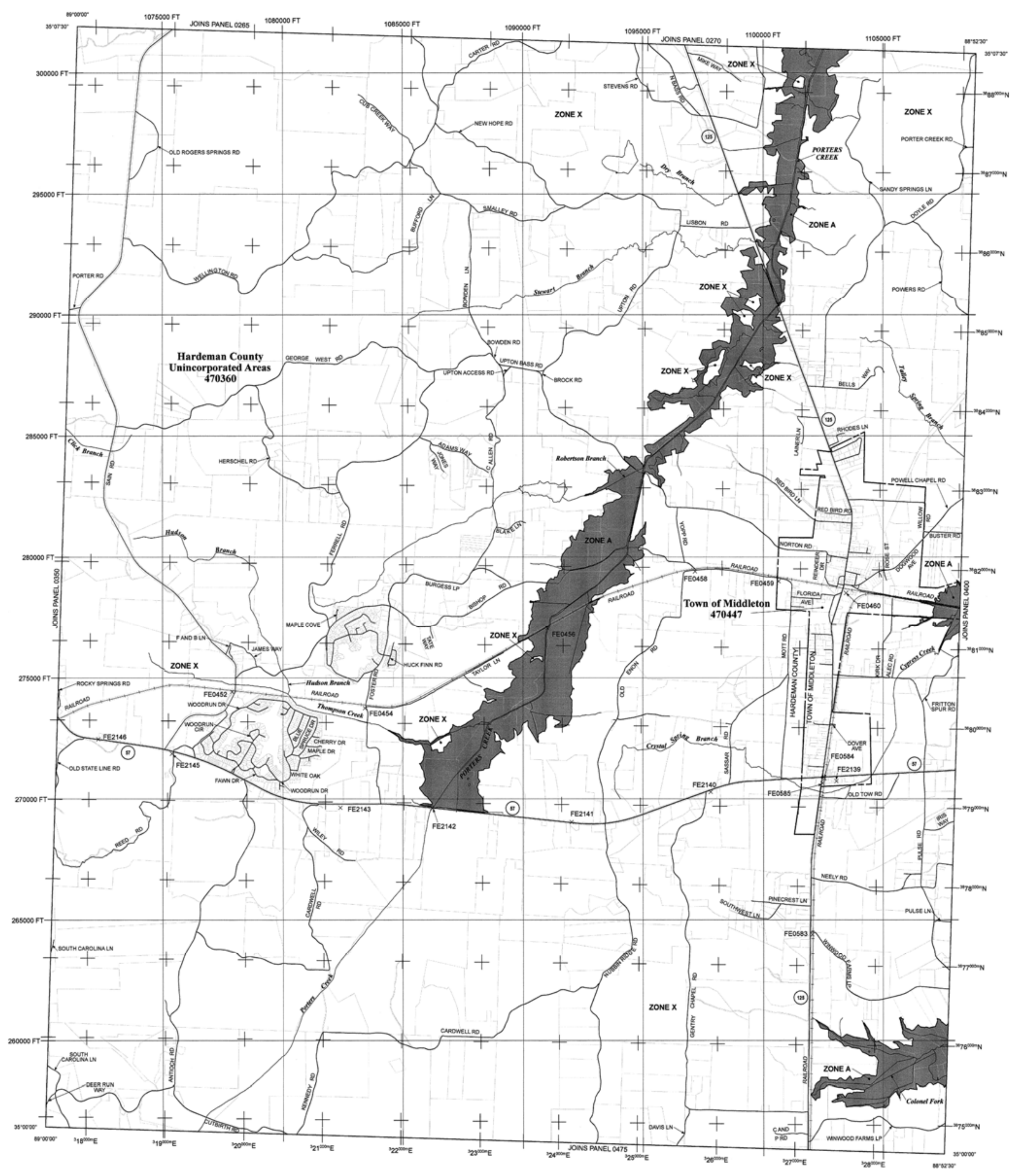
p reflects more detailed and up-to-date **stream channel configurations** se shown on the previous FIRM for this jurisdiction. The floodplains and ys that were transferred from the previous FIRM may have been adjusted to to these new stream channel configurations. As a result, the Flood Profiles odway Data tables *in the Flood Insurance Study report (which contains tive hydraulic data)* may reflect stream channel distances that differ from shown on this map.

**ate limits** shown on this map are based on the best data available at the time cation. Because changes due to annexations or de-annexations may have d after this map was published, map users should contact appropriate ity officials to verify current corporate limit locations.

efer to the separately printed **Map Index** for an overview map of the county the layout of map panels; community map repository addresses; and a f Communities table containing National Flood Insurance Program dates for mmunity as well as a listing of the panels on which each community is

the **FEMA Map Service Center** at 1-800-358-9616 for information on e products associated with this FIRM. Available products may include ly issued Letters of Map Change, *a Flood Insurance Study report*, and/or ersions of this map. The FEMA Map Service Center may also be reached by -800-358-9620 and its website at http://www.msc.fema.gov/.

ave **questions about this map** or questions concerning the National Flood e Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or FEMA website at http://www.fema.gov/.




## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJE
INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard inc A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface eleva 1% annual chance flood.

| | |
|---|---|
| ZONE A | No Base Flood Elevation determined. |
| ZONE AE | Base Flood Elevations determined. |
| ZONE AH | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood determined. |
| ZONE AO | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); aver determined. For areas of alluvial fan flooding, velocities also determined |
| ZONE AR | Area of special flood hazard formerly protected from the 1% annual c event by a flood control system that was subsequently decertified. indicates that the former flood control system is being restored protection from the 1% annual chance of greater flood event. |
| ZONE A99 | Areas to be protected from 1% annual chance flood event by a Fe protection system under construction; no Base Flood Elevations determi |
| ZONE V | Coastal flood zone with velocity hazard (wave action); no Base Flood determined. |
| ZONE VE | Coastal flood zone with velocity hazard (wave action); Base Flood determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be encroachment so that the 1% annual chance flood can be carried without substantial flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| ZONE X | Areas of 0.2% annual chance flood; areas of 1% annual chance flood w depths of less than 1 foot or with drainage areas less than 1 squar areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| ZONE X | Areas determined to be outside the 0.2% annual chance floodplain. |
| ZONE D | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Are

| | |
|---|---|
| | Floodplain boundary |
| | Floodway boundary |
| | Zone D boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of dif Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone in feet* |

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

| | |
|---|---|
| (A)——(A) | Cross section line |
| (23)------(23) | Transect line |
| 97°07'30", 32°22'30" | Geographic coordinates referenced to the North Datum of 1983 (NAD 83), Western Hemisphere |
| 4275000mE | 1000-meter Universal Transverse Mercator grid ticks, |
| 6000000 FT | 5000-foot grid values: Tennessee State Plane coordin (FIPSZONE = 4100), Lambert projection |
| DX5510 x | Bench mark (see explanation in Notes to Users sec FIRM panel) |
| • M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 28, 2007

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Com History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance ag the National Flood Insurance Program at 1-800-638-6620.

N

**MAP SCALE 1" = 2000'**

1,000 0 1,000 2,000 3,000 4,000 FEET

600 0 600 1,200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0375C

# FIRM

**FLOOD INSURANCE RATE**

**HARDEMAN COUNT**

**TENNESSEE**

**AND INCORPORATED AR**

**PANEL 375 OF 500**

(SEE MAP INDEX FOR FIRM PANEL

CONTAINS:

| COMMUNITY | NUMBER | PANE |
|---|---|---|
| HARDEMAN COUNTY | 470360 | 0375 |
| MIDDLETON, TOWN OF | 470447 | 0375 |

Notice to User: The **Map Number** shown below sho when placing map orders; the **Community Number** should be used on insurance applications for community.

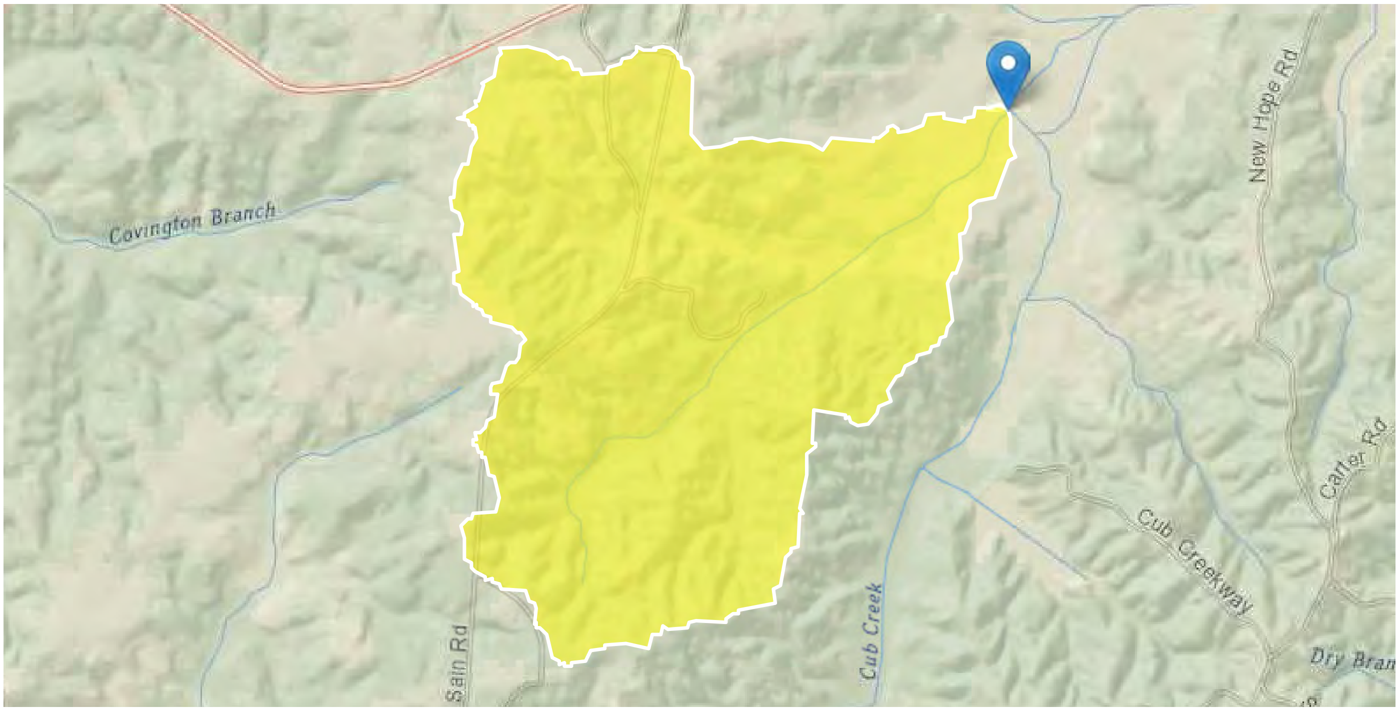
**MAP NU**
**47069C**

**EFFECTIVE**
**SEPTEMBER 28**

**Federal Emergency Management**

# Cub Creek StreamStats Report

**Region ID:** TN
**Workspace ID:** TN20230328133405119000
**Clicked Point (Latitude, Longitude):** 35.13395, -88.96557
**Time:** 2023-03-28 08:34:34 -0500




Collapse All

## Basin Characteristics

| Parameter Code | Parameter Description | Value | Unit |
|---|---|---|---|
| CLIMFAC2YR | Two-year climate factor from Lichy and Karlinger (1990) | 2.425 | dimensionless |
| CONTDA | Area that contributes flow to a point on a stream | 1.66 | square miles |
| DRNAREA | Area that drains to a point on a stream | 1.66 | square miles |
| PERMGTE2IN | Percent of area underlain by soils with permeability greater than or equal to 2 inches per hour | 82.242 | percent |
| RECESS | Number of days required for streamflow to recede one order of magnitude when hydrograph is plotted on logarithmic scale | 350 | days per log cycle |
| SOILPERM | Average Soil Permeability | 2.357 | inches per hour |

## Bankfull Statistics

### Bankfull Statistics Parameters [Atlantic Plain D Bieger 2015]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.66 | square miles | 0.30888 | 1086.8715 |

### Bankfull Statistics Parameters [USA Bieger 2015]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.66 | square miles | 0.07722 | 59927.7393 |

### Bankfull Statistics Flow Report [Atlantic Plain D Bieger 2015]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_D_channel_width | 12.4 | ft |
| Bieger_D_channel_depth | 1.26 | ft |
| Bieger_D_channel_cross_sectional_area | 15.1 | ft^2 |

### Bankfull Statistics Flow Report [USA Bieger 2015]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_USA_channel_width | 14.8 | ft |
| Bieger_USA_channel_depth | 1.34 | ft |
| Bieger_USA_channel_cross_sectional_area | 22.5 | ft^2 |

### Bankfull Statistics Flow Report [Area-Averaged]

| Statistic | Value | Unit |
|---|---|---|
| Bieger_D_channel_width | 12.4 | ft |
| Bieger_D_channel_depth | 1.26 | ft |
| Bieger_D_channel_cross_sectional_area | 15.1 | ft^2 |
| Bieger_USA_channel_width | 14.8 | ft |
| Bieger_USA_channel_depth | 1.34 | ft |
| Bieger_USA_channel_cross_sectional_area | 22.5 | ft^2 |

*Bankfull Statistics Citations*

**Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p.**

**(https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_campaign=PDI**

## Annual Flow Statistics

### Annual Flow Statistics Parameters [Low Flow West Region 2009 5159]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.66 | square miles | 2 | 2405 |
| RECESS | Recession Index | 350 | days per log cycle | 32 | 350 |
| CLIMFAC2YR | Tennessee Climate Factor 2 Year | 2.425 | dimensionless | 2.307 | 2.455 |
| PERMGTE2IN | Percent permeability gte 2 in per hr | 82.242 | percent | 2 | 98 |

### Annual Flow Statistics Disclaimers [Low Flow West Region 2009 5159]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

### Annual Flow Statistics Flow Report [Low Flow West Region 2009 5159]

| Statistic | Value | Unit |
|---|---|---|
| Mean Annual Flow | 2.52 | ft^3/s |

*Annual Flow Statistics Citations*

**Law, G.S., Tasker, G.D., and Ladd, D.E.,2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009–5159, 212 p., 1 pl. (http://pubs.usgs.gov/sir/2009/5159/)**

## Flow-Duration Statistics

### Flow-Duration Statistics Parameters [Low Flow West Region 2009 5159]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| DRNAREA | Drainage Area | 1.66 | square miles | 2 | 2405 |
| RECESS | Recession Index | 350 | days per log cycle | 32 | 350 |
| PERMGTE2IN | Percent permeability gte 2 in per hr | 82.242 | percent | 2 | 98 |
| CLIMFAC2YR | Tennessee Climate Factor 2 Year | 2.425 | dimensionless | 2.307 | 2.455 |

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| SOILPERM | Average Soil Permeability | 2.357 | inches per hour | 0.97 | 2.44 |

### Flow-Duration Statistics Disclaimers [Low Flow West Region 2009 5159]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

### Flow-Duration Statistics Flow Report [Low Flow West Region 2009 5159]

| Statistic | Value | Unit |
|---|---|---|
| 99.5 Percent Duration | 0.235 | ft^3/s |
| 99 Percent Duration | 0.262 | ft^3/s |
| 98 Percent Duration | 0.29 | ft^3/s |
| 95 Percent Duration | 0.352 | ft^3/s |
| 90 Percent Duration | 0.409 | ft^3/s |
| 80 Percent Duration | 0.509 | ft^3/s |
| 70 Percent Duration | 0.625 | ft^3/s |
| 60 Percent Duration | 0.827 | ft^3/s |
| 50 Percent Duration | 0.966 | ft^3/s |
| 40 Percent Duration | 1.32 | ft^3/s |
| 30 Percent Duration | 1.98 | ft^3/s |
| 20 Percent Duration | 2.92 | ft^3/s |
| 10 Percent Duration | 4.89 | ft^3/s |

*Flow-Duration Statistics Citations*

**Law, G.S., Tasker, G.D., and Ladd, D.E.,2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009–5159, 212 p., 1 pl. (http://pubs.usgs.gov/sir/2009/5159/)**

## Peak-Flow Statistics

### Peak-Flow Statistics Parameters [DAOnly Area 4]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
|---|---|---|---|---|---|
| CONTDA | Contributing Drainage Area | 1.66 | square miles | 0.76 | 2308 |

### Peak-Flow Statistics Flow Report [DAOnly Area 4]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

| Statistic | Value | Unit | PIl | PIu | SE | ASEp | Equiv. Yrs. |
|---|---|---|---|---|---|---|---|
| 50-percent AEP flood | 569 | ft^3/s | 300 | 1080 | 38.7 | 38.7 | 1.8 |
| 20-percent AEP flood | 815 | ft^3/s | 439 | 1510 | 37.2 | 37.2 | 2.4 |
| 10-percent AEP flood | 973 | ft^3/s | 519 | 1830 | 38 | 38 | 3.1 |
| 4-percent AEP flood | 1170 | ft^3/s | 603 | 2270 | 40.1 | 40.1 | 3.8 |
| 2-percent AEP flood | 1310 | ft^3/s | 653 | 2630 | 42.2 | 42.2 | 4.2 |
| 1-percent AEP flood | 1450 | ft^3/s | 697 | 3020 | 44.7 | 44.7 | 4.4 |
| 0.2-percent AEP flood | 1760 | ft^3/s | 769 | 4030 | 51.1 | 51.1 | 4.7 |

*Peak-Flow Statistics Citations*

**Law, G.S., and Tasker G.D.,2003, Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000: U.S. Geological Survey Water-Resources Investigations Report 03-4176, 79p. (http://pubs.usgs.gov/wri/wri034176/)**



Application Version: 4.14.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

**APPENDIX 4**
**NRCS CUSTOM SOIL REPORT**

United States Department of Agriculture

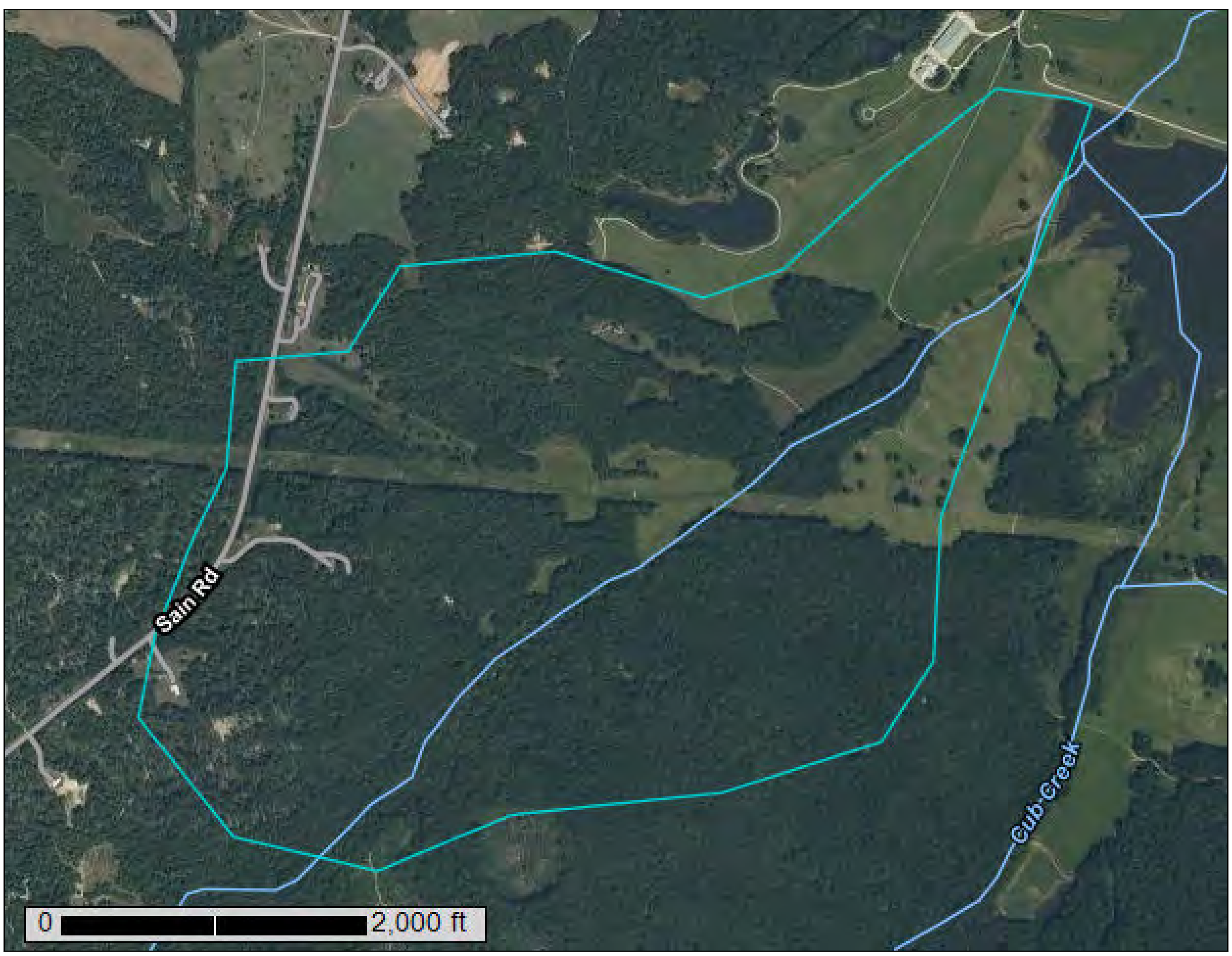
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for

# Hardeman County, Tennessee




March 28, 2023

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

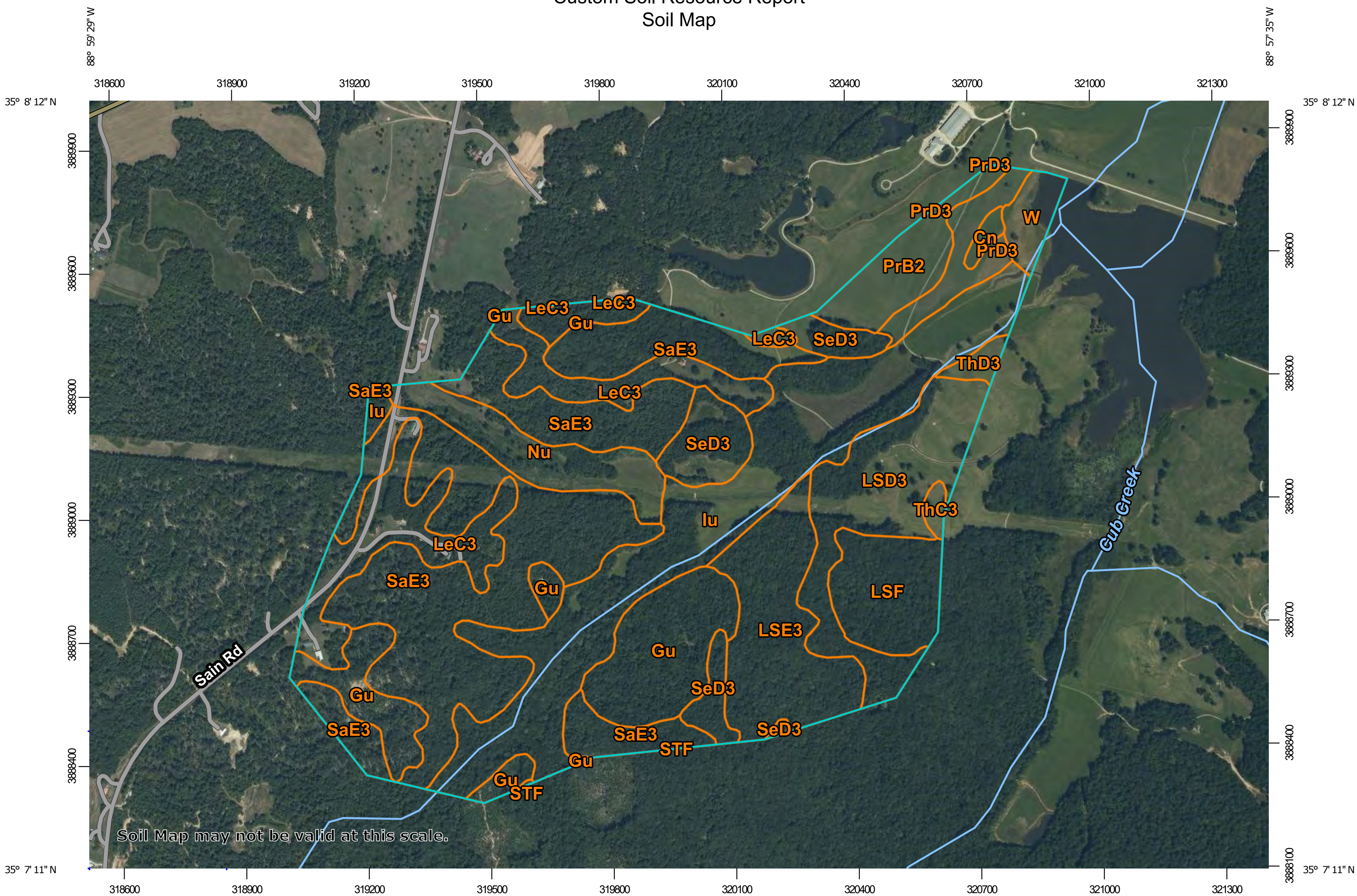
The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

# Contents

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Soil Map




Map Scale: 1:13,200 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hardeman County, Tennessee
Survey Area Data: Version 20, Sep 15, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 9, 2019—Sep 15, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| Cn | Chenneby silt loam, 0 to 2 percent slopes, occasionally flooded | 1.6 | 0.4% |
| Gu | Gullied land-Hapudults complex, very steep | 42.7 | 10.1% |
| Iu | Iuka silt loam, occasionally flooded | 77.5 | 18.4% |
| LeC3 | Lexington silty clay loam, 5 to 8 percent slopes, severely eroded | 35.5 | 8.4% |
| LSD3 | Luverne and Smithdale soils, 8 to 12 percent slopes, severely eroded | 33.7 | 8.0% |
| LSE3 | Luverne and Smithdale soils, 12 to 25 percent slopes, severely eroded | 31.4 | 7.4% |
| LSF | Luverne and Smithdale sandy loams, 25 to 45 percent slopes | 17.4 | 4.1% |
| Nu | Nugent loamy sand, occasionally flooded | 17.4 | 4.1% |
| PrB2 | Providence silt loam, 2 to 5 percent slopes, moderately eroded, north | 13.6 | 3.2% |
| PrD3 | Providence silty clay loam, 8 to 12 percent slopes, severely eroded | 9.5 | 2.2% |
| SaE3 | Smithdale loam, 12 to 25 percent slopes, severely eroded | 114.8 | 27.2% |
| SeD3 | Smithdale and Lexington soils, 8 to 12 percent slopes, severely eroded | 17.9 | 4.2% |
| STF | Smithdale and Toinette soils, 20 to 45 percent slopes | 0.1 | 0.0% |
| ThC3 | Tippah silt loam, 5 to 8 percent slopes, severely eroded | 1.4 | 0.3% |
| ThD3 | Tippah silt loam, 8 to 12 percent slopes, severely eroded | 2.3 | 0.6% |
| W | Water | 5.7 | 1.4% |
| **Totals for Area of Interest** | | **422.5** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Hardeman County, Tennessee

## Cn—Chenneby silt loam, 0 to 2 percent slopes, occasionally flooded

### Map Unit Setting

*National map unit symbol:* 2w6fh
*Elevation:* 310 to 470 feet
*Mean annual precipitation:* 40 to 60 inches
*Mean annual air temperature:* 59 to 72 degrees F
*Frost-free period:* 200 to 240 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Chenneby and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Chenneby

#### Setting

*Landform:* Flood-plain steps
*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Silty alluvium

#### Typical profile

*A - 0 to 7 inches:* silt loam
*Bw - 7 to 22 inches:* silty clay loam
*Bg - 22 to 50 inches:* silty clay loam
*Cg - 50 to 62 inches:* silty clay loam

#### Properties and qualities

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* About 12 to 29 inches
*Frequency of flooding:* OccasionalNone
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 10.8 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* B/D
*Hydric soil rating:* No

### Minor Components

#### Cascilla

*Percent of map unit:* 7 percent
*Landform:* Flood-plain steps

*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* No

**Rosebloom**

*Percent of map unit:* 3 percent
*Landform:* Flood plains
*Landform position (three-dimensional):* Dip
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* Yes

## Gu—Gullied land-Hapudults complex, very steep

**Map Unit Setting**

*National map unit symbol:* bzrg
*Elevation:* 330 to 670 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Gullied land:* 70 percent
*Hapludults and similar soils:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Hapludults**

**Properties and qualities**

*Slope:* 25 to 45 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydric soil rating:* No

## Iu—Iuka silt loam, occasionally flooded

**Map Unit Setting**

*National map unit symbol:* bzrh
*Elevation:* 310 to 610 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Iuka and similar soils:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Iuka**

**Setting**

*Landform:* Flood plains
*Landform position (three-dimensional):* Talf
*Parent material:* Loamy alluvium

**Typical profile**

*H1 - 0 to 5 inches:* silt loam
*H2 - 5 to 34 inches:* sandy loam
*H3 - 34 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* About 18 to 36 inches
*Frequency of flooding:* NoneOccasional
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 9.1 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

## LeC3—Lexington silty clay loam, 5 to 8 percent slopes, severely eroded

**Map Unit Setting**

*National map unit symbol:* bzrp

*Elevation:* 300 to 650 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Lexington and similar soils:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Lexington**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loess over loamy marine deposits

**Typical profile**

*H1 - 0 to 5 inches:* silty clay loam
*H2 - 5 to 14 inches:* silty clay loam
*H3 - 14 to 37 inches:* silt loam
*H4 - 37 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 5 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Moderate (about 6.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* B
*Ecological site:* F134XY003AL - Northern Loess Interfluve - PROVISIONAL
*Hydric soil rating:* No

## LSD3—Luverne and Smithdale soils, 8 to 12 percent slopes, severely eroded

**Map Unit Setting**

*National map unit symbol:* bzrx
*Elevation:* 340 to 640 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Luverne and similar soils:* 60 percent
*Smithdale and similar soils:* 40 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Luverne**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Stratified clayey and/or loamy marine deposits

**Typical profile**

*H1 - 0 to 4 inches:* clay loam
*H2 - 4 to 18 inches:* clay
*H3 - 18 to 30 inches:* sandy clay loam
*H4 - 30 to 60 inches:* stratified loamy sand to sandy clay loam

**Properties and qualities**

*Slope:* 8 to 12 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Moderate (about 6.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

**Description of Smithdale**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loamy marine deposits

**Typical profile**

*H1 - 0 to 4 inches:* loam
*H2 - 4 to 32 inches:* sandy clay loam
*H3 - 32 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 8 to 12 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 9.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

## LSE3—Luverne and Smithdale soils, 12 to 25 percent slopes, severely eroded

**Map Unit Setting**

*National map unit symbol:* bzry
*Elevation:* 340 to 640 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Luverne and similar soils:* 65 percent
*Smithdale and similar soils:* 35 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Luverne**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Stratified clayey and/or loamy marine deposits

**Typical profile**

*H1 - 0 to 4 inches:* clay loam
*H2 - 4 to 18 inches:* clay
*H3 - 18 to 30 inches:* sandy clay loam
*H4 - 30 to 60 inches:* stratified loamy sand to sandy clay loam

**Properties and qualities**

*Slope:* 12 to 25 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Moderate (about 6.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* C

*Hydric soil rating:* No

**Description of Smithdale**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loamy marine deposits

**Typical profile**

*H1 - 0 to 4 inches:* loam
*H2 - 4 to 32 inches:* sandy clay loam
*H3 - 32 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 12 to 25 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 9.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

## LSF—Luverne and Smithdale sandy loams, 25 to 45 percent slopes

**Map Unit Setting**

*National map unit symbol:* bzrz
*Elevation:* 340 to 640 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Luverne and similar soils:* 60 percent
*Smithdale and similar soils:* 40 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Luverne**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope

*Parent material:* Stratified clayey and/or loamy marine deposits

**Typical profile**

*H1 - 0 to 9 inches:* sandy loam
*H2 - 9 to 29 inches:* sandy clay
*H3 - 29 to 36 inches:* sandy clay loam
*H4 - 36 to 60 inches:* stratified loamy sand to sandy clay loam

**Properties and qualities**

*Slope:* 20 to 45 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Moderate (about 7.1 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

### Description of Smithdale

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loamy marine deposits

**Typical profile**

*H1 - 0 to 7 inches:* sandy loam
*H2 - 7 to 40 inches:* sandy clay loam
*H3 - 40 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 20 to 45 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 9.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

## Nu—Nugent loamy sand, occasionally flooded

### Map Unit Setting

*National map unit symbol:* bzs0
*Elevation:* 310 to 590 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Nugent and similar soils:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Nugent

#### Setting

*Landform:* Flood plains
*Landform position (three-dimensional):* Talf
*Parent material:* Sandy alluvium

#### Typical profile

*H1 - 0 to 6 inches:* loamy sand
*H2 - 6 to 60 inches:* stratified loamy sand to fine sandy loam

#### Properties and qualities

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)
*Depth to water table:* About 36 to 48 inches
*Frequency of flooding:* NoneOccasional
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 5.9 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3s
*Hydrologic Soil Group:* A
*Ecological site:* F134XY017AL - Northern Sandy Drainageway
*Hydric soil rating:* No

## PrB2—Providence silt loam, 2 to 5 percent slopes, moderately eroded, north

### Map Unit Setting

*National map unit symbol:* 2vxxl
*Elevation:* 350 to 650 feet
*Mean annual precipitation:* 47 to 58 inches
*Mean annual air temperature:* 46 to 68 degrees F
*Frost-free period:* 196 to 250 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Providence and similar soils:* 94 percent
*Minor components:* 6 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Providence

#### Setting

*Landform:* Divides, terraces
*Landform position (two-dimensional):* Summit, footslope
*Landform position (three-dimensional):* Interfluve, tread
*Down-slope shape:* Linear, concave
*Across-slope shape:* Linear
*Parent material:* Loess over loamy marine deposits

#### Typical profile

*Ap - 0 to 6 inches:* silt loam
*Bt - 6 to 18 inches:* silt loam
*Btx - 18 to 32 inches:* silty clay loam
*2Btx - 32 to 62 inches:* loam
*2Bt - 62 to 79 inches:* sandy clay loam

#### Properties and qualities

*Slope:* 2 to 5 percent
*Depth to restrictive feature:* 14 to 21 inches to fragipan
*Drainage class:* Moderately well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* About 12 to 16 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 3.8 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Minor Components**

**Lexington**

*Percent of map unit:* 6 percent
*Landform:* Divides
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* No

## PrD3—Providence silty clay loam, 8 to 12 percent slopes, severely eroded

**Map Unit Setting**

*National map unit symbol:* bzs7
*Elevation:* 330 to 620 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Providence and similar soils:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Providence**

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loess over loamy marine deposits

**Typical profile**

*H1 - 0 to 5 inches:* silty clay loam
*H2 - 5 to 18 inches:* silty clay loam
*H3 - 18 to 45 inches:* silt loam
*H4 - 45 to 60 inches:* loam

**Properties and qualities**

*Slope:* 8 to 12 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
*Depth to water table:* About 14 to 22 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 3.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* C/D
*Hydric soil rating:* No

## SaE3—Smithdale loam, 12 to 25 percent slopes, severely eroded

**Map Unit Setting**

*National map unit symbol:* 2vxwx
*Elevation:* 160 to 660 feet
*Mean annual precipitation:* 48 to 67 inches
*Mean annual air temperature:* 51 to 68 degrees F
*Frost-free period:* 230 to 290 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Smithdale and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Smithdale**

**Setting**

*Landform:* Hillslopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loamy fluviomarine deposits derived from sedimentary rock

**Typical profile**

*A - 0 to 3 inches:* loam
*E - 3 to 13 inches:* fine sandy loam
*Bt1 - 13 to 53 inches:* sandy clay loam
*Bt2 - 53 to 59 inches:* sandy loam

**Properties and qualities**

*Slope:* 12 to 25 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.13 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 9.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

**Minor Components**

**Luverne**
*Percent of map unit:* 6 percent
*Landform:* Hillslopes
*Landform position (two-dimensional):* Shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

**Lexington**
*Percent of map unit:* 4 percent
*Landform:* Loess hills
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

## SeD3—Smithdale and Lexington soils, 8 to 12 percent slopes, severely eroded

**Map Unit Setting**
*National map unit symbol:* bzsd
*Elevation:* 300 to 690 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**
*Smithdale and similar soils:* 60 percent
*Lexington and similar soils:* 40 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Smithdale**

**Setting**
*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loamy marine deposits

**Typical profile**
*H1 - 0 to 4 inches:* loam
*H2 - 4 to 32 inches:* sandy clay loam
*H3 - 32 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 8 to 12 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 9.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

### Description of Lexington

**Setting**

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loess over loamy marine deposits

**Typical profile**

*H1 - 0 to 5 inches:* silty clay loam
*H2 - 5 to 14 inches:* silty clay loam
*H3 - 14 to 37 inches:* silt loam
*H4 - 37 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 8 to 12 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Moderate (about 6.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* B
*Ecological site:* F134XY003AL - Northern Loess Interfluve - PROVISIONAL
*Hydric soil rating:* No

## STF—Smithdale and Toinette soils, 20 to 45 percent slopes

### Map Unit Setting

*National map unit symbol:* 2vxy1
*Elevation:* 100 to 640 feet
*Mean annual precipitation:* 52 to 69 inches
*Mean annual air temperature:* 57 to 70 degrees F
*Frost-free period:* 215 to 270 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Smithdale and similar soils:* 55 percent
*Toinette and similar soils:* 35 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Smithdale

#### Setting

*Landform:* Hillslopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loamy fluviomarine deposits derived from sedimentary rock

#### Typical profile

*A - 0 to 4 inches:* sandy loam
*E - 4 to 11 inches:* sandy loam
*Bt1 - 11 to 38 inches:* sandy clay loam
*Bt2 - 38 to 52 inches:* sandy loam
*Bt3 - 52 to 80 inches:* sandy loam

#### Properties and qualities

*Slope:* 20 to 45 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 9.6 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* B

*Hydric soil rating:* No

### Description of Toinette

#### Setting

*Landform:* Hillslopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Sandy marine deposits

#### Typical profile

*A - 0 to 3 inches:* loamy sand
*E - 3 to 22 inches:* loamy sand
*Bt - 22 to 46 inches:* sandy clay loam
*BC - 46 to 79 inches:* loamy sand

#### Properties and qualities

*Slope:* 20 to 45 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Moderate (about 7.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

### Minor Components

#### Lexington

*Percent of map unit:* 6 percent
*Landform:* Hillslopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

#### Providence

*Percent of map unit:* 4 percent
*Landform:* Hillslopes
*Landform position (two-dimensional):* Shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Hydric soil rating:* No

## ThC3—Tippah silt loam, 5 to 8 percent slopes, severely eroded

### Map Unit Setting

*National map unit symbol:* bzsm
*Elevation:* 360 to 590 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Tippah and similar soils:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Tippah

#### Setting

*Landform:* Hillslopes
*Landform position (three-dimensional):* Crest
*Parent material:* Loess over clayey marine deposits

#### Typical profile

*H1 - 0 to 5 inches:* silt loam
*H2 - 5 to 28 inches:* silty clay loam
*H3 - 28 to 60 inches:* silty clay

#### Properties and qualities

*Slope:* 5 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 11.1 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

## ThD3—Tippah silt loam, 8 to 12 percent slopes, severely eroded

### Map Unit Setting

*National map unit symbol:* bzsp
*Elevation:* 360 to 570 feet
*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Tippah and similar soils:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Tippah

#### Setting

*Landform:* Hillslopes
*Landform position (three-dimensional):* Side slope
*Parent material:* Loess over clayey marine deposits

#### Typical profile

*H1 - 0 to 5 inches:* silt loam
*H2 - 5 to 28 inches:* silty clay loam
*H3 - 28 to 60 inches:* silty clay

#### Properties and qualities

*Slope:* 8 to 12 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 11.1 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

## W—Water

### Map Unit Setting

*National map unit symbol:* bzsv

*Mean annual precipitation:* 48 to 62 inches
*Mean annual air temperature:* 48 to 71 degrees F
*Frost-free period:* 197 to 211 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Water:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**APPENDIX 5**
**SITE PHOTOS,**
**STREAM AND WETLAND DETERMINATION FORMS,**
**SQT WORKBOOK**

Photo 1: STR-1 looking downstream at study boundary

Photo 2: STR-1 looking upstream

Photo 3: STR-1 looking downstream

Photo 4: STR-1 looking downstream at end into Cub Creek Lake Number Two A

Photo 5: STR-2 looking upstream at headcut and point of intermittency

Photo 6: STR-2 looking downstream

Photo 7: STR-2A looking upstream from confluence with STR-2

Photo 8: STR-3 looking downstream at start/point of intermittency

Photo 9: STR-3 looking downstream

Photo 10: STR-3 looking upstream

Photo 11: STR-3A looking downstream from start/point of intermittency

Photo 12: STR-4 looking downstream at start/point of intermittency

Photo 13: STR-4 looking upstream

Photo 14: STR-4 looking upstream

Photo 15: STR-4A looking upstream

Photo 16: STR-4B looking upstream from confluence with STR-4

Photo 17: STR-5 looking downstream

Photo 18: STR-5 looking downstream

Photo 19: STR-5 looking upstream from confluence with STR-1

Photo 20: STR-6 looking downstream from start/point of intermittency

Photo 21: STR-6 looking downstream

Photo 22: STR-7 looking upstream

Photo 23: STR-7 looking upstream

Photo 24: STR-8 looking downstream from confluence with STR-8B

Photo 25: STR-8 looking downstream at major active headcut

Photo 26: STR-8 looking downstream at confluence with STR-1

Photo 27: STR-8A looking at seep from hillslope at start

Photo 28: STR-8A looking downstream

Photo 29: STR-8B looking downstream at confluence with STR-8

Photo 30: STR-9 looking upstream at start

Photo 31: STR-9 looking upstream

Photo 32: STR-9 looking downstream

## WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/27/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-A

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.133637 Long: -88.966536 Datum: NAD 83

Soil Map Unit Name: Providence (PrD3)/Chenneby (Cn)/Water (W) NWI classification: PEM

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:
Mowed field adjacent to lake

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ☐ | No ✓ | Depth (inches): |
| Water Table Present? | Yes ✓ | No ☐ | Depth (inches): 6 |
| Saturation Present? (includes capillary fringe) | Yes ✓ | No ☐ | Depth (inches): 1-2 |

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

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

Remarks:

**VEGETATION (Five Strata) –** Use scientific names of plants. Sampling Point: WET-A

| Tree Stratum (Plot size: ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |
| **Sapling Stratum** (Plot size: ) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |
| **Shrub Stratum** (Plot size: ) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |
| **Herb Stratum** (Plot size: 5 ) | | | |
| 1. Eleocharis obtusa | 35 | Y | OBL |
| 2. Carex frankii | 30 | Y | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 65 | = Total Cover | |
| 50% of total cover: 32.5 | | 20% of total cover: 13 | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | 65 | x 1 = 65 |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 65 (A) | 65 (B) |

Prevalence Index = B/A = 1.0

**Hydrophytic Vegetation Indicators:**

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

Freshly mowed wetland

**SOIL**

Sampling Point: WET-A

**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 | 10 YR 4/2 | 70 | 7.5 YR 4/4 | 30 | C | PL | Sandy L | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

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

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

**Restrictive Layer (if observed):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes [x] No [ ]

Remarks:

## WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/27/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-A

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.133645 Long: -88.966797 Datum: NAD 83

Soil Map Unit Name: Providence (PrD3)/Chenneby (Cn)/Water (W) 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:
mowed hillslope adjacent to WET-A

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata)** – Use scientific names of plants. Sampling Point: UPL-A

**Tree Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| = Total Cover | | | |

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

**Sapling Stratum** (Plot size: 15)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| = Total Cover | | | |

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

**Shrub Stratum** (Plot size: 15)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| = Total Cover | | | |

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

**Herb Stratum** (Plot size: 5)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Festuca paradoxa* | 40 | Y | FAC |
| 2. *Andropogon virginicus* | 30 | Y | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| = Total Cover | 70 | | |

50% of total cover: 35 20% of total cover: 14

**Woody Vine Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |

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

**Dominance Test worksheet:**

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | 40 | x 3 = 120 |
| FACU species | 30 | x 4 = 120 |
| UPL species | | x 5 = |
| Column Totals: | 70 (A) | 240 (B) |

Prevalence Index = B/A = 3.43

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL** Sampling Point: UPL-A

**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 | 10 YR 4/5 | 100 | | | | | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/24/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-B

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.129477 Long: -88.973417 Datum: NAD 83

Soil Map Unit Name: Iuka (Iu) NWI classification: PFO

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

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

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

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ | No ☐ |
| Hydric Soil Present? | Yes ✓ | No ☐ |
| Wetland Hydrology Present? | Yes ✓ | No ☐ |

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

Remarks:
forested wetland, evidence of inundation although dry at time of delineation

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: WET-B

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Liquidambar styraciflua* | 40 | Y | FAC |
| 2. *Ulmus americana* | 20 | Y | FACW |
| 3. *Betula nigra* | 15 | Y | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 75 | = Total Cover | |
| 50% of total cover: 37.5 | 20% of total cover: 15 | | |

| Sapling Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Ulmus americana* | 5 | Y | FACW |
| 2. *Quercus phellos* | 5 | Y | FAC |
| 3. *Liquidambar styraciflua* | 5 | Y | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 15 | = Total Cover | |
| 50% of total cover: 7.5 | 20% of total cover: 3 | | |

| Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Microstegium vimineum | 25 | Y | FAC |
| 2. Persicaria virginiana | 10 | Y | FAC |
| 3. *Onoclea sensibilis* | 5 | N | FACW |
| 4. *Saururus cernuus* | 5 | N | OBL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 45 | = Total Cover | |
| 50% of total cover: 22.5 | 20% of total cover: 9 | | |

| Woody Vine Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 5 | x 1 = | 5 |
| FACW species | 45 | x 2 = | 90 |
| FAC species | 85 | x 3 = | 255 |
| FACU species | | x 4 = | |
| UPL species | | x 5 = | |
| Column Totals: | 135 (A) | | 350 (B) |

Prevalence Index = B/A = 2.59

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-B

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10 YR 4/2 | 70 | 7.5 YR 4/3 | 30 | C | PL | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-B

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.129999 Long: -88.973995 Datum: NAD 83

Soil Map Unit Name: Lexington (LeC3)/Iuka (Iu) 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.

| | Yes | No |
|---|---|---|
| Hydrophytic Vegetation Present? | ✓ | |
| Hydric Soil Present? | | ✓ |
| Wetland Hydrology Present? | | ✓ |

Is the Sampled Area within a Wetland? 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**Field Observations:**

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

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

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

Remarks:

**VEGETATION (Five Strata) –** Use scientific names of plants.

Sampling Point: UPL-B

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Acer rubrum* | 25 | Y | FAC |
| 2. *Liquidambar styraciflua* | 20 | Y | FAC |
| 3. *Betula nigra* | 10 | N | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 55 | = Total Cover | |
| 50% of total cover: 27.5 | | 20% of total cover: 11 | |

| Sapling Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Betula nigra* | 5 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 5 | = Total Cover | |
| 50% of total cover: 2.5 | | 20% of total cover: 1 | |

| Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Microstegium vimineum* | 45 | Y | FAC |
| 2. *Persicaria virginiana* | 15 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 60 | = Total Cover | |
| 50% of total cover: 30 | | 20% of total cover: 12 | |

| Woody Vine Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Vitis rotundifolia* | 10 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 10 | = Total Cover | |
| 50% of total cover: 5 | | 20% of total cover: 2 | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 15 | x 2 = 30 |
| FAC species | 115 | x 3 = 345 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 130 (A) | 375 (B) |

Prevalence Index = B/A = 2.88

**Hydrophytic Vegetation Indicators:**

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [x] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: UPL-B

**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 |
|---|---|---|---|---|---|---|---|---|
| 0-10 | 10 YR 4/3 | 100 | | | | | silt loam | compacted soils |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-C

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.131655 Long: -88.976690 Datum: NAD 83

Soil Map Unit Name: Smithdale (SaE3) NWI classification: PFO

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

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

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

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ | No ☐ |
| Hydric Soil Present? | Yes ✓ | No ☐ |
| Wetland Hydrology Present? | Yes ✓ | No ☐ |

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

Remarks:
forested wetland, floodplain

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata)** – Use scientific names of plants.

Sampling Point: WET-C

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Liquidambar styraciflua | 35 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 35 = Total Cover | | |
| 50% of total cover: 17.5 | 20% of total cover: 7 | | |

| Sapling Stratum (Plot size: ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Shrub Stratum (Plot size: ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Athyrium asplenioides* | 20 | Y | FAC |
| 2. *Onoclea sensibilis* | 15 | Y | FACW |
| 3. Juncus effusus | 15 | Y | FACW |
| 4. *Osmunda spectabilis* | 10 | N | OBL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 60 = Total Cover | | |
| 50% of total cover: 30 | 20% of total cover: 12 | | |

| Woody Vine Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | 10 | x 1 = 10 |
| FACW species | 30 | x 2 = 60 |
| FAC species | 55 | x 3 = 165 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 95 (A) | 235 (B) |

Prevalence Index = B/A = 2.47

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-C

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10 YR 6/1 | 90 | 7.5 YR 4/6 | 10 | C | M | sandy/c | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-C

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 10-15

Subregion (LRR or MLRA): P 133A Lat: 35.131514 Long: -88.976583 Datum: NAD 83

Soil Map Unit Name: Smithdale (SaE3) 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.

| | Yes | No |
|---|---|---|
| Hydrophytic Vegetation Present? | ☐ | ☑ |
| Hydric Soil Present? | ☐ | ☑ |
| Wetland Hydrology Present? | ☐ | ☑ |

**Is the Sampled Area within a Wetland?** 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**Field Observations:**

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

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

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

Remarks:

**VEGETATION (Five Strata)** – Use scientific names of plants.

Sampling Point: UPL-C

Tree Stratum (Plot size: 30 )

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Quercus falcata* | 30 | Y | FACU |
| 2. *Carya ovalis* | 10 | Y | FACU |
| 3. *Ilex opaca* | 10 | Y | FACU |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 50 = Total Cover | | |

50% of total cover: 25 20% of total cover: 10

Sapling Stratum (Plot size: 15 )

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

Shrub Stratum (Plot size: 15 )

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

Herb Stratum (Plot size: 5 )

| | | | |
|---|---|---|---|
| 1. *Vitis rotundifolia* | 10 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 10 = Total Cover | | |

50% of total cover: 5 20% of total cover: 2

Woody Vine Stratum (Plot size: 30 )

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |

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

**Dominance Test worksheet:**

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | 10 | x 3 = 30 |
| FACU species | 50 | x 4 = 200 |
| UPL species | | x 5 = |
| Column Totals: | 60 (A) | 230 (B) |

Prevalence Index = B/A = 3.83

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL** Sampling Point: UPL-C

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

| Depth | Matrix | | Redox Features | | | | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | | |
| 0-10 | 10 YR 4/3 | 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: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6-29-2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-D

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.128341 Long: -88.971354 Datum: NAD 83

Soil Map Unit Name: Luverne/Smithdale (LSD3) NWI classification: PFO

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

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

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

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ☑ | No ☐ |
| Hydric Soil Present? | Yes ☑ | No ☐ |
| Wetland Hydrology Present? | Yes ☑ | No ☐ |

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

Remarks:

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: WET-D

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Liquidambar styraciflua* | 30 | Y | FAC |
| 2. *Acer rubrum* | 20 | Y | FAC |
| 3. *Quercus phellos* | 10 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 60 = Total Cover | | |
| 50% of total cover: 30 | 20% of total cover: 12 | | |

| Sapling Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. *Acer rubrum* | 5 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Shrub Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: 5) | | | |
|---|---|---|---|
| 1. *Microstegium vimineum* | 35 | Y | FAC |
| 2. *Onoclea sensibilis* | 25 | Y | FACW |
| 3. *Panicum virgatum* | 10 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 70 = Total Cover | | |
| 50% of total cover: 35 | 20% of total cover: 14 | | |

| Woody Vine Stratum (Plot size: 30) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

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

Total Number of Dominant Species Across All Strata: 5 (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 | 25 | x 2 = 50 |
| FAC species | 110 | x 3 = 330 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 135 (A) | 380 (B) |

Prevalence Index = B/A = 2.81

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-D

**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 |
|---|---|---|---|---|---|---|---|---|
| 0-16 | 10 YR 5/2 | 75 | 7.5 YR 4/4 | 25 | C | PL | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-D

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.128227 Long: -88.971132 Datum: NAD 83

Soil Map Unit Name: Luverne/Smithdale (LSD3) 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.

| | Yes | No |
|---|---|---|
| Hydrophytic Vegetation Present? | ✓ | |
| Hydric Soil Present? | | ✓ |
| Wetland Hydrology Present? | | ✓ |

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

Remarks:
Hillslope adjacent to WET-D

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**Field Observations:**

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

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

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

Remarks:

**VEGETATION (Five Strata)** – Use scientific names of plants.

Sampling Point: WET-D

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Ulmus americana* | 25 | Y | FACW |
| 2. Quercus falcata | 25 | Y | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 50 | = Total Cover | |
| 50% of total cover: 25 | 20% of total cover: 10 | | |

| Sapling Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | 20% of total cover: | | |

| Shrub Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: 5) | | | |
|---|---|---|---|
| 1. *Smilax rotundifolia* | 25 | Y | FAC |
| 2. *Vitis rotundifolia* | 15 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 40 | = Total Cover | |
| 50% of total cover: 20 | 20% of total cover: 8 | | |

| Woody Vine Stratum (Plot size: 30) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 25 | x 2 = 50 |
| FAC species | 40 | x 3 = 120 |
| FACU species | 25 | x 4 = 100 |
| UPL species | | x 5 = |
| Column Totals: | 90 (A) | 270 (B) |

Prevalence Index = B/A = 3.0

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: UPL-D

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

| Depth | Matrix | | Redox Features | | | | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | | |
| 0-18 | 10 YR 4/6 | 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: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-E

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.128309 Long: -88.976420 Datum: NAD 83

Soil Map Unit Name: Nugent (Nu) NWI classification: PEM

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:
emergent wetland near powerline right-of-way

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: WET-E

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| = Total Cover | | | |
| 50% of total cover: ___ 20% of total cover: ___ | | | |

| Sapling Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| = Total Cover | | | |
| 50% of total cover: ___ 20% of total cover: ___ | | | |

| Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| = Total Cover | | | |
| 50% of total cover: ___ 20% of total cover: ___ | | | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Juncus marginatus* | 35 | Y | FACW |
| 2. *Panicum virgatum* | 20 | Y | FAC |
| 3. *Eleocharis obtusa* | 10 | N | OBL |
| 4. *Hypericum mutilum* | 10 | N | FACW |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| = Total Cover | 75 | | |
| 50% of total cover: 37.5 20% of total cover: 15 | | | |

| Woody Vine Stratum (Plot size: ___) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| 50% of total cover: ___ 20% of total cover: ___ | | | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | 10 | x 1 = 10 |
| FACW species | 45 | x 2 = 90 |
| FAC species | 20 | x 3 = 60 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 75 (A) | 160 (B) |

Prevalence Index = B/A = 2.13

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL**

Sampling Point: WET-E

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10 YR 5/2 | 75 | 7.5 YR 4/6 | 25 | C | PL | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

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

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

**Restrictive Layer (if observed):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes [x] No [ ]

Remarks:

# WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-E

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.128163 Long: -88.976546 Datum: NAD 83

Soil Map Unit Name: Nugent (Nu) 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.

| | Yes | No |
|---|---|---|
| Hydrophytic Vegetation Present? | ☐ | ✓ |
| Hydric Soil Present? | ☐ | ✓ |
| Wetland Hydrology Present? | ☐ | ✓ |

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

Remarks:
high knob adjacent to slope wetland (WET-E), near power line right-of-way

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**Field Observations:**

| | Yes | No | Depth (inches) |
|---|---|---|---|
| Surface Water Present? | ☐ | ✓ | |
| Water Table Present? | ☐ | ✓ | |
| Saturation Present? (includes capillary fringe) | ☐ | ✓ | |

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

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

Remarks:

**VEGETATION (Five Strata) –** Use scientific names of plants. Sampling Point: UPL-E

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |

| Sapling Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |

| Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Festuca paradoxa* | 40 | Y | FAC |
| 2. *Rubus argutus* | 15 | Y | FACU |
| 3. *Eupatorium capillifolium* | 10 | N | FACU |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 65 | = Total Cover | |
| 50% of total cover: | 32.5 | 20% of total cover: | 13 |

| Woody Vine Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| 50% of total cover: | | 20% of total cover: | |

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That Are OBL, FACW, or FAC: | 1 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of Dominant Species That Are OBL, FACW, or FAC: | 50 | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | | x 1 = | |
| FACW species | | x 2 = | |
| FAC species | 40 | x 3 = | 120 |
| FACU species | 25 | x 4 = | 100 |
| UPL species | | x 5 = | |
| Column Totals: | 65 (A) | | 220 (B) |

Prevalence Index = B/A = 3.38

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL** Sampling Point: UPL-E

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

| Depth | Matrix | | Redox Features | | | | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | | |
| 0-12 | 10 YR 4/4 | 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: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-F

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.129108 Long: -88.979491 Datum: NAD 83

Soil Map Unit Name: Nugent (Nu) NWI classification: PEM

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

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

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

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ☑ | No ☐ |
| Hydric Soil Present? | Yes ☑ | No ☐ |
| Wetland Hydrology Present? | Yes ☑ | No ☐ |

Is the Sampled Area within a Wetland? Yes ☑ No ☐

Remarks:
emergent wetland from upstream pond seep, frequently mowed, some early successional forest species

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: WET-F

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Sapling Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Liquidambar styraciflua* | 40 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 40 = Total Cover | | |
| 50% of total cover: 20 | 20% of total cover: 8 | | |

| Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Juncus effusus* | 30 | Y | FACW |
| 2. *Juncus marginatus* | 15 | Y | FACW |
| 3. *Carex frankii* | 10 | N | OBL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 55 = Total Cover | | |
| 50% of total cover: 27.5 | 20% of total cover: 11 | | |

| Woody Vine Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | 10 | x 1 = 10 |
| FACW species | 45 | x 2 = 90 |
| FAC species | 40 | x 3 = 120 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 95 (A) | 220 (B) |

Prevalence Index = B/A = 2.32

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-F

**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 | 10 YR 5/2 | 60 | 7.5 YR 4/6 | 40 | RM | M | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 6/29/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-F

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

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

Subregion (LRR or MLRA): P 133A Lat: 35.129180 Long: -88.979505 Datum: NAD 83

Soil Map Unit Name: Nugent (Nu)/Smithdale (SaE3) 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 ☐ |
| Hydric Soil Present? | Yes ☐ | No ✓ |
| Wetland Hydrology Present? | Yes ☐ | No ✓ |

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

Remarks:
hillslope adjacent to WET-F, maintained/mowed access 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: UPL-F

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Quercus falcata | 25 | Y | FACU |
| 2. *Pinus taeda* | 20 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 45 = Total Cover | | |
| 50% of total cover: 22.5 | 20% of total cover: 9 | | |

| Sapling Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Shrub Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: 5) | | | |
|---|---|---|---|
| 1. *Festuca paradoxa* | 30 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 30 = Total Cover | | |
| 50% of total cover: 15 | 20% of total cover: 6 | | |

| Woody Vine Stratum (Plot size: 30) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

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

Total Number of Dominant Species Across All Strata: 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 | | x 1 = |
| FACW species | | x 2 = |
| FAC species | 50 | x 3 = 150 |
| FACU species | 25 | x 4 = 100 |
| UPL species | | x 5 = |
| Column Totals: | 75 (A) | 250 (B) |

Prevalence Index = B/A = 3.33

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL** Sampling Point: UPL-F

**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 | 10 YR 5/4 | 100 | | | | | sand/silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/8/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-G

Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.126918 Long: -88.973262 Datum: NAD 83

Soil Map Unit Name: Luverne/Smithdale (LSE3) NWI classification: PFO

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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata)** – Use scientific names of plants. Sampling Point: WET-G

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Liquidambar styraciflua* | 30 | Y | FAC |
| 2. *Acer rubrum* | 25 | Y | FAC |
| 3. *Nyssa sylvatica* | 5 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 60 = Total Cover | | |
| 50% of total cover: 30 | 20% of total cover: 12 | | |

| Sapling Stratum (Plot size: ) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Shrub Stratum (Plot size: ) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

| Herb Stratum (Plot size: ) | | | |
|---|---|---|---|
| 1. *Osmunda cinnamomea* | 30 | Y | FACW |
| 2. *Microstegium vimineum* | 25 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 55 = Total Cover | | |
| 50% of total cover: 27.5 | 20% of total cover: 11 | | |

| Woody Vine Stratum (Plot size: ) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 30 | x 2 = 60 |
| FAC species | 85 | x 3 = 255 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 115 (A) | 315 (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]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL** Sampling Point: WET-G

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-5 | 10 YR 4/2 | 100 | | | | | | |
| 5-12 | 10 YR 5/1 | 90 | 2.5 Y 5/6 | 10 | C | PL | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/8/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-H

Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.125485 Long: -88.976805 Datum: NAD 83

Soil Map Unit Name: Gullied (Gu)/Iuka (Iu) NWI classification: PFO

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

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

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

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ | No ☐ |
| Hydric Soil Present? | Yes ✓ | No ☐ |
| Wetland Hydrology Present? | Yes ✓ | No ☐ |

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

Remarks:

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: WET-H

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Platanus occidentalis* | 25 | Y | FAC |
| 2. *Acer rubrum* | 20 | Y | FAC |
| 3. *Nyssa sylvatica* | 10 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 55 | = Total Cover | |

50% of total cover: 27.5 20% of total cover: 11

| Sapling Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |

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

| Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |

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

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Onoclea sensibilis* | 35 | Y | FACW |
| 2. *Microstegium vimineum* | 30 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 65 | = Total Cover | |

50% of total cover: 32.5 20% of total cover: 13

| Woody Vine Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |

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

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 35 | x 2 = 70 |
| FAC species | 85 | x 3 = 255 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 120 (A) | 325 (B) |

Prevalence Index = B/A = 2.71

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-H

**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 |
|---|---|---|---|---|---|---|---|---|
| 0-5 | 10 YR 4/2 | 85 | 2.5 Y 5/8 | 15 | C | PL | silt/clay | |
| 5-12 | 10 YR 5/1 | 80 | 2.5 Y 5/8 | 20 | C | PL | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/9/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-K

Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.124759 Long: -88.978099 Datum: NAD 83

Soil Map Unit Name: Iuka (Iu) NWI classification: PFO

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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata)** – Use scientific names of plants. Sampling Point: WET-K

**Tree Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Acer rubrum* | 30 | Y | FAC |
| 2. *Platanus occidentalis* | 20 | Y | FAC |
| 3. *Nyssa sylvatica* | 15 | N | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 65 | = Total Cover | |

50% of total cover: 32.5 20% of total cover: 13

**Sapling Stratum** (Plot size: 15)

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |

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

**Shrub Stratum** (Plot size: 15)

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |

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

**Herb Stratum** (Plot size: 5)

| | | | |
|---|---|---|---|
| 1. *Microstegium vimineum* | 35 | Y | FAC |
| 2. Carex sp. | 20 | Y | FACW |
| 3. *Boehmeria cylindrica* | 15 | N | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 70 | = Total Cover | |

50% of total cover: 35 20% of total cover: 15

**Woody Vine Stratum** (Plot size: 30)

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |

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

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 50 | x 2 = 100 |
| FAC species | 85 | x 3 = 255 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 135 (A) | 355 (B) |

Prevalence Index = B/A = 2.63

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

**SOIL** Sampling Point: WET-K

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-6 | 10 YR 4/2 | 80 | 2.5 Y 5/6 | 20 | C | PL | silt/clay+ | |
| 6-12 | 10 YR 5/2 | 80 | 2.5 Y 5/6 | 20 | C | PL | silt/clay+ | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/9/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-G/H/K

Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 2-5

Subregion (LRR or MLRA): P 133A Lat: 35.124826 Long: -88.977637 Datum: NAD 83

Soil Map Unit Name: Iuka (Iu)/Gullied (Gu) 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 ☐ |
| Hydric Soil Present? | Yes ☐ | No ☑ |
| Wetland Hydrology Present? | Yes ☐ | No ☑ |

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

Remarks:
up hillslope between PFOs WET-H and WET-K

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) –** Use scientific names of plants. Sampling Point: UPL-G/H

**Tree Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Pinus taeda* | 35 | Y | FAC |
| 2. *Liquidambar styraciflua* | 25 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 60 = Total Cover | | |

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

**Sapling Stratum** (Plot size: 15)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

**Shrub Stratum** (Plot size: 15)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Cornus florida* | 20 | Y | FACU |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 20 = Total Cover | | |

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

**Herb Stratum** (Plot size: 5)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Vitis rotundifolia* | 15 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 15 = Total Cover | | |

50% of total cover: 7.5  20% of total cover: 3

**Woody Vine Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |

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

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | 75 | x 3 = 225 |
| FACU species | 20 | x 4 = 80 |
| UPL species | | x 5 = |
| Column Totals: | 95 (A) | 305 (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]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: UPL-G/H/I

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-12 | 10 YR 4/4 | 100 | | | | | sand/silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/9/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-I

Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.126912 Long: -88.975755 Datum: NAD 83

Soil Map Unit Name: Iuka (Iu) NWI classification: PFO

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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata)** – Use scientific names of plants. Sampling Point: WET-I

**Tree Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Betula nigra* | 15 | Y | FACW |
| 2. Acer rubrum | 15 | Y | FAC |
| 3. Quercus phellos | 15 | Y | FAC |
| 4. Nyssa sylvatica | 10 | Y | FAC |
| 5. *Liquidambar styraciflua* | 10 | Y | FAC |
| 6. | | | |
| | 65 = Total Cover | | |

50% of total cover: 32.5 20% of total cover: 13

**Sapling Stratum** (Plot size: )

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

**Shrub Stratum** (Plot size: )

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

**Herb Stratum** (Plot size: 5)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Carex sp. | 35 | Y | FACW |
| 2. *Boehmeria cylindrica* | 25 | Y | FACW |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 60 = Total Cover | | |

50% of total cover: 30 20% of total cover: 11

**Woody Vine Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |

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

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (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 | 75 | x 2 = 150 |
| FAC species | 50 | x 3 = 150 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 125 (A) | 300 (B) |

Prevalence Index = B/A = 2.4

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-I

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-15 | 10 YR 4/2 | 80 | 7.5 YR 5/6 | 20 | C | PL | sandy/cl | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/9/2022
Applicant/Owner: UT Foundation State: TN Sampling Point: WET-J
Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0-2
Subregion (LRR or MLRA): P 133A Lat: 35.125646 Long: -88.978070 Datum: NAD 83
Soil Map Unit Name: Iuka (Iu) NWI classification: PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐
Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ | No ☐ |
| Hydric Soil Present? | Yes ✓ | No ☐ |
| Wetland Hydrology Present? | Yes ✓ | No ☐ |

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

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata)** – Use scientific names of plants. Sampling Point: WET-J

**Tree Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Liquidambar styraciflua* | 40 | Y | FAC |
| 2. *Acer rubrum* | 25 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 65 = Total Cover | | |

50% of total cover: 32.5 20% of total cover: 13

**Sapling Stratum** (Plot size: 15)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

**Shrub Stratum** (Plot size: 15)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

**Herb Stratum** (Plot size: 5)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Onoclea sensibilis | 35 | Y | FACW |
| 2. Microstegium vimineum | 30 | Y | FAC |
| 3. Carex sp. | 10 | N | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 75 = Total Cover | | |

50% of total cover: 37.5 20% of total cover: 15

**Woody Vine Stratum** (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |

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

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 45 | x 2 = 90 |
| FAC species | 95 | x 3 = 285 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 140 (A) | 375 (B) |

Prevalence Index = B/A = 2.68

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-J

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10 YR 4/2 | 100 | | | | | silt/clay | |
| 6-12 | 10 YR 5/1 | 100 | | | | | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/9/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: WET-L

Investigator(s): G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope/terrace Local relief (concave, convex, none): none Slope (%): 0-2

Subregion (LRR or MLRA): P 133A Lat: 35.123421 Long: -88.979840 Datum: NAD 83

Soil Map Unit Name: Iuka (Iu) NWI classification: PFO

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

Are Vegetation [ ] Soil [ ] or Hydrology [ ] significantly disturbed? [ ] Are "Normal Circumstances" present? Yes [x] No [ ]

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

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

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes [x] No [ ] | **Is the Sampled Area within a Wetland?** **Yes** [x] **No** [ ] |
| Hydric Soil Present? | Yes [x] No [ ] | |
| Wetland Hydrology Present? | Yes [x] No [ ] | |

Remarks:

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

**Field Observations:**

Surface Water Present? Yes [ ] No [x] Depth (inches): ______

Water Table Present? Yes [ ] No [x] Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes [ ] No [x] Depth (inches): ______

**Wetland Hydrology Present? Yes** [x] **No** [ ]

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

Remarks:

**VEGETATION (Five Strata)** – Use scientific names of plants. Sampling Point: WET-L

Tree Stratum (Plot size: 30)

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Liquidambar styraciflua* | 35 | Y | FAC |
| 2. Acer Rubrum | 25 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 60 = Total Cover | | |

50% of total cover: 30 20% of total cover: 11

Sapling Stratum (Plot size: 15)

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

Shrub Stratum (Plot size: 15)

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | = Total Cover | | |

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

Herb Stratum (Plot size: 5)

| | | | |
|---|---|---|---|
| 1. *Onoclea sensibilis* | 40 | Y | FACW |
| 2. *Saururus cernuus* | 25 | Y | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 65 = Total Cover | | |

50% of total cover: 32.5 20% of total cover: 13

Woody Vine Stratum (Plot size: 30)

| | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |

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

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | 25 | x 1 = 25 |
| FACW species | 40 | x 2 = 80 |
| FAC species | 60 | x 3 = 180 |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | 125 (A) | 285 (B) |

Prevalence Index = B/A = 2.28

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: WET-L

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-4 | 10 YR 4/2 | 100 | | | | | silt/clay | |
| 4-14 | 10 YR 5/1 | 100 | | | | | silt/clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Cub Creek Mitigation Bank Phase 2 City/County: Hardeman Sampling Date: 8/9/2022

Applicant/Owner: UT Foundation State: TN Sampling Point: UPL-I/J/L

Investigator(s): D. Spradlin/ G. Babbit/ C. Roberts Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 5-10

Subregion (LRR or MLRA): P 133A Lat: 35.125931 Long: -88.978648 Datum: NAD 83

Soil Map Unit Name: Iuka (Iu), Smithdale (SaE3) 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:
hillslope between WET-I, WET-J, and WET-L

## HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

**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 (Five Strata) – Use scientific names of plants.

Sampling Point: UPL-I/J/L

| Tree Stratum (Plot size: 30) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Pinus taeda* | 80 | Y | FAC |
| 2. Ulmus americana | 5 | N | FACW |
| 3. *Quercus velutina* | 5 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | 90 | = Total Cover | |

50% of total cover: 45 20% of total cover: 18

| Sapling Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |

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

| Shrub Stratum (Plot size: 15) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | = Total Cover | |

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

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

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

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

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

**Dominance Test worksheet:**

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

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

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

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 5 | x 2 = 10 |
| FAC species | 80 | x 3 = 240 |
| FACU species | 5 | x 4 = 80 |
| UPL species | | x 5 = |
| Column Totals: | 90 (A) | 330 (B) |

Prevalence Index = B/A = 3.67

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Five Vegetation Strata:**

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

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

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

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

**Woody vine** – All woody vines, regardless of height.

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

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

## SOIL

Sampling Point: UPL-I/J/L

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

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-12 | 10 YR 4/4 | 100 | | | | | sand/silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

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

**Indicators for Problematic Hydric Soils[3]:**

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

Photo 33: WET-A representative vegetation

Photo 34: WET-A section of soil profile

Photo 35: UPL-A representative vegetation

Photo 36: UPL-A section of soil profile

Photo 37: WET-B representative vegetation

Photo 38: WET-B section of soil profile

Photo 39: UPL-B representative vegetation

Photo 40: UPL-B section of soil profile

Photo 41: WET-C representative vegetation

Photo 42: WET-C section of soil profile

Photo 43: UPL-C representative vegetation

Photo 44: UPL-C section of soil profile

Photo 45: WET-D representative vegetation

Photo 46: WET-D section of soil profile

Photo 47: UPL-D representative vegetation

Photo 48: UPL-D section of soil profile

Photo 49: WET-E representative vegetation

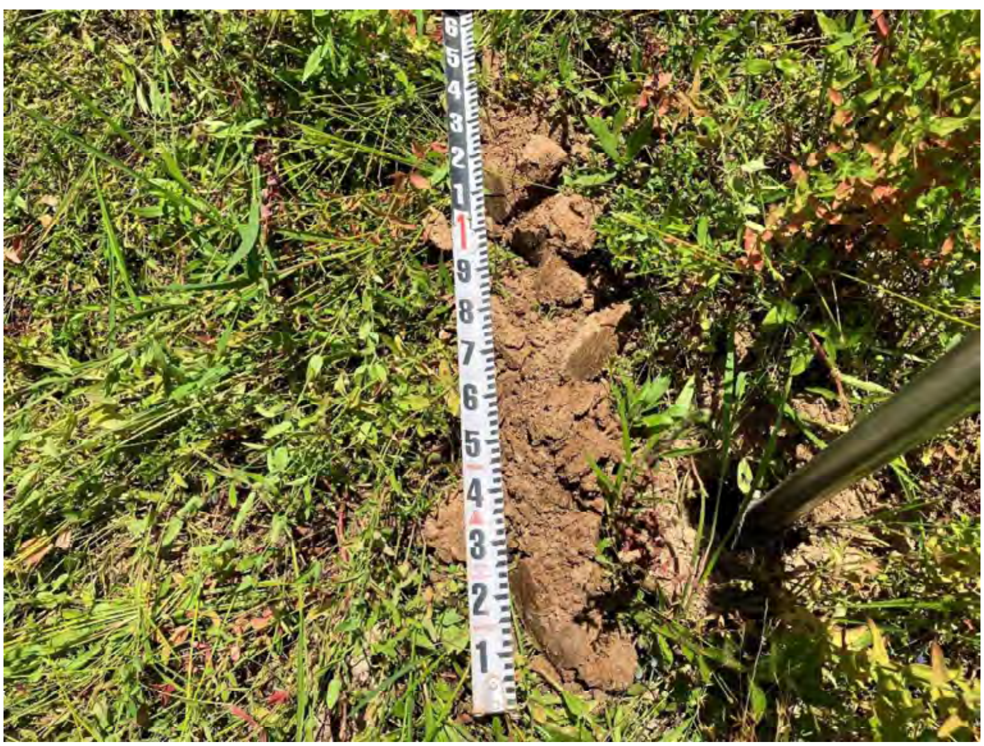


Photo 50: WET-E section of soil profile

Photo 51: UPL-E representative vegetation

Photo 52: UPL-E section of soil profile

Photo 53: WET-F representative vegetation

Photo 54: WET-F section of soil profile

Photo 55: UPL-F representative vegetation

Photo 56: UPL-F section of soil profile

Photo 57: WET-K representative vegetation

Photo 58: WET-K section of soil profile

Photo 59: UPL-G/H/K representative vegetation

Photo 60: UPL-G/H/K section of soil test pit

Photo 61: WET-I representative vegetation

Photo 62: WET-I section of soil test pit

Photo 63: WET-L representative vegetation

Photo 64: WET-L section of soil profile

Photo 65: UPL-I/J/L representative vegetation

Photo 66: UPL-I/J/L section of soil profile

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-1 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.122631 END: 35.132915 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.980040 END: -88.964900 |
| Precipitation this Season vs. Normal : low | Source of recent & seasonal precip. data : NOAA; Bolivar Water Works |
| Watershed Size : ~1.65 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** N/A

**Justification / Notes :**

Channel well defined and a mapped stream according to USGS hydro.

Flowing water present over 7 days since last >0.1" precip.

Presence of multiple fish species observed

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

**Hydrologic Determination Field Data Sheet**

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-2 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.131685 END: 35.130851 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.972127 END: -88.968844 |
| Precipitation this Season vs. Normal : low | |
| Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.05 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu)/Smithdale (SaD3) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 26.25

**Justification / Notes :**

Channel well defined and a mapped stream according to USGS hydro.

Flowing water present over 7 days since last >0.1" precip.

## Secondary Field Indicator Evaluation

| **A. Geomorphology** (Subtotal = 12.75 | **Absent** | **Weak** | **Moderate** | **Strong** | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 2 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1.5 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 1 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 1 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 1.5 |

| **B. Hydrology** (Subtotal = 7.00 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 1.5 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 1.5 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 1 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| **C. Biology** (Subtotal = 6.50 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 1.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 26.25

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

- Defined bed and bank throughout
- Wetland soils/plants surrounding channel
- Water flowing in channel 7 days since >0.1" precip

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-2A |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.130718 END: 35.131268 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.971092 END: -88.970485 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.01 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu)/Smithdale (SaD3) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Moderate | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1” in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = “Yes”, then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 19.5

**Justification / Notes :**

Channel bed and bank well defined

## Secondary Field Indicator Evaluation

**A. Geomorphology** (Subtotal = 7.50

| | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 3 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 0.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 0 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 0.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 0.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

**B. Hydrology** (Subtotal = 5.50

| | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 1 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0.5 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 1 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

**C. Biology** (Subtotal = 6.50

| | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 1 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 19.50

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

- Defined bed and bank throughout
- Wetland soils/plants surrounding channel
- Water present in channel at downstream section, dry up to headcut draining wetland

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-3 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.126138 END: 35.129754 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.970296 END: -88.970708 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.05 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Luverne/Smithdale (LSD3) (LSF) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 20.25

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| **A. Geomorphology** (Subtotal = 11.50 | **Absent** | **Weak** | **Moderate** | **Strong** | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 2.5 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 2 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 0.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 1 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| **B. Hydrology** (Subtotal = 4.25 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 0.5 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.75 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| **C. Biology** (Subtotal = 4.50 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 20.25

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

**Hydrologic Determination Field Data Sheet**

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-3A |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.126250 END: 35.126804 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.971160 END: -88.971157 |
| Precipitation this Season vs. Normal : low | Source of recent & seasonal precip. data : NOAA; Bolivar Water Works |
| Watershed Size : ~0.01 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Luverne/Smithdale (LSF) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1” in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = “Yes”, then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 19.75

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 9.75 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 1.5 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1.5 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1.5 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 0.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 1 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| B. Hydrology (Subtotal = 4.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 0.5 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 1 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 5.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants.

[2] Focus is on the presence of aquatic or wetland plants.

Total Points = 19.75

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

## Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-4 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.131211 END: 35.128743 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.977337 END: -88.972204 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.05 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu)/ Smithdale (SaE3) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 31.75

**Justification / Notes :**

# Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 16.00 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 2.5 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 2 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 2 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 1 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1.5 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 1 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 1 |

| B. Hydrology (Subtotal = 8.00 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 1.5 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 2 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 1 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 1 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 7.75 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 1.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 0.75 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 31.75

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-4A |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.129488 END: 35.129218 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.972975 END: -88.972292 |
| Precipitation this Season vs. Normal : low | Source of recent & seasonal precip. data : NOAA; Bolivar Water Works |
| Watershed Size : ~0.01 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Moderate | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 19.5

**Justification / Notes :**

- channel drains WET-B

## Secondary Field Indicator Evaluation

| **A. Geomorphology** (Subtotal = 9.75 | **Absent** | **Weak** | **Moderate** | **Strong** | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 3 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 0.5 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 0 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 1 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| **B. Hydrology** (Subtotal = 4.75 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 1 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.75 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| **C. Biology** (Subtotal = 5.00 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 1 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 0.5 | |

[1] Focus is on the presence of terrestrial plants.

[2] Focus is on the presence of aquatic or wetland plants.

Total Points = 19.50

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

**Hydrologic Determination Field Data Sheet**

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-4B |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.131730 END: 35.131618 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.976450 END: -88.976330 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.01 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Smithdale (SaE3) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 20.75

**Justification / Notes :**

- active headcut channel off STR-4, flowing water

## Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 10.00 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 2 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 0.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 0 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 3 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| B. Hydrology (Subtotal = 6.25 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 1.5 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 1.5 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.25 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 4.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 0.5 | |

[1] Focus is on the presence of terrestrial plants.
[2] Focus is on the presence of aquatic or wetland plants.

Total Points = 20.75

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 6/29/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-5 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.130186 END: 35.128092 |
| Previous Rainfall (7-days) : 0.00 | Longitude: BEG: -88.983201 END: -88.973086 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.51 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu)/ Nugent (Nu) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ☐ | Stream |
| 6. Presence of fish (except *Gambusia*) | ☐ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1” in local watershed | ☐ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = “Yes”, then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** N/A

**Justification / Notes :**

- flowing water in channel 7 days since last >0.1" precip
- non-Gambusia fish species present

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

**Hydrologic Determination Field Data Sheet**

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 8/10/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-6 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.123284 END: 35.126900 |
| Previous Rainfall (7-days) : 3.14 | Longitude: BEG: -88.972235 END: -88.974181 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.21 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Luverne/Smithdale (LSE3) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1” in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = “Yes”, then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 27

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 13.25 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 2.5 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1.5 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 2 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 1 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 1 |

| B. Hydrology (Subtotal = 8.25 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 2 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 2 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1.25 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 1 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 5.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants.
[2] Focus is on the presence of aquatic or wetland plants.

Total Points = 27.00

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | | |
|---|---|---|
| Named Waterbody: UT to Cub Creek | | Date/Time: 8/10/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | | Project ID : STR-7 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | | |
| Site Location: Middleton, TN | | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.122599 END: 35.124610 | |
| Previous Rainfall (7-days) : 3.14 | Longitude: BEG: -88.979783 END: -88.978742 | |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | | |
| Watershed Size : ~0.1 sq. mi. | County: Hardeman | |
| Soil Type(s) / Geology : Iuka (Iu) | Source: NRCS | |
| Surrounding Land Use : Forested/Agriculture | | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 26.75

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 14.75 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 3 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 2 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 2 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1.5 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 2 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| B. Hydrology (Subtotal = 6.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 2 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1.5 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 1 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 5.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 1 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 0.5 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 26.75

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 8/10/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-8 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.125355 END: 35.124561 |
| Previous Rainfall (7-days) : 3.14 | Longitude: BEG: -88.982046 END: -88.978967 |
| Precipitation this Season vs. Normal : low | Source of recent & seasonal precip. data : NOAA; Bolivar Water Works |
| Watershed Size : ~0.15 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 26

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 14.50 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 3 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 2 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 2 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1.5 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 1 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| B. Hydrology (Subtotal = 5.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 2 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 1 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 6.00 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 0.5 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 26.00

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

**Hydrologic Determination Field Data Sheet**

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 8/10/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-8A |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.124423 END: 35.124545 |
| Previous Rainfall (7-days) : 3.14 | Longitude: BEG: -88.981619 END: -88.981057 |
| Precipitation this Season vs. Normal : low | Source of recent & seasonal precip. data : NOAA; Bolivar Water Works |
| Watershed Size : ~0.01 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Smithdale (SaE3)/Iuka (Iu) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1" in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 21.75

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| A. Geomorphology (Subtotal = 11.00 | Absent | Weak | Moderate | Strong | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 2 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 2 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 1 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 0.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| B. Hydrology (Subtotal = 5.25 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 2 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 0.75 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| C. Biology (Subtotal = 5.50 | Absent | Weak | Moderate | Strong | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 1 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 21.75

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

# Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 8/10/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-8B |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.125323 END: 35.125309 |
| Previous Rainfall (7-days) : 3.14 | Longitude: BEG: -88.982300 END: -88.981977 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.01 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Smithdale (SaE3) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1” in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = “Yes”, then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 20.5

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| **A. Geomorphology** (Subtotal = 11.00 | **Absent** | **Weak** | **Moderate** | **Strong** | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 1.5 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1.5 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 1 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 1 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| **B. Hydrology** (Subtotal = 5.00 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 2 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 0.75 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.25 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

| **C. Biology** (Subtotal = 4.50 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 1.5 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 1 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 20.50

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

**Hydrologic Determination Field Data Sheet**

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

| | |
|---|---|
| Named Waterbody: UT to Cub Creek | Date/Time: 8/10/2022 |
| Assessors/Affiliation: D. Spradlin/G. Babbit | Project ID : STR-9 |
| Site Name/Description: Cub Creek Mitigation Bank Phase 2 | |
| Site Location: Middleton, TN | |
| HUC (12 digit): 080102080202 | Latitude: BEG: 35.122930 END: 35.124145 |
| Previous Rainfall (7-days) : 3.14 | Longitude: BEG: -88.981816 END: -88.979309 |
| Precipitation this Season vs. Normal : low<br>Source of recent & seasonal precip. data : NOAA; Bolivar Water Works | |
| Watershed Size : ~0.05 sq. mi. | County: Hardeman |
| Soil Type(s) / Geology : Iuka (Iu) | Source: NRCS |
| Surrounding Land Use : Forested/Agriculture | |
| Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Absent | |

## Primary Field Indicators Observed

| Primary Indicators | NO | YES |
|---|---|---|
| 1. Hydrologic feature exists solely due to a process discharge | ✓ | WWC |
| 2. Defined bed and bank absent, vegetation composed of upland and FACU species | ✓ | WWC |
| 3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A | ✓ | WWC |
| 4. Daily flow and precipitation records showing feature only flows in direct response to rainfall | ✓ | WWC |
| 5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase | ✓ | Stream |
| 6. Presence of fish (except *Gambusia*) | ✓ | Stream |
| 7. Presence of naturally occurring ground water table connection | ✓ | Stream |
| 8. Flowing water in channel and 7 days since last precip >0.1” in local watershed | ✓ | Stream |
| 9. Evidence watercourse has been used as a supply of drinking water | ✓ | Stream |

**NOTE: If any Primary Indicators 1-9 = “Yes”, then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

**Overall Hydrologic Determination =** STREAM

**Secondary Indicator Score (if applicable) =** 24

**Justification / Notes :**

## Secondary Field Indicator Evaluation

| **A. Geomorphology** (Subtotal = 13.75 | **Absent** | **Weak** | **Moderate** | **Strong** | |
|---|---|---|---|---|---|
| 1. Continuous bed and bank | 0 | 1 | 2 | 3 | 3 |
| 2. Sinuous channel | 0 | 1 | 2 | 3 | 1.5 |
| 3. In-channel structure: riffle-pool sequences | 0 | 1 | 2 | 3 | 1.5 |
| 4. Sorting of soil textures or other substrate | 0 | 1 | 2 | 3 | 2 |
| 5. Active/relic floodplain | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 6. Depositional bars or benches | 0 | 1 | 2 | 3 | 1.5 |
| 7. Braided channel | 0 | 1 | 2 | 3 | 0 |
| 8. Recent alluvial deposits | 0 | 0.5 | 1 | 1.5 | 1 |
| 9. Natural levees | 0 | 1 | 2 | 3 | 0 |
| 10. Headcuts | 0 | 1 | 2 | 3 | 1.5 |
| 11. Grade controls | 0 | 0.5 | 1 | 1.5 | 0.5 |
| 12. Natural valley or drainageway | 0 | 0.5 | 1 | 1.5 | 0.75 |
| 13. At least second order channel on existing USGS or NRCS map | 0 | 1 | 2 | 3 | 0 |

| **B. Hydrology** (Subtotal = 5.75 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 14. Subsurface flow/discharge into channel | 0 | 1 | 2 | 3 | 2 | |
| 15. Water in channel and >48 hours since sig. rain | 0 | 1 | 2 | 3 | 0 | N/A |
| 16. Leaf litter in channel (January – September) | 1.5 | 1 | 0.5 | 0 | 0.75 | N/A |
| 17. Sediment on plants or on debris | 0 | 0.5 | 1 | 1.5 | 0.5 | |
| 18. Organic debris lines or piles (wrack lines) | 0 | 0.5 | 1 | 1.5 | 1 | |
| 19. Hydric soils in channel bed or sides of channel | No = 0 | | Yes = 1.5 | | 1.5 | |

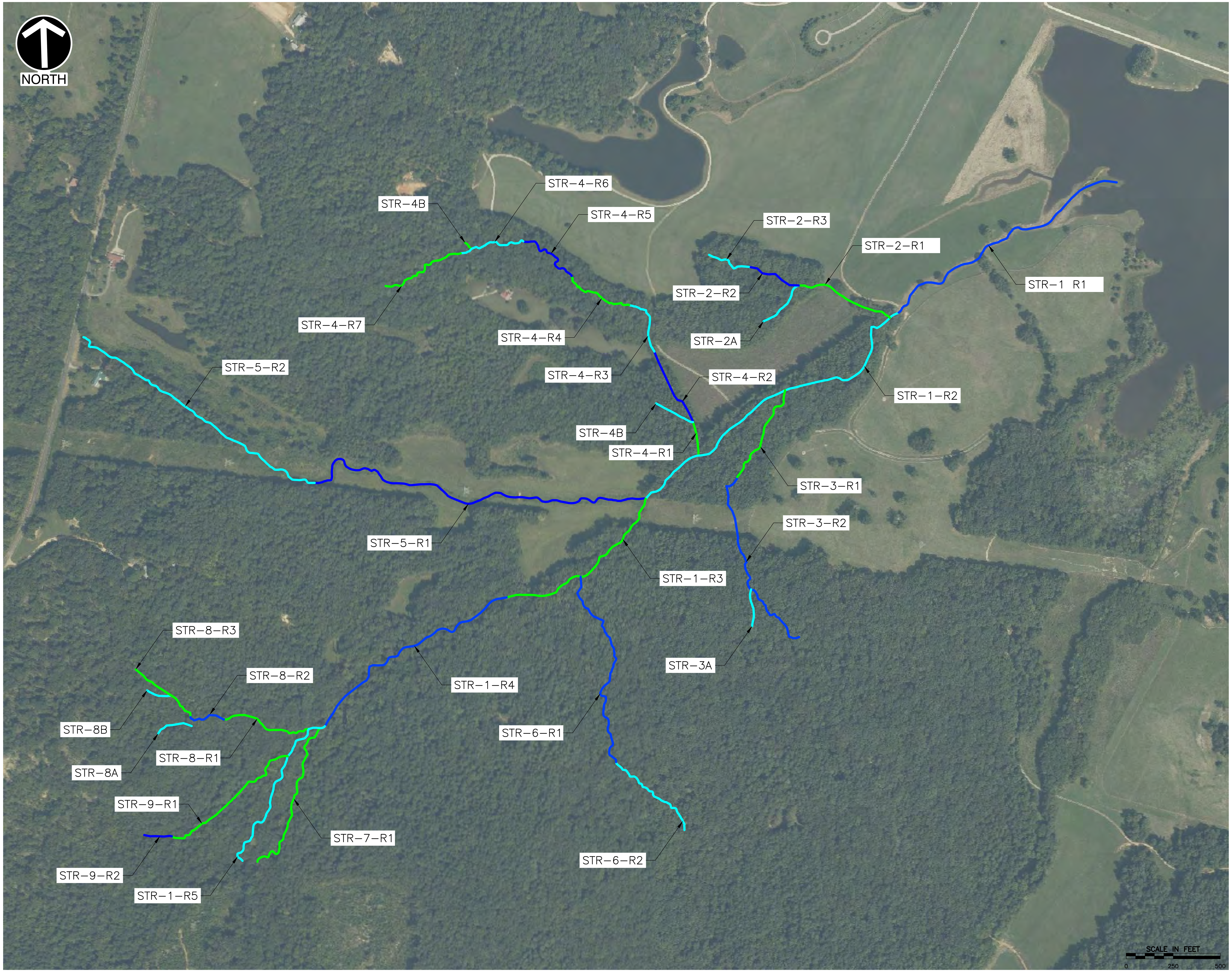
| **C. Biology** (Subtotal = 4.50 | **Absent** | **Weak** | **Moderate** | **Strong** | | |
|---|---|---|---|---|---|---|
| 20. Fibrous roots in channel bed [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 21. Rooted plants in the thalweg [1] | 3 | 2 | 1 | 0 | 2 | N/A |
| 22. Crayfish in stream (exclude in floodplain) | 0 | 1 | 2 | 3 | 0.5 | |
| 23. Bivalves/mussels | 0 | 1 | 2 | 3 | 0 | |
| 24. Amphibians | 0 | 0.5 | 1 | 1.5 | 0 | |
| 25. Macrobenthos (record type & abundance) | 0 | 1 | 2 | 3 | 0 | |
| 26. Filamentous algae; periphyton | 0 | 1 | 2 | 3 | 0 | |
| 27. Iron oxidizing bacteria/fungus | 0 | 0.5 | 1 | 1.5 | 0 | |
| 28. Wetland plants in channel bed [2] | 0 | 0.5 | 1 | 1.5 | 0 | |

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 24.00

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**




REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| △ | | |
| △ | | |
| △ | | |
| △ | | |

LEGEND

SQT REACH STREAM CENTERLINE (COLOR VARIES)

NOTE:
1. STREAM CENTERLINE COLOR DIFFERS FOR EACH SQT REACH.

CEC
Civil & Environmental Consultants, Inc.
2704 Cherokee Farm Way · Suite 101 · Knoxville, TN 37920
Ph: 865.977.9997 · Fax: 865.977.9919
www.cecinc.com

THE UNIVERSITY OF TENNESSEE FOUNDATION, INC.
CUB CREEK MITIGATION BANK PHASE 2
MIDDLETON, TN

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | BFS | CHECKED BY: | BFS | APPROVED BY: | GSB |
| DATE: | OCTOBER 2022 | DWG SCALE: | AS NOTED | PROJECT NO: | 322-520 |

SQT EXISTING CONDITIONS
REACH BREAK MAP

FIGURE NO.: 1

SHEET 1 OF 1

TN SQT v1.0
Quantification Tool Spreadsheet Reach 2

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-1-R1 |
| Upstream Latitude: | 35° 7' 53.55" N |
| Upstream Longitude: | 88° 58' 4.10" W |
| Downstream Latitude: | 35° 7' 55.90" N |
| Downstream Longitude: | 88° 58' 0.21" W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 1.2257 |
| Proposed Bed Material: | Silt/Clay |
| Existing Stream Length (feet): | 1460.1 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.1 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.29 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1460.1 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 423 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.93 | |
| | Reach Runoff | 0.00 | |
| Hydraulics | Floodplain Connectivity | 0.85 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.63 | |
| | Riparian Vegetation | 0.02 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.12 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.47 | | |
| Hydraulics | 0.85 | | |
| Geomorphology | 0.15 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8827 | 0.93 | 0.93 | 0.47 | Functioning At Risk | 0.29 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0 | 0.00 | 0.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1.2 | 0.70 | 0.85 | 0.85 | Functioning | | |
| | | Entrenchment Ratio | 10.2 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.15 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.63 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 32 | 0.25 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | | | 0.02 | | | | |
| | | Right - Average DBH (in) | 0 | 0.00 | | | | | |
| | | Left - Buffer Width (feet) | 0 | 0.00 | | | | | |
| | | Right - Buffer Width (feet) | 0 | 0.00 | | | | | |
| | | Left - Tree Density (#/acre) | 0 | 0.00 | | | | | |
| | | Right - Tree Density (#/acre) | 0 | 0.00 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 5 | 0.07 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 5 | 0.07 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 8.4 | 0.00 | 0.12 | | | | |
| | | Pool Depth Ratio | 1.5 | 0.35 | | | | | |
| | | Percent Riffle (%) | 59 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.08 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-1-R2 |
| Upstream Latitude: | 35° 7'41.30"N |
| Upstream Longitude: | 88°58'22.93"W |
| Downstream Latitude: | 35° 7'51.23"N |
| Downstream Longitude: | 88°58'7.35"W |
| Existing Stream Type: | F |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 1.2104 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 1824.84 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.5 |
| Proposed Flow Type: | |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.20 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1824.84 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 365 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.96 | |
| | Reach Runoff | 0.64 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.32 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.37 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.23 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.80 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.22 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**

**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9159 | 0.96 | 0.96 | 0.80 | Functioning | 0.20 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.6373 | 0.64 | 0.64 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2.2 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.5 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.32 | 0.22 | Not Functioning | | |
| | | # Pieces | 6 | 0.32 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | VH/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 44 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 3.89 | 0.42 | 0.37 | | | | |
| | | Right - Average DBH (in) | 2.63 | 0.28 | | | | | |
| | | Left - Buffer Width (feet) | 52 | 0.70 | | | | | |
| | | Right - Buffer Width (feet) | 95 | 0.79 | | | | | |
| | | Left - Tree Density (#/acre) | 880 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 1200 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 25 | 0.33 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 15 | 0.20 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 0 | 0.00 | 0.23 | | | | |
| | | Pool Depth Ratio | 2 | 0.70 | | | | | |
| | | Percent Riffle (%) | 76 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.1 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

TN SQT v1.0
Quantification Tool Spreadsheet Reach 2

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-1-R3 |
| Upstream Latitude: | 35° 7'51.23"N |
| Upstream Longitude: | 88°58'7.35"W |
| Downstream Latitude: | 35° 7'58.42"N |
| Downstream Longitude: | 88°57'53.63"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 1.2257 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 1460.1 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.3 |
| Proposed Flow Type: | |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.24 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1460.1 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 350 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.98 | |
| | Reach Runoff | 0.95 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.16 | |
| | Lateral Migration | 0.22 | |
| | Riparian Vegetation | 0.47 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.27 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.97 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.22 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9341 | 0.98 | 0.98 | 0.97 | Functioning | 0.24 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.9498 | 0.95 | 0.95 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2.2 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.9 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.16 | 0.22 | Not Functioning | | |
| | | # Pieces | 3 | 0.16 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.22 | | | | |
| | | Dominant BEHI/NBS | M/Ex | 0.10 | | | | | |
| | | Percent Streambank Erosion (%) | 20 | 0.34 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 6.37 | 0.68 | 0.47 | | | | |
| | | Right - Average DBH (in) | 3.11 | 0.33 | | | | | |
| | | Left - Buffer Width (feet) | 129 | 0.86 | | | | | |
| | | Right - Buffer Width (feet) | 245 | 1.00 | | | | | |
| | | Left - Tree Density (#/acre) | 680 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 360 | 0.53 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 25 | 0.33 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 30 | 0.40 | | | | | |
| | | Left - Native Shrub Cover (%) | 5 | 0.06 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 6.7 | 0.10 | 0.27 | | | | |
| | | Pool Depth Ratio | 2 | 0.70 | | | | | |
| | | Percent Riffle (%) | 51 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.11 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-1-R4 |
| Upstream Latitude: | 35° 7'28.58"N |
| Upstream Longitude: | 88°58'43.18"W |
| Downstream Latitude: | 35° 7'35.65"N |
| Downstream Longitude: | 88°58'31.81"W |
| Existing Stream Type: | F |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.727 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 1289.65 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.3 |
| Proposed Flow Type: | |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.26 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1289.65 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 335 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.98 | |
| | Reach Runoff | 0.99 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.32 | |
| | Lateral Migration | 0.19 | |
| | Riparian Vegetation | 0.56 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.57 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.99 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.33 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9292 | 0.98 | 0.98 | 0.99 | Functioning | 0.26 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.9932 | 0.99 | 0.99 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2.6 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.4 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.32 | 0.33 | Functioning At Risk | | |
| | | # Pieces | 6 | 0.32 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.19 | | | | |
| | | Dominant BEHI/NBS | H/Ex | 0.10 | | | | | |
| | | Percent Streambank Erosion (%) | 30 | 0.27 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 5.21 | 0.56 | 0.56 | | | | |
| | | Right - Average DBH (in) | 3.54 | 0.38 | | | | | |
| | | Left - Buffer Width (feet) | 600 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 875 | 1.00 | | | | | |
| | | Left - Tree Density (#/acre) | 280 | 0.92 | | | | | |
| | | Right - Tree Density (#/acre) | 480 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 55 | 0.73 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 40 | 0.53 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 3.3 | 1.00 | 0.57 | | | | |
| | | Pool Depth Ratio | 2 | 0.70 | | | | | |
| | | Percent Riffle (%) | 53 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.09 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-1-R5 |
| Upstream Latitude: | 35° 7'21.36"N |
| Upstream Longitude: | 88°58'48.17"W |
| Downstream Latitude: | 35° 7'28.58"N |
| Downstream Longitude: | 88°58'43.18"W |
| Existing Stream Type: | F |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.349 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 983.12 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.8 |
| Proposed Flow Type: | |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.23 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 983.12 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 226 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 0.89 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.32 | |
| | Lateral Migration | 0.15 | |
| | Riparian Vegetation | 0.41 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.00 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.95 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.18 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9502 | 1.00 | 1.00 | 0.95 | Functioning | 0.23 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.8893 | 0.89 | 0.89 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 5.1 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.4 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.32 | 0.18 | Not Functioning | | |
| | | # Pieces | 6 | 0.32 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.15 | | | | |
| | | Dominant BEHI/NBS | H/M | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 60 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | | | 0.41 | | | | |
| | | Right - Average DBH (in) | 5.21 | 0.56 | | | | | |
| | | Left - Buffer Width (feet) | 60 | 0.72 | | | | | |
| | | Right - Buffer Width (feet) | 32 | 0.33 | | | | | |
| | | Left - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Right - Tree Density (#/acre) | 280 | 0.92 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 15 | 0.20 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 0 | 0.00 | 0.00 | | | | |
| | | Pool Depth Ratio | 0.8 | 0.00 | | | | | |
| | | Percent Riffle (%) | 66 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.17 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-2-R1 |
| Upstream Latitude: | 35° 7'52.51"N |
| Upstream Longitude: | 88°58'13.77"W |
| Downstream Latitude: | 35° 7'51.03"N |
| Downstream Longitude: | 88°58'7.67"W |
| Existing Stream Type: | B |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0488 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 539.17 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.8 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.15 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 539.17 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 81 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.67 | |
| | Reach Runoff | 0.29 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.32 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.00 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.48 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.26 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Functional Category | Function-Based Parameters | Measurement Method | Field Value | Index Value | Parameter | Category | Category | ECS | ECS |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.6393 | 0.67 | 0.67 | 0.48 | Functioning At Risk | 0.15 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.2853 | 0.29 | 0.29 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 3.1 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.5 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.26 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 0 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 0 | 0.00 | 0.32 | | | | |
| | | Right - Average DBH (in) | 12.5 | 1.00 | | | | | |
| | | Left - Buffer Width (feet) | 19 | 0.15 | | | | | |
| | | Right - Buffer Width (feet) | 32 | 0.33 | | | | | |
| | | Left - Tree Density (#/acre) | 0 | 0.00 | | | | | |
| | | Right - Tree Density (#/acre) | 40 | 0.30 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 40 | 0.53 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 70 | 0.93 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 0 | 0.00 | 0.00 | | | | |
| | | Pool Depth Ratio | 0 | 0.00 | | | | | |
| | | Percent Riffle (%) | 100 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.05 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-2-R2 |
| Upstream Latitude: | 35° 7'53.41"N |
| Upstream Longitude: | 88°58'16.87"W |
| Downstream Latitude: | 35° 7'52.51"N |
| Downstream Longitude: | 88°58'13.77"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | E |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0226 |
| Proposed Bed Material: | Sand |
| Existing Stream Length (feet): | 287.48 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.9 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.40 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 287.48 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 115 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.34 | |
| | Reach Runoff | 0.66 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.73 | |
| | Lateral Migration | 0.88 | |
| | Riparian Vegetation | 0.62 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.21 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.50 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.49 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**

**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.3268 | 0.34 | 0.34 | 0.50 | Functioning At Risk | 0.40 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.6617 | 0.66 | 0.66 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 7 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.73 | 0.49 | Functioning At Risk | | |
| | | # Pieces | 15 | 0.73 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.88 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 8 | 0.76 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 12.75 | 1.00 | 0.62 | | | | |
| | | Right - Average DBH (in) | 10.83 | 1.00 | | | | | |
| | | Left - Buffer Width (feet) | 22 | 0.18 | | | | | |
| | | Right - Buffer Width (feet) | 89 | 0.78 | | | | | |
| | | Left - Tree Density (#/acre) | 200 | 1.00 | | | | | |
| | | Right - Tree Density (#/acre) | 360 | 0.53 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 70 | 0.93 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 50 | 0.67 | | | | | |
| | | Left - Native Shrub Cover (%) | 10 | 0.14 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 8.1 | 0.00 | 0.21 | | | | |
| | | Pool Depth Ratio | 1.9 | 0.63 | | | | | |
| | | Percent Riffle (%) | 75 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.05 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-2-R3 |
| Upstream Latitude: | 35° 7'53.97"N |
| Upstream Longitude: | 88°58'19.56"W |
| Downstream Latitude: | 35° 7'53.41"N |
| Downstream Longitude: | 88°58'16.87"W |
| Existing Stream Type: | A |
| Proposed Stream Type: | A |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.008 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 257.04 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 3.7 |
| Proposed Flow Type: | |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.13 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 257.04 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 33 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.21 | |
| | Reach Runoff | 0.44 | |
| Hydraulics | Floodplain Connectivity | 0.15 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.45 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.30 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.33 | | |
| Hydraulics | 0.15 | | |
| Geomorphology | 0.19 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.2 | 0.21 | 0.21 | 0.33 | Functioning At Risk | 0.13 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.4391 | 0.44 | 0.44 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 4 | 0.00 | 0.15 | 0.15 | Not Functioning | | |
| | | Entrenchment Ratio | 1.2 | 0.30 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.19 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 89 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 9.17 | 0.99 | 0.45 | | | | |
| | | Right - Average DBH (in) | 6 | 0.65 | | | | | |
| | | Left - Buffer Width (feet) | 125.3 | 0.85 | | | | | |
| | | Right - Buffer Width (feet) | 9.7 | 0.06 | | | | | |
| | | Left - Tree Density (#/acre) | 120 | 0.89 | | | | | |
| | | Right - Tree Density (#/acre) | 520 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 30 | 0.40 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 10 | 0.13 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.30 | | | | |
| | | Pool Depth Ratio | 2.3 | 0.91 | | | | | |
| | | Percent Riffle (%) | 60 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.11 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-2A |
| Upstream Latitude: | 35° 7'50.54"N |
| Upstream Longitude: | 88°58'15.91"W |
| Downstream Latitude: | 35° 7'52.51"N |
| Downstream Longitude: | 88°58'13.77"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0129 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 280.16 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.5 |
| Proposed Flow Type: | |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.27 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 280.16 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 76 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.70 | |
| | Reach Runoff | 0.84 | |
| Hydraulics | Floodplain Connectivity | 0.36 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.44 | |
| | Riparian Vegetation | 0.54 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.00 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.77 | | |
| Hydraulics | 0.36 | | |
| Geomorphology | 0.20 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 1

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Functional Category | Function-Based Parameters | Measurement Method | Field Value | Index Value | Parameter | Category | Category | ECS | ECS |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.6674 | 0.70 | 0.70 | 0.77 | Functioning | 0.27 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.8397 | 0.84 | 0.84 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1.8 | 0.00 | 0.36 | 0.36 | Functioning At Risk | | |
| | | Entrenchment Ratio | 2.5 | 0.71 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.20 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.44 | | | | |
| | | Dominant BEHI/NBS | M/L | 0.60 | | | | | |
| | | Percent Streambank Erosion (%) | 30 | 0.27 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 6.58 | 0.71 | 0.54 | | | | |
| | | Right - Average DBH (in) | 9.5 | 1.00 | | | | | |
| | | Left - Buffer Width (feet) | 250 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 43 | 0.54 | | | | | |
| | | Left - Tree Density (#/acre) | 360 | 0.53 | | | | | |
| | | Right - Tree Density (#/acre) | 160 | 1.00 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 5 | 0.07 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 40 | 0.53 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | | | 0.00 | | | | |
| | | Pool Depth Ratio | | | | | | | |
| | | Percent Riffle (%) | 100 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.05 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

## Reach Information and Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-3-R1 |
| Upstream Latitude: | 35° 7'42.29"N |
| Upstream Longitude: | 88°58'17.21"W |
| Downstream Latitude: | 35° 7'47.05"N |
| Downstream Longitude: | 88°58'14.36"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0541 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 572.95 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## Notes

1. Users input values that are highlighted based on restoration potential
2. Users select values from a pull-down menu
3. Leave values blank for field values that were not measured
4. **These field values do not apply to ephemeral channels.**

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.25 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 572.95 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 143 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.98 | |
| | Reach Runoff | 0.62 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.32 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.48 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.18 | |
| | Sinuosity | 1.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.80 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.44 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 1

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9337 | 0.98 | 0.98 | 0.80 | Functioning | 0.25 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.622 | 0.62 | 0.62 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 4.1 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.5 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.32 | 0.44 | Functioning At Risk | | |
| | | # Pieces | 6 | 0.32 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 100 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 7.03 | 0.76 | 0.48 | | | | |
| | | Right - Average DBH (in) | 6.6 | 0.71 | | | | | |
| | | Left - Buffer Width (feet) | 148 | 0.90 | | | | | |
| | | Right - Buffer Width (feet) | 149 | 0.90 | | | | | |
| | | Left - Tree Density (#/acre) | 560 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 560 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 30 | 0.40 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 10 | 0.13 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | | | 0.18 | | | | |
| | | Pool Depth Ratio | 1.5 | 0.35 | | | | | |
| | | Percent Riffle (%) | 58 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.2 | 1.00 | 1.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-3-R2 |
| Upstream Latitude: | 35° 7'35.21"N |
| Upstream Longitude: | 88°58'14.66"W |
| Downstream Latitude: | 35° 7'42.29"N |
| Downstream Longitude: | 88°58'17.21"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | E |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.017 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 1090.4 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.5 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.50 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1090.4 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 545 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| | |
|---|---|
| | **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 0.87 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.65 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.65 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.42 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.94 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.54 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 0.94 | Functioning | 0.50 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.8716 | 0.87 | 0.87 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 12.3 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.65 | 0.54 | Functioning At Risk | | |
| | | # Pieces | 12 | 0.65 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 0 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 13.8 | 1.00 | 0.65 | | | | |
| | | Right - Average DBH (in) | 2.3 | 0.25 | | | | | |
| | | Left - Buffer Width (feet) | 96 | 0.79 | | | | | |
| | | Right - Buffer Width (feet) | 134 | 0.87 | | | | | |
| | | Left - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Right - Tree Density (#/acre) | 280 | 0.92 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 70 | 0.93 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 80 | 1.00 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | | | 0.42 | | | | |
| | | Pool Depth Ratio | 2.2 | 0.84 | | | | | |
| | | Percent Riffle (%) | 72 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.09 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 3**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-3A |
| Upstream Latitude: | 35° 7'34.53"N |
| Upstream Longitude: | 88°58'16.08"W |
| Downstream Latitude: | 35° 7'36.45"N |
| Downstream Longitude: | 88°58'16.20"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | E |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.008 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 199.81 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 3 |
| Proposed Flow Type: | |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.48 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 199.81 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 96 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| | |
|---|---|
| | **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.90 | |
| Geomorphology | Large Woody Debris | 0.91 | |
| | Lateral Migration | 0.66 | |
| | Riparian Vegetation | 0.65 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.40 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.90 | | |
| Geomorphology | 0.52 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 3**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.48 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 0.90 | 0.90 | Functioning | | |
| | | Entrenchment Ratio | 3.3 | 0.80 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.91 | 0.52 | Functioning At Risk | | |
| | | # Pieces | 25 | 0.91 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.66 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 22 | 0.32 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 7.75 | 0.83 | 0.65 | | | | |
| | | Right - Average DBH (in) | 7.99 | 0.86 | | | | | |
| | | Left - Buffer Width (feet) | 66.6 | 0.73 | | | | | |
| | | Right - Buffer Width (feet) | 89.8 | 0.78 | | | | | |
| | | Left - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Right - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 40 | 0.53 | | | | | |
| | | Left - Native Shrub Cover (%) | 30 | 0.72 | | | | | |
| | | Right - Native Shrub Cover (%) | 20 | 0.38 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 5.2 | 0.19 | 0.40 | | | | |
| | | Pool Depth Ratio | 2.6 | 1.00 | | | | | |
| | | Percent Riffle (%) | 60 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.03 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R1 |
| Upstream Latitude: | 35° 7'45.25"N |
| Upstream Longitude: | 88°58'20.23"W |
| Downstream Latitude: | 35° 7'43.57"N |
| Downstream Longitude: | 88°58'19.81"W |
| Existing Stream Type: | F |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0538 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 182.31 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.7 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.15 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 182.31 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 27 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.86 | |
| | Reach Runoff | 0.27 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.27 | |
| | Lateral Migration | 0.10 | |
| | Riparian Vegetation | 0.37 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.05 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.57 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.16 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8181 | 0.86 | 0.86 | 0.57 | Functioning At Risk | 0.15 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.2729 | 0.27 | 0.27 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 5.5 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.3 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.27 | 0.16 | Not Functioning | | |
| | | # Pieces | 5 | 0.27 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.10 | | | | |
| | | Dominant BEHI/NBS | VH/H | 0.20 | | | | | |
| | | Percent Streambank Erosion (%) | 49 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 2.92 | 0.31 | 0.37 | | | | |
| | | Right - Average DBH (in) | 6.73 | 0.72 | | | | | |
| | | Left - Buffer Width (feet) | 27.7 | 0.26 | | | | | |
| | | Right - Buffer Width (feet) | 68 | 0.74 | | | | | |
| | | Left - Tree Density (#/acre) | 360 | 0.53 | | | | | |
| | | Right - Tree Density (#/acre) | 480 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 30 | 0.40 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 15 | 0.20 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.05 | | | | |
| | | Pool Depth Ratio | 1.2 | 0.14 | | | | | |
| | | Percent Riffle (%) | 57 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.01 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R2 |
| Upstream Latitude: | 35° 7'48.82"N |
| Upstream Longitude: | 88°58'22.81"W |
| Downstream Latitude: | 35° 7'45.25"N |
| Downstream Longitude: | 88°58'20.23"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0535 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 436.05 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.4 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.31 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 436.05 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 135 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.87 | |
| | Reach Runoff | 0.64 | |
| Hydraulics | Floodplain Connectivity | 0.66 | |
| Geomorphology | Large Woody Debris | 0.11 | |
| | Lateral Migration | 0.21 | |
| | Riparian Vegetation | 0.28 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.16 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.76 | | |
| Hydraulics | 0.66 | | |
| Geomorphology | 0.15 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8224 | 0.87 | 0.87 | 0.76 | Functioning | 0.31 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.6417 | 0.64 | 0.64 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1.5 | 0.31 | 0.66 | 0.66 | Functioning At Risk | | |
| | | Entrenchment Ratio | 6.3 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.11 | 0.15 | Not Functioning | | |
| | | # Pieces | 2 | 0.11 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.21 | | | | |
| | | Dominant BEHI/NBS | Ex/VH | 0.00 | | | | | |
| | | Percent Streambank Erosion (%) | 16 | 0.41 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 5 | 0.54 | 0.28 | | | | |
| | | Right - Average DBH (in) | 2.73 | 0.29 | | | | | |
| | | Left - Buffer Width (feet) | 31.4 | 0.32 | | | | | |
| | | Right - Buffer Width (feet) | 27.2 | 0.26 | | | | | |
| | | Left - Tree Density (#/acre) | 560 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 1440 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 10 | 0.13 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.16 | | | | |
| | | Pool Depth Ratio | 1.7 | 0.49 | | | | | |
| | | Percent Riffle (%) | 89 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.02 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 3**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R3 |
| Upstream Latitude: | 35° 7'51.10"N |
| Upstream Longitude: | 88°58'24.61"W |
| Downstream Latitude: | 35° 7'48.82"N |
| Downstream Longitude: | 88°58'22.81"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0516 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 330.17 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.8 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.40 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 330.17 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 132 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.88 | |
| | Reach Runoff | 0.50 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.59 | |
| | Lateral Migration | 0.18 | |
| | Riparian Vegetation | 0.42 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.33 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.69 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.30 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 3**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8387 | 0.88 | 0.88 | 0.69 | Functioning At Risk | 0.40 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.5032 | 0.50 | 0.50 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 9.2 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.59 | 0.30 | Functioning At Risk | | |
| | | # Pieces | 11 | 0.59 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.18 | | | | |
| | | Dominant BEHI/NBS | H/M | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 40 | 0.05 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 6 | 0.65 | 0.42 | | | | |
| | | Right - Average DBH (in) | 8.2 | 0.88 | | | | | |
| | | Left - Buffer Width (feet) | 27.2 | 0.26 | | | | | |
| | | Right - Buffer Width (feet) | 144.5 | 0.89 | | | | | |
| | | Left - Tree Density (#/acre) | 120 | 0.89 | | | | | |
| | | Right - Tree Density (#/acre) | 440 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 2 | 0.03 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 10 | 0.13 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.33 | | | | |
| | | Pool Depth Ratio | 2.7 | 1.00 | | | | | |
| | | Percent Riffle (%) | 87 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.17 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 4**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R4 |
| Upstream Latitude: | 35° 7'52.64"N |
| Upstream Longitude: | 88°58'28.26"W |
| Downstream Latitude: | 35° 7'51.10"N |
| Downstream Longitude: | 88°58'24.61"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0476 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 393.23 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 2.4 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.37 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 393.23 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 145 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.92 | |
| | Reach Runoff | 0.47 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.50 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.07 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.70 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.15 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 4

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8757 | 0.92 | 0.92 | 0.70 | Functioning | 0.37 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.4728 | 0.47 | 0.47 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 8.7 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.15 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 59 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 8.58 | 0.92 | 0.50 | | | | |
| | | Right - Average DBH (in) | 7.46 | 0.80 | | | | | |
| | | Left - Buffer Width (feet) | 83.5 | 0.77 | | | | | |
| | | Right - Buffer Width (feet) | 103.3 | 0.81 | | | | | |
| | | Left - Tree Density (#/acre) | 360 | 0.53 | | | | | |
| | | Right - Tree Density (#/acre) | 240 | 1.00 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 10 | 0.13 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 5 | 0.07 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.07 | | | | |
| | | Pool Depth Ratio | 1.3 | 0.21 | | | | | |
| | | Percent Riffle (%) | 82 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.15 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 5**

## Reach Information and Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R5 |
| Upstream Latitude: | 35° 7'54.70"N |
| Upstream Longitude: | 88°58'31.36"W |
| Downstream Latitude: | 35° 7'52.64"N |
| Downstream Longitude: | 88°58'28.26"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0416 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 394.51 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.8 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## Notes

1. Users input values that are highlighted based on restoration potential
2. Users select values from a pull-down menu
3. Leave values blank for field values that were not measured
4. **These field values do not apply to ephemeral channels.**

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.38 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 394.51 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 150 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| | |
|---|---|
| Credits | |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.98 | |
| | Reach Runoff | 0.43 | |
| Hydraulics | Floodplain Connectivity | 0.81 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.17 | |
| | Riparian Vegetation | 0.43 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.33 | |
| | Sinuosity | 1.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.71 | | |
| Hydraulics | 0.81 | | |
| Geomorphology | 0.39 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**

**Quantification Tool Spreadsheet Reach 5**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9275 | 0.98 | 0.98 | 0.71 | Functioning | 0.38 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.427 | 0.43 | 0.43 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1.2 | 0.70 | 0.81 | 0.81 | Functioning | | |
| | | Entrenchment Ratio | 4.2 | 0.91 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.39 | Functioning At Risk | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.17 | | | | |
| | | Dominant BEHI/NBS | H/VH | 0.10 | | | | | |
| | | Percent Streambank Erosion (%) | 33 | 0.24 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 5.16 | 0.55 | 0.43 | | | | |
| | | Right - Average DBH (in) | 4.6 | 0.49 | | | | | |
| | | Left - Buffer Width (feet) | 70.4 | 0.74 | | | | | |
| | | Right - Buffer Width (feet) | 91.9 | 0.78 | | | | | |
| | | Left - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Right - Tree Density (#/acre) | 400 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 15 | 0.20 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 25 | 0.33 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.33 | | | | |
| | | Pool Depth Ratio | 2.9 | 1.00 | | | | | |
| | | Percent Riffle (%) | 80 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.25 | 1.00 | 1.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R6 |
| Upstream Latitude: | 35° 7'53.61"N |
| Upstream Longitude: | 88°58'35.43"W |
| Downstream Latitude: | 35° 7'54.70"N |
| Downstream Longitude: | 88°58'31.36"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0365 |
| Proposed Bed Material: | Silt/Clay |
| Existing Stream Length (feet): | 374.49 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 2.2 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.22 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 374.49 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 82 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 0.85 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.38 | |
| | Lateral Migration | 0.15 | |
| | Riparian Vegetation | 0.36 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.00 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.93 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.18 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0
Quantification Tool Spreadsheet Reach 1

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Functional Category | Function-Based Parameters | Measurement Method | Field Value | Index Value | Parameter | Category | Category | ECS | ECS |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 0.93 | Functioning | 0.22 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.847 | 0.85 | 0.85 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 8.6 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.4 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.38 | 0.18 | Not Functioning | | |
| | | # Pieces | 7 | 0.38 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.15 | | | | |
| | | Dominant BEHI/NBS | VH/M | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 100 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 3.73 | 0.40 | 0.36 | | | | |
| | | Right - Average DBH (in) | 1.84 | 0.20 | | | | | |
| | | Left - Buffer Width (feet) | 156 | 0.91 | | | | | |
| | | Right - Buffer Width (feet) | 140 | 0.88 | | | | | |
| | | Left - Tree Density (#/acre) | 600 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 680 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 2.5 | 0.03 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 15 | 0.20 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.00 | | | | |
| | | Pool Depth Ratio | 0 | 0.00 | | | | | |
| | | Percent Riffle (%) | 100 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.11 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4-R7 |
| Upstream Latitude: | 35° 7'52.35"N |
| Upstream Longitude: | 88°58'38.46"W |
| Downstream Latitude: | 35° 7'53.61"N |
| Downstream Longitude: | 88°58'35.43"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0117 |
| Proposed Bed Material: | Silt/Clay |
| Existing Stream Length (feet): | 319.56 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 2.6 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.48 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 319.56 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 153 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.54 | |
| | Lateral Migration | 0.65 | |
| | Riparian Vegetation | 0.45 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.33 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.39 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.48 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 10.1 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.54 | 0.39 | Functioning At Risk | | |
| | | # Pieces | 10 | 0.54 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.65 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 26 | 0.29 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 4.42 | 0.48 | 0.45 | | | | |
| | | Right - Average DBH (in) | 3.58 | 0.38 | | | | | |
| | | Left - Buffer Width (feet) | 92.3 | 0.78 | | | | | |
| | | Right - Buffer Width (feet) | 167.7 | 0.94 | | | | | |
| | | Left - Tree Density (#/acre) | 640 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 600 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 30 | 0.40 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 40 | 0.53 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.33 | | | | |
| | | Pool Depth Ratio | 3 | 1.00 | | | | | |
| | | Percent Riffle (%) | 72 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.14 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

TN SQT v1.0
Quantification Tool Spreadsheet Reach 3

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4A |
| Upstream Latitude: | 35° 7'46.07"N |
| Upstream Longitude: | 88°58'22.65"W |
| Downstream Latitude: | 35° 7'45.25"N |
| Downstream Longitude: | 88°58'20.23"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0253 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 221.27 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.1 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

1. Users input values that are highlighted based on restoration potential
2. Users select values from a pull-down menu
3. Leave values blank for field values that were not measured
**4. These field values do not apply to ephemeral channels.**

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.31 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 221.27 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 69 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.91 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.38 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.25 | |
| | Riparian Vegetation | 0.45 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.26 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.96 | | |
| Hydraulics | 0.38 | | |
| Geomorphology | 0.19 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 3

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Functional Category | Function-Based Parameters | Measurement Method | Field Value | Index Value | Parameter | Category | Category | ECS | ECS |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8664 | 0.91 | 0.91 | 0.96 | Functioning | 0.31 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2 | 0.00 | 0.38 | 0.38 | Functioning At Risk | | |
| | | Entrenchment Ratio | 2.9 | 0.76 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.19 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.25 | | | | |
| | | Dominant BEHI/NBS | VH/M | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 35 | 0.20 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 8.5 | 0.91 | 0.45 | | | | |
| | | Right - Average DBH (in) | 6.8 | 0.73 | | | | | |
| | | Left - Buffer Width (feet) | 31.7 | 0.33 | | | | | |
| | | Right - Buffer Width (feet) | 114.1 | 0.83 | | | | | |
| | | Left - Tree Density (#/acre) | 440 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 600 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 30 | 0.40 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 0 | 0.00 | 0.26 | | | | |
| | | Pool Depth Ratio | 2.1 | 0.77 | | | | | |
| | | Percent Riffle (%) | 91 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.01 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 4**

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-4B |
| Upstream Latitude: | 35° 7'54.20"N |
| Upstream Longitude: | 88°58'35.18"W |
| Downstream Latitude: | 35° 7'53.86"N |
| Downstream Longitude: | 88°58'34.74"W |
| Existing Stream Type: | B |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0183 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 49.02 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 10 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.26 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 49.02 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 13 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| | |
|---|---|
| | **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.96 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.27 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.00 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.29 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 4**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9542 | 1.00 | 1.00 | 1.00 | Functioning | 0.26 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2.9 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.5 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.96 | 0.29 | Not Functioning | | |
| | | # Pieces | 28 | 0.96 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 100 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 3.73 | 0.40 | 0.27 | | | | |
| | | Right - Average DBH (in) | 3.54 | 0.38 | | | | | |
| | | Left - Buffer Width (feet) | 20.3 | 0.16 | | | | | |
| | | Right - Buffer Width (feet) | 18.7 | 0.14 | | | | | |
| | | Left - Tree Density (#/acre) | 600 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 840 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 25 | 0.33 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.00 | | | | |
| | | Pool Depth Ratio | 0 | 0.00 | | | | | |
| | | Percent Riffle (%) | 100 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.04 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-5-R1 |
| Upstream Latitude: | 35° 7'41.40"N |
| Upstream Longitude: | 88°58'44.04"W |
| Downstream Latitude: | 35° 7'41.30"N |
| Downstream Longitude: | 88°58'22.93"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.2334 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 2006.26 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.6 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.31 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 2006.26 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 622 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.37 | |
| | Reach Runoff | 0.54 | |
| Hydraulics | Floodplain Connectivity | 0.88 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.15 | |
| | Riparian Vegetation | 0.16 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.67 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.46 | | |
| Hydraulics | 0.88 | | |
| Geomorphology | 0.20 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.3525 | 0.37 | 0.37 | 0.46 | Functioning At Risk | 0.31 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 0.5359 | 0.54 | 0.54 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 0.88 | 0.88 | Functioning | | |
| | | Entrenchment Ratio | 2.8 | 0.75 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | 0 | 0.00 | 0.00 | 0.20 | Not Functioning | | |
| | | # Pieces | | | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.15 | | | | |
| | | Dominant BEHI/NBS | M/H | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 50 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 0 | 0.00 | 0.16 | | | | |
| | | Right - Average DBH (in) | 0 | 0.00 | | | | | |
| | | Left - Buffer Width (feet) | 0 | 0.00 | | | | | |
| | | Right - Buffer Width (feet) | 0 | 0.00 | | | | | |
| | | Left - Tree Density (#/acre) | 0 | 0.00 | | | | | |
| | | Right - Tree Density (#/acre) | 0 | 0.00 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 60 | 0.80 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 60 | 0.80 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.67 | | | | |
| | | Pool Depth Ratio | 3.6 | 1.00 | | | | | |
| | | Percent Riffle (%) | 24 | 1.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.14 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**

**Quantification Tool Spreadsheet Reach 2**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-5-R2 |
| Upstream Latitude: | 35° 7'48.77"N |
| Upstream Longitude: | 88°58'59.59"W |
| Downstream Latitude: | 35° 7'41.40"N |
| Downstream Longitude: | 88°58'44.04"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.1284 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 1538.65 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.9 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | January - June |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.13 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1538.65 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 200 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.20 | |
| | Reach Runoff | 0.71 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.27 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.37 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.22 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.46 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.21 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.1913 | 0.20 | 0.20 | 0.46 | Functioning At Risk | 0.13 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.7065 | 0.71 | 0.71 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 5.2 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.3 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.27 | 0.21 | Not Functioning | | |
| | | # Pieces | 5 | 0.27 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | VH/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 100 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 0.8 | 0.09 | 0.37 | | | | |
| | | Right - Average DBH (in) | 3.65 | 0.39 | | | | | |
| | | Left - Buffer Width (feet) | 8.7 | 0.05 | | | | | |
| | | Right - Buffer Width (feet) | 109.3 | 0.82 | | | | | |
| | | Left - Tree Density (#/acre) | 560 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 680 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 50 | 0.67 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 50 | 0.67 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.22 | | | | |
| | | Pool Depth Ratio | 1.6 | 0.42 | | | | | |
| | | Percent Riffle (%) | 45 | 0.25 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.06 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-6-R1 |
| Upstream Latitude: | 35° 7'27.10"N |
| Upstream Longitude: | 88°58'24.46"W |
| Downstream Latitude: | 35° 7'36.85"N |
| Downstream Longitude: | 88°58'27.12"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.062 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 1180.72 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.2 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.25 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 1180.72 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 295 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.32 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.45 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.26 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.25 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 1

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.25 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 4 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.1 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.32 | 0.25 | Not Functioning | | |
| | | # Pieces | 6 | 0.32 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 100 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 3.4 | 0.37 | 0.45 | | | | |
| | | Right - Average DBH (in) | 6.28 | 0.68 | | | | | |
| | | Left - Buffer Width (feet) | 255.5 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 346.3 | 1.00 | | | | | |
| | | Left - Tree Density (#/acre) | 440 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 520 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 10 | 0.13 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 5 | 0.07 | | | | | |
| | | Left - Native Shrub Cover (%) | 5 | 0.06 | | | | | |
| | | Right - Native Shrub Cover (%) | 10 | 0.14 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.26 | | | | |
| | | Pool Depth Ratio | 2.1 | 0.77 | | | | | |
| | | Percent Riffle (%) | 90 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.17 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 2

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-6-R2 |
| Upstream Latitude: | 35° 7'24.17"N |
| Upstream Longitude: | 88°58'20.09"W |
| Downstream Latitude: | 35° 7'27.10"N |
| Downstream Longitude: | 88°58'24.46"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.013 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 517.07 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.8 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.48 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 517.07 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 248 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| Credits |
|---|

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.94 | |
| Geomorphology | Large Woody Debris | 0.38 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.65 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.39 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.94 | | |
| Geomorphology | 0.48 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.48 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 0.94 | 0.94 | Functioning | | |
| | | Entrenchment Ratio | 3.9 | 0.87 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.38 | 0.48 | Functioning At Risk | | |
| | | # Pieces | 7 | 0.38 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 0 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 7.95 | 0.85 | 0.65 | | | | |
| | | Right - Average DBH (in) | 4.18 | 0.45 | | | | | |
| | | Left - Buffer Width (feet) | 548 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 374 | 1.00 | | | | | |
| | | Left - Tree Density (#/acre) | 240 | 1.00 | | | | | |
| | | Right - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Left - Native Shrub Cover (%) | 15 | 0.25 | | | | | |
| | | Right - Native Shrub Cover (%) | 30 | 0.72 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 6.5 | 0.17 | 0.39 | | | | |
| | | Pool Depth Ratio | 3.5 | 1.00 | | | | | |
| | | Percent Riffle (%) | 73 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.12 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-7-R1 |
| Upstream Latitude: | 35° 7'21.34"N |
| Upstream Longitude: | 88°58'47.21"W |
| Downstream Latitude: | 35° 7'28.46"N |
| Downstream Longitude: | 88°58'43.51"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.228 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 910.36 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 0.9 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.26 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 910.36 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 237 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.43 | |
| | Lateral Migration | 0.15 | |
| | Riparian Vegetation | 0.54 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.37 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.30 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.9825 | 1.00 | 1.00 | 1.00 | Functioning | 0.26 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 5.7 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.1 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.43 | 0.30 | Functioning At Risk | | |
| | | # Pieces | 8 | 0.43 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.15 | | | | |
| | | Dominant BEHI/NBS | H/M | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 80 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 0.75 | 0.08 | 0.54 | | | | |
| | | Right - Average DBH (in) | 4.19 | 0.45 | | | | | |
| | | Left - Buffer Width (feet) | 69.9 | 0.74 | | | | | |
| | | Right - Buffer Width (feet) | 706.5 | 1.00 | | | | | |
| | | Left - Tree Density (#/acre) | 200 | 1.00 | | | | | |
| | | Right - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 60 | 0.80 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 45 | 0.60 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 6.9 | 0.03 | 0.37 | | | | |
| | | Pool Depth Ratio | 1.6 | 0.42 | | | | | |
| | | Percent Riffle (%) | 37 | 0.65 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.16 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-8-R1 |
| Upstream Latitude: | 35° 7'28.76"N |
| Upstream Longitude: | 88°58'49.64"W |
| Downstream Latitude: | 35° 7'28.40"N |
| Downstream Longitude: | 88°58'44.20"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.057 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 500.34 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 2.4 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.31 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 500.34 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 155 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| **Credits** |

WARNING: Sufficient data are not provided.

| FUNCTION BASED PARAMETERS SUMMARY | | | |
|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Existing Parameter** | **Proposed Parameter** |
| Hydrology | Catchment Hydrology | 0.91 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.20 | |
| Geomorphology | Large Woody Debris | 0.75 | |
| | Lateral Migration | 0.27 | |
| | Riparian Vegetation | 0.45 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.49 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

| FUNCTIONAL CATEGORY REPORT CARD | | | |
|---|---|---|---|
| **Functional Category** | **ECS** | **PCS** | **Functional Lift** |
| Hydrology | 0.96 | | |
| Hydraulics | 0.20 | | |
| Geomorphology | 0.39 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**

**Quantification Tool Spreadsheet Reach 1**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.864 | 0.91 | 0.91 | 0.96 | Functioning | 0.31 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1.7 | 0.00 | 0.20 | 0.20 | Not Functioning | | |
| | | Entrenchment Ratio | 2.1 | 0.40 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.75 | 0.39 | Functioning At Risk | | |
| | | # Pieces | 16 | 0.75 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.27 | | | | |
| | | Dominant BEHI/NBS | H/M | 0.30 | | | | | |
| | | Percent Streambank Erosion (%) | 33 | 0.24 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 2.4 | 0.26 | 0.45 | | | | |
| | | Right - Average DBH (in) | 1.65 | 0.18 | | | | | |
| | | Left - Buffer Width (feet) | 67.8 | 0.74 | | | | | |
| | | Right - Buffer Width (feet) | 117.9 | 0.84 | | | | | |
| | | Left - Tree Density (#/acre) | 480 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 240 | 1.00 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 35 | 0.47 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 35 | 0.47 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 4 | 0.55 | 0.49 | | | | |
| | | Pool Depth Ratio | 2.3 | 0.91 | | | | | |
| | | Percent Riffle (%) | 60 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.11 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-8-R2 |
| Upstream Latitude: | 35° 7'28.83"N |
| Upstream Longitude: | 88°58'51.78"W |
| Downstream Latitude: | 35° 7'28.76"N |
| Downstream Longitude: | 88°58'49.64"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | E |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.044 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 204.29 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.2 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.34 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 204.29 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 69 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

| **Credits** |
|---|
| |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.88 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.38 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.49 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.32 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.94 | | |
| Hydraulics | 0.38 | | |
| Geomorphology | 0.36 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8347 | 0.88 | 0.88 | 0.94 | Functioning | 0.34 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2 | 0.00 | 0.38 | 0.38 | Functioning At Risk | | |
| | | Entrenchment Ratio | 2.8 | 0.75 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.36 | Functioning At Risk | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 0 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 1.13 | 0.12 | 0.49 | | | | |
| | | Right - Average DBH (in) | 2.18 | 0.23 | | | | | |
| | | Left - Buffer Width (feet) | 238 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 188 | 0.98 | | | | | |
| | | Left - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Right - Tree Density (#/acre) | 400 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 35 | 0.47 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 65 | 0.86 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 6 | 0.35 | 0.32 | | | | |
| | | Pool Depth Ratio | 1.5 | 0.35 | | | | | |
| | | Percent Riffle (%) | 45 | 0.25 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.15 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 3**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-8-R3 |
| Upstream Latitude: | 35° 7'31.25"N |
| Upstream Longitude: | 88°58'55.38"W |
| Downstream Latitude: | 35° 7'28.76"N |
| Downstream Longitude: | 88°58'49.64"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.044 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 403.56 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 2.2 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.20 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 403.56 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 81 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 0.87 | |
| | Reach Runoff | 0.80 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.44 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.16 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 0.84 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.16 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 3

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 0.8303 | 0.87 | 0.87 | 0.84 | Functioning | 0.20 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 0.8018 | 0.80 | 0.80 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 2.7 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.4 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.16 | Not Functioning | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 69 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 1.2 | 0.13 | 0.44 | | | | |
| | | Right - Average DBH (in) | 1.4 | 0.15 | | | | | |
| | | Left - Buffer Width (feet) | 337 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 115 | 0.83 | | | | | |
| | | Left - Tree Density (#/acre) | 480 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 480 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 65 | 0.86 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 35 | 0.47 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 6.6 | 0.00 | 0.16 | | | | |
| | | Pool Depth Ratio | 1.7 | 0.49 | | | | | |
| | | Percent Riffle (%) | 55 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.05 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 4**

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-8A |
| Upstream Latitude: | 35° 7'27.91"N |
| Upstream Longitude: | 88°58'53.82"W |
| Downstream Latitude: | 35° 7'28.38"N |
| Downstream Longitude: | 88°58'51.69"W |
| Existing Stream Type: | C |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.005 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 200.19 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.9 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.49 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 200.19 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 98 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.51 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.67 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.44 | | |
| Physicochemical | | | |
| Biology | | | |

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.49 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 11.1 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.44 | Functioning At Risk | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 0 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 5.27 | 0.57 | 0.51 | | | | |
| | | Right - Average DBH (in) | 4.03 | 0.43 | | | | | |
| | | Left - Buffer Width (feet) | 144 | 0.89 | | | | | |
| | | Right - Buffer Width (feet) | 183.1 | 0.97 | | | | | |
| | | Left - Tree Density (#/acre) | 520 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 400 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 40 | 0.53 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 45 | 0.60 | | | | | |
| | | Left - Native Shrub Cover (%) | 5 | 0.06 | | | | | |
| | | Right - Native Shrub Cover (%) | 5 | 0.06 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 4.7 | 1.00 | 0.67 | | | | |
| | | Pool Depth Ratio | 4 | 1.00 | | | | | |
| | | Percent Riffle (%) | 70 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.1 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

TN SQT v1.0
Quantification Tool Spreadsheet Reach 5

| Reach Information and Reference Standard Stratification | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-8B |
| Upstream Latitude: | 35° 7'31.16"N |
| Upstream Longitude: | 88°58'56.32"W |
| Downstream Latitude: | 35° 7'31.08"N |
| Downstream Longitude: | 88°58'55.13"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.0005 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 103.99 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 3.7 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

| Notes |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

| FUNCTIONAL LIFT SUMMARY | |
|---|---|
| Exisiting Condition Score (ECS) | 0.46 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 103.99 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 48 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

| MITIGATION SUMMARY |
|---|
| Credits |

WARNING: Sufficient data are not provided.

**FUNCTION BASED PARAMETERS SUMMARY**

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.97 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.33 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.36 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

**FUNCTIONAL CATEGORY REPORT CARD**

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.97 | | |
| Geomorphology | 0.34 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0

Quantification Tool Spreadsheet Reach 5

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Functional Category | Function-Based Parameters | Measurement Method | Field Value | Index Value | Parameter | Category | Category | ECS | ECS |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.46 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 0.97 | 0.97 | Functioning | | |
| | | Entrenchment Ratio | 4.5 | 0.94 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.34 | Functioning At Risk | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 0 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 1.51 | 0.16 | 0.33 | | | | |
| | | Right - Average DBH (in) | 3.83 | 0.41 | | | | | |
| | | Left - Buffer Width (feet) | 8.4 | 0.05 | | | | | |
| | | Right - Buffer Width (feet) | 11.2 | 0.07 | | | | | |
| | | Left - Tree Density (#/acre) | 800 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 240 | 1.00 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 20 | 0.27 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 62 | 0.82 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 5.6 | 0.07 | 0.36 | | | | |
| | | Pool Depth Ratio | 2.7 | 1.00 | | | | | |
| | | Percent Riffle (%) | 64 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.05 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 1**

## Reach Information and Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-9-R1 |
| Upstream Latitude: | 35° 7'22.53"N |
| Upstream Longitude: | 88°58'52.73"W |
| Downstream Latitude: | 35° 7'26.94"N |
| Downstream Longitude: | 88°58'45.49"W |
| Existing Stream Type: | G |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.059 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 827.65 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 1.3 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## Notes

1. Users input values that are highlighted based on restoration potential
2. Users select values from a pull-down menu
3. Leave values blank for field values that were not measured
**4. These field values do not apply to ephemeral channels.**

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.27 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 827.65 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 223 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 0.00 | |
| Geomorphology | Large Woody Debris | 0.80 | |
| | Lateral Migration | 0.20 | |
| | Riparian Vegetation | 0.47 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.23 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 0.00 | | |
| Geomorphology | 0.34 | | |
| Physicochemical | | | |
| Biology | | | |

TN SQT v1.0
Quantification Tool Spreadsheet Reach 1

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Functional Category** | **Function-Based Parameters** | **Measurement Method** | **Field Value** | **Index Value** | **Parameter** | **Category** | **Category** | **ECS** | **ECS** |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.27 | Not Functioning |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 6.3 | 0.00 | 0.00 | 0.00 | Not Functioning | | |
| | | Entrenchment Ratio | 1.5 | 0.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.80 | 0.34 | Functioning At Risk | | |
| | | # Pieces | 19 | 0.80 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 0.20 | | | | |
| | | Dominant BEHI/NBS | H/L | 0.40 | | | | | |
| | | Percent Streambank Erosion (%) | 100 | 0.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 4.75 | 0.51 | 0.47 | | | | |
| | | Right - Average DBH (in) | 6.63 | 0.71 | | | | | |
| | | Left - Buffer Width (feet) | 216 | 1.00 | | | | | |
| | | Right - Buffer Width (feet) | 152 | 0.90 | | | | | |
| | | Left - Tree Density (#/acre) | 560 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 320 | 0.72 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 5 | 0.07 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 25 | 0.33 | | | | | |
| | | Left - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 100 | 0.00 | 0.23 | | | | |
| | | Pool Depth Ratio | 2 | 0.70 | | | | | |
| | | Percent Riffle (%) | 69 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.11 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

**TN SQT v1.0**

**Quantification Tool Spreadsheet Reach 2**

| |
|---|
| 1. Users input values that are highlighted based on restoration potential |
| 2. Users select values from a pull-down menu |
| 3. Leave values blank for field values that were not measured |
| **4. These field values do not apply to ephemeral channels.** |

## Reference Standard Stratification

| | |
|---|---|
| Project Name: | Cub Creek, 322-520 |
| Reach ID: | STR-9-R2 |
| Upstream Latitude: | 35° 7'22.55"N |
| Upstream Longitude: | 88°58'54.51"W |
| Downstream Latitude: | 35° 7'22.53"N |
| Downstream Longitude: | 88°58'52.73"W |
| Existing Stream Type: | E |
| Proposed Stream Type: | C |
| Ecoregion: | 65abei |
| Drainage Area (sqmi): | 0.009 |
| Proposed Bed Material: | |
| Existing Stream Length (feet): | 148.27 |
| Proposed Stream Length (feet): | |
| Proposed Stream Slope (%): | 2.7 |
| Proposed Flow Type: | Perennial/Intermittent |
| Data Collection Season: | July - December |
| Macro Collection Method: | |
| Valley Type: | Unconfined Alluvial |

## FUNCTIONAL LIFT SUMMARY

| | |
|---|---|
| Exisiting Condition Score (ECS) | 0.46 |
| Proposed Condition Score (PCS) | |
| Change in Functional Condition (PCS - ECS) | |
| Existing Stream Length (feet) | 148.27 |
| Proposed Stream Length (feet) | |
| Additional Stream Length (feet) | |
| Existing Stream Functional Feet (FF) | 68 |
| Proposed Stream Functional Feet (FF) | |
| Functional Lift (Proposed FF - Existing FF) | |

## MITIGATION SUMMARY

**Credits**

WARNING: Sufficient data are not provided.

## FUNCTION BASED PARAMETERS SUMMARY

| Functional Category | Function-Based Parameters | Existing Parameter | Proposed Parameter |
|---|---|---|---|
| Hydrology | Catchment Hydrology | 1.00 | |
| | Reach Runoff | 1.00 | |
| Hydraulics | Floodplain Connectivity | 1.00 | |
| Geomorphology | Large Woody Debris | 0.00 | |
| | Lateral Migration | 1.00 | |
| | Riparian Vegetation | 0.43 | |
| | Bed Material | | |
| | Bed Form Diversity | 0.14 | |
| | Sinuosity | 0.00 | |
| Physicochemical | Bacteria | | |
| | Organic Enrichment | | |
| | Nitrogen | | |
| | Phosphorus | | |
| Biology | Macroinvertebrates | | |
| | Fish | | |

## FUNCTIONAL CATEGORY REPORT CARD

| Functional Category | ECS | PCS | Functional Lift |
|---|---|---|---|
| Hydrology | 1.00 | | |
| Hydraulics | 1.00 | | |
| Geomorphology | 0.31 | | |
| Physicochemical | | | |
| Biology | | | |

**TN SQT v1.0**
**Quantification Tool Spreadsheet Reach 2**

| EXISTING CONDITION ASSESSMENT | | | | | Roll Up Scoring | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Functional Category | Function-Based Parameters | Measurement Method | Field Value | Index Value | Parameter | Category | Category | ECS | ECS |
| Hydrology | Catchment Hydrology | Watershed Land Use Runoff Score | 1 | 1.00 | 1.00 | 1.00 | Functioning | 0.46 | Functioning At Risk |
| | Reach Runoff | Stormwater Infiltration | 1 | 1.00 | 1.00 | | | | |
| Hydraulics | Floodplain Connectivity | Bank Height Ratio | 1 | 1.00 | 1.00 | 1.00 | Functioning | | |
| | | Entrenchment Ratio | 9.6 | 1.00 | | | | | |
| Geomorphology | Large Woody Debris | Large Woody Debris Index | | | 0.00 | 0.31 | Functioning At Risk | | |
| | | # Pieces | 0 | 0.00 | | | | | |
| | Lateral Migration | Erosion Rate (ft/yr) | | | 1.00 | | | | |
| | | Dominant BEHI/NBS | L/L | 1.00 | | | | | |
| | | Percent Streambank Erosion (%) | 2 | 1.00 | | | | | |
| | | Percent Armoring (%) | | | | | | | |
| | Riparian Vegetation | Left - Average Diameter at Breast Height (DBH; in) | 2.95 | 0.32 | 0.43 | | | | |
| | | Right - Average DBH (in) | 5.75 | 0.62 | | | | | |
| | | Left - Buffer Width (feet) | 142.7 | 0.89 | | | | | |
| | | Right - Buffer Width (feet) | 70.1 | 0.74 | | | | | |
| | | Left - Tree Density (#/acre) | 560 | 0.50 | | | | | |
| | | Right - Tree Density (#/acre) | 480 | 0.50 | | | | | |
| | | Left - Native Herbaceous Cover (%) | 15 | 0.20 | | | | | |
| | | Right - Native Herbaceous Cover (%) | 35 | 0.47 | | | | | |
| | | Left - Native Shrub Cover (%) | 5 | 0.06 | | | | | |
| | | Right - Native Shrub Cover (%) | 0 | 0.00 | | | | | |
| | Bed Material Characterization | Size Class Pebble Count Analyzer (p-value) | | | | | | | |
| | Bed Form Diversity | Pool Spacing Ratio | 8.4 | 0.00 | 0.14 | | | | |
| | | Pool Depth Ratio | 1.6 | 0.42 | | | | | |
| | | Percent Riffle (%) | 74 | 0.00 | | | | | |
| | | Aggradation Ratio | | | | | | | |
| | Plan Form | Sinuosity | 1.01 | 0.00 | 0.00 | | | | |
| Physicochemical | Bacteria | E. Coli (Cfu/100 mL) | | | | | | | |
| | Organic Enrichment | Percent Nutrient Tolerant Macroinvertebrates (%) | | | | | | | |
| | Nitrogen | Nitrate-Nitrite (mg/L) | | | | | | | |
| | Phosphorus | Total Phosphorus (mg/L) | | | | | | | |
| Biology | Macroinvertebrates | Tennessee Macroinvertebrate Index | | | | | | | |
| | | Percent Clingers (%) | | | | | | | |
| | | Percent EPT - Cheumatopsyche (%) | | | | | | | |
| | | Percent Oligochaeta and Chironomidae (%) | | | | | | | |
| | Fish | Native Fish Score Index | | | | | | | |
| | | Catch per Unit Effort Score | | | | | | | |

# APPENDIX 6
# SITE PROTECTION FORMS

This instrument prepared by:
Tennessee Department of Environment and Conservation
Division of Water Resources
Attn: ________________________
312 Rosa L. Parks Ave., 10th Floor
Nashville, Tennessee 37243

STATE OF TENNESSEE
COUNTY OF ______________

**NOTICE OF LAND USE RESTRICTIONS**
**("*[Add Property Name]*")**

Notice is hereby given that, pursuant to their respective authorities found at Tennessee Code Annotated ("T.C.A.") § 68-212-225 and 33 Code of Federal Regulations ("C.F.R.") § 332.7(a)*,* the Commissioner of the Tennessee Department of Environment and Conservation ("TDEC") and the ____________ District Engineer of the United States Corps of Engineers ("USACE") determined that land use restrictions are appropriate for the protection of streams and wetlands, or for other environmental conservation purposes, at the below-described property. Pursuant to T.C.A. § 68-212-225(d) the register of deeds shall record this Notice of Land Use Restrictions ("Notice") and index it in the grantor index under the name of the owner of the property.

**WITNESSETH:**

**WHEREAS**, to its actual knowledge, State of Tennessee ("Owner") is the sole owner in fee simple of approximately ______ acres of real property described in a deed of record with the ________ County, Tennessee Register of Deeds, Book ______, Page _____ *[or Instrument Number]* ("Property"), and as more particularly described in the legal description attached as **Exhibit A** and incorporated herein by reference;

**WHEREAS**, the Property is shown on a survey drawn by _________ dated ___________, attached hereto as **Exhibit B** and incorporated herein by reference;

**WHEREAS**, the Property possesses natural resources with significant aquatic, ecological and habitat values ("Conservation Values"). These natural resources are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people. These values include Waters of the United States, as defined in 40 C.F.R § 122.2 and 33 C.F.R. Part 328, and Waters of the State, as defined in T.C.A. § 69-3-101, *et seq*., including streams, wetlands and the adjacent uplands, and other native vegetation and wildlife. These natural resources are of great importance to USACE, TDEC and Owner;

**WHEREAS**, the Property has been approved by USACE for use as compensatory mitigation pursuant to and as defined in 33 C.F.R. Part 332;

**WHEREAS**, the Property is managed by the *[Insert Department Name and Abbreviation]* on behalf of the Owner; however the *[Insert Department Name and Abbreviation]* is constructing and managing the approved mitigation project on behalf of the Owner;

**WHEREAS**, the Property is identified as being occupied by, or as being potential habitat for species of native plants and wildlife, which Owner desires to establish, preserve, protect, restore, and enhance;

**WHEREAS,** on or about _______________, the Commissioner of TDEC issued Aquatic Resource Alteration Permit Number _____________ ("ARAP") to ______________, incorporated herein by reference;

**WHEREAS**, on or about _______________, the __________ District Engineer of the USACE issued Department of the Army Permit Number _______________ ("DA Permit") pursuant to Section 404 of the Clean Water Act to _____________, incorporated herein by reference;

**WHEREAS**, the ARAP and DA Permit, and any modifications thereto, authorize certain activities which could affect wetlands or other surface waters in or of the State of Tennessee;

**WHEREAS,** the ARAP and DA Permit and approval of the Property for use as mitigation requires that certain uses of the Property be restricted; and,

**WHEREAS,** the purpose of this Notice is to ensure that the Property will be retained forever in an open space condition and to prevent any use of the Property that will impair or interfere with the Conservation Values. Owner intends that this Notice (i) will assure that the Property will be used for such activities that are consistent with the purpose of this Notice, and (ii) shall be implemented consistent with the ARAP and DA Permit.

**NOW, THEREFORE,** in consideration of the foregoing, Owner hereby declares that the Property shall be held, sold, and conveyed subject to the following land use restrictions. Said land use restrictions shall run with the land and shall be binding on all parties having any right, title, or interest in the Property or any part thereof, their heirs, successors, successors-in-title, and assigns, and shall inure to the benefit of each owner thereof and to TDEC and USACE and the respective successors and assigns of such parties:

**Land Use Restrictions:** Any activity on or use of the Property inconsistent with the purpose of this Notice is prohibited. Without limiting the generality of the foregoing, the following activities and uses are expressly prohibited in, on, over, or under the Property.

1) **Destruction or Alteration.** There shall be no destruction or alteration of the Property described in this Notice other than those alterations authorized by TDEC under the ARAP and by USACE under the DA Permit.

2) **Livestock.** Livestock shall not be permitted to graze, inhabit, or otherwise enter the Property.

3) **Uses**. There shall be no commercial or industrial activity undertaken or allowed; nor shall any right of passage across or upon the Property be allowed or granted if that right of passage is used in conjunction with commercial or industrial activity.

4) **Vegetation**. There shall be no removal, destruction, cutting, or spraying with biocides or other agrichemicals of any vegetation, nor any disturbance or change in the natural habitat in any manner, excepting activities (*e.g*., invasive species eradication and access road upkeep) that are essential to the maintenance of the Property as a protected natural area. There shall be no planting or introduction of any vegetation, except as described in the ARAP or DA Permit.

5) **Topography**. Except as permitted under the ARAP or DA Permit, there shall be no filling, excavating, dredging, mining, drilling, removal of topsoil, sand, gravel, rock, minerals or other materials, any dumping of ashes, garbage, or of any other material not required for the Property's maintenance as a protected natural area, nor granting or authorizing surface entry to the Property for any of these purposes, and no changing of the topography of the land in any manner, excepting activities (*e.g*., wetland restoration, restorative streambank grading) that are essential for the management of the Property as a protected natural area.

6) **Building**. There shall be no construction or placing of buildings, mobile homes, advertising signs, billboards, or other structures, or additions or improvements to existing structures, excepting notice signs as required by the ARAP or DA Permit.

7) **Roads**. Except as permitted under the ARAP or DA Permit, there shall be no building of new roads or any other rights of way, nor widening of existing roads or rights of way, excepting access routes and trails required for the management of the Property as a natural area.

8) **Waters**. Except as permitted under the ARAP or DA Permit, there shall be no draining, ditching, diking, dredging, channelizing, damming, pumping, impounding, water withdrawals, or underground injection wells; no changing the grade or elevation, impairing or diverting the flow or circulation of waters, or reducing the reach of waters; and no other discharge or activity requiring

a permit under applicable clean water or water pollution control laws and regulations, as amended.

9) **Resources**. There shall be no transfer, encumbrance, sale, lease, or other conveyance of the mineral, air or water rights for the Property and any portion thereof separate from the surface rights, changing the place or purpose of use of the water rights, abandoning or allowing the abandonment of, by action or inaction, any water or water rights, ditch or ditch rights, spring rights, reservoir or storage rights, wells, ground water rights, or other rights in and to the use of water historically used on or otherwise appurtenant to the Property, including, but not limited to, (i) riparian water rights, (ii) appropriative water rights, (iii) rights to waters secured under contract with any irrigation or water district, to the extent such waters are customarily applied to the Property, and (iv) any water from wells that exist or may be constructed in the future on the Property.

10) **Vehicles**. There shall be no operation of dune buggies, motorcycles, or any recreational all-terrain vehicles, or any other types of motorized vehicles, excepting work vehicles (*e.g.*, tractors, backhoes, work trucks) required to maintain the Property as a protected natural area.

11) **Non-Native/Exotic Species.** There shall be no introduction of non-native or exotic species to the Property.

12) **Subdivision**. There shall be no legal or de facto division, subdivision, partitioning, or any other division of the Property.

13) **General.** There shall be no use of the Property which may adversely affect the purpose of this Notice or that violates or fails to comply with relevant federal, state, or local laws, regulations, or policies applicable to Owner, the Property, or the use or activity in question.

**Other Provisions:**

14) **Entrance and Inspection.** USACE and TDEC shall have the right to enter and inspect the Property and may enforce this Notice by means of a civil action.

15) **Enforcement.** Owner grants USACE and TDEC, as third party beneficiaries hereof, a discretionary right to enforce these land use restrictions in a judicial action against any person or other entity violating or attempting to violate these land use restrictions; provided, however, that no violation of these land use restrictions shall result in forfeiture or reversion of title. In any enforcement action, an enforcing agency shall be entitled to complete restoration for any violation, as well as any other remedy available under law or equity, such as injunctive relief and administrative, civil or

criminal penalties. No omission or delay in acting by USACE or TDEC shall bar subsequent enforcement rights or constitute a waiver of any enforcement right. These enforcement rights are in addition to, and shall not limit, enforcement rights available under other provisions of law or equity, or under any applicable permit or certification. Nothing herein shall limit the right of USACE and TDEC to modify, suspend, or revoke the DA Permit or ARAP, respectively. Nothing herein shall be construed to authorize USACE or TDEC to institute proceedings against the Owner for changes to the Property due to acts of God, natural disasters, or unauthorized acts of third parties outside the control of Owner so long as the compensatory mitigation has been completed and determined by the USACE and TDEC to be successful in accordance with the ARAP and DA Permit.

16) **Costs of Ownership**. Owner retains all responsibilities and will bear all costs and liabilities of any kind related to the ownership, operation, upkeep, and maintenance of the Property, including the maintenance of adequate liability insurance coverage. Owner remains solely responsible for obtaining any applicable governmental permits and approvals required for any activity or use permitted by this Notice. Owner agrees that neither USACE nor TDEC have any duty or responsibility for the operation, upkeep or maintenance of the Property, the monitoring of hazardous conditions on it, or the protection of Owner, the public, or any third parties from risks related to conditions on the Property.

17) **Filing**. Owner will record or cause this Notice to be recorded in the official land records of the Register of Deeds of ________ County, Tennessee, as soon as practicable after execution of this instrument, and will provide USACE and TDEC a copy of the recorded instrument within thirty (30) days of recordation.

18) **Term**. This Notice shall run with and bind the Property in perpetuity unless/until this Notice shall be made less stringent or canceled as set forth under the paragraph entitled "Amendment and Termination."

19) **Amendment and Termination.** This Notice may only be waived, amended, modified, or terminated for cause by and upon the agreement of both the Commissioner of TDEC and ___________ District Engineer of USACE. No amendment to this Notice shall be effective until such amendment or instrument terminating this Notice is recorded in the Register of Deeds Office for _____________ County, Tennessee. Additional compensatory mitigation may be required for impacts resulting from the amendment.

20) **Modifications**. *[Insert Department Abbreviation(s)]* must provide sixty (60) days notice to TDEC and USACE prior to any action being taken that serves to void, modify, amend, or terminate this Notice.

21) **Severability.** Invalidation of any of these covenants or restrictions by judgment or court order shall in no way affect any other provisions, which shall remain in full force and effect.

22) **Title**. If any enforceable easement, right, interest, or lease on or to the Property, whether or not listed on **Exhibit C** (prepared after a review of the land file held by the Department of General Services, and that held by *[Insert Department Abbreviation(s)]*, and a title search prepared by ____ dated ____), is exercised in such a manner that conflicts with or voids the uses of the Property set out in this Notice, then the *[Insert Department Abbreviation(s)]* will be responsible for providing alternative compensatory mitigation in such amounts and of such resource type and function as USACE and TDEC or any enforcer of this Notice reasonably determines in accordance with the ARAP and DA Permit.

23) **Transfer and Assignment.** Owner shall include the following notice on all deeds, mortgages, plats, or any other legal instrument used to convey any interest in the Property:

> NOTICE: This Property is subject to a Notice of Land Use Restriction dated [*insert date of Declaration*], recorded in the [*insert County name*] Register of Deeds Office on [*insert date recorded*] in Deed Book [*insert number*], Page [*insert number*] *[or Instrument Number,]* and enforceable by the Tennessee Department of Environment and Conservation and U.S. Army Corps of Engineers.

Owner shall provide USACE and TDEC with written notice of any transfer sixty (60) days prior to such transfer. The notice shall include the name, address, and telephone number of the prospective transferee, a copy of the proposed deed or other documentation evidencing the conveyance, and a survey map that shows the boundaries of the Property being transferred. The new transferee will provide USACE and TDEC a letter acknowledging the terms and conditions of this Notice. Failure to comply with this paragraph does not impair the validity or enforceability of this Notice.

24) **Other Permits**. Any permit application, or request for certification or modification, which may affect the Property, made to any governmental entity with authority over Waters of the United States or Waters of the State, must expressly reference and include a copy, with the recording stamp, of the terms of this Notice.

25) **Jurisdictional Waters**. The Property will remain protected even though it may later be determined, through case law decisions or otherwise, not to have jurisdictional Waters of the United States.

26) **General Disclaimer**. USACE, including its employees, agents, and assigns disclaim and will not be held responsible for Owner's negligent acts or omissions or Owner's breach of any representation, warranty, covenant, or agreements contained in this Notice, or violations of any federal, state, or local laws, including all environmental laws including, without limitation, those that give rise to liabilities, claims, demands, losses, expenses, damages, fines, fees, penalties, suits, proceedings, actions, costs of actions, or sanctions asserted by or on behalf of any person or governmental authority, and other liabilities (whether legal or equitable in nature and including court costs) to which Owner may be subject or incur relating to the Property.

27) **Notification.** Any notice, request for approval, or other communication required by these land use restrictions shall be sent by registered mail, pre-paid postage, to the following addresses (or such addresses as may be hereinafter specified by notice pursuant to this paragraph):

To Owner: State of Tennessee
*Insert name and contact information for agency primarily responsible for managing the property*

*With copy to:*
*Insert name and contact information for agency responsible for managing the mitigation project*

To USACE: U.S. Army Corps of Engineers
Attn: Regulatory Division Chief

*For Nashville District:*
3701 Bell Road
Nashville, Tennessee 37214

*For Memphis District:*
167 North Main, Room B-202
Memphis, Tennessee 38103-1894

To TDEC: TDEC, Division of Water Resources
Attn: Natural Resources Unit
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243

**IN WITNESS WHEREOF,** *[Insert Department Name(s)]* on behalf of the State of Tennessee has caused this Notice of Land Use Restriction to be executed by its duly authorized representative(s) on this the ______ day of _______________, 20__.

***[Insert Agency Name Primarily Responsible for Managing the Property]***

By: __________________________

Name: ________________________

STATE OF TENNESSEE
COUNTY OF ______________

Personally appeared before me, the undersigned Notary Public having authority within the aforesaid State, ______________ *[Insert Name]*, with whom I am personally acquainted (or proved to me on the basis of satisfactory evidence), and who acknowledged that he/she executed the within instrument for the purposes therein contained, and who further acknowledged that he/she is the ___________ *[Insert Title]* of the ______________ *[Insert Department Name]*.

WITNESS my hand, at office, this _______day of ________________, 20___.

____________________________________
Notary Public

My Commission Expires: ______________

***[Insert Agency Name Responsible for the Mitigation Project]***

By: __________________________

Name: ________________________

STATE OF TENNESSEE
COUNTY OF ______________

Personally appeared before me, the undersigned Notary Public having authority within the aforesaid State, ______________ *[Insert Name]*, with whom I am personally acquainted (or proved to me on the basis of satisfactory evidence), and who acknowledged that he/she executed the within instrument for the purposes therein contained, and who further acknowledged that he/she is the ___________ *[Insert Title]* of the ______________ *[Insert Department Name]*.

WITNESS my hand, at office, this _______day of ________________, 20___.

___________________________________
Notary Public

My Commission Expires: ______________

Acknowledged By:

**Tennessee Department of General Services**

By: _________________________

Name: _______________________

Title: Commissioner

Exhibits should be on separate pages attached to this document.

EXHIBIT A – LEGAL DESCRIPTION

EXHIBIT B – SURVEY OF PROPERTY

EXHIBIT C – TITLE ENCUMBRANCES

**NOTE:** ***The following Conservation Easement Deed template is provided by the U.S. Army Corps of Engineers, Nashville District and Tennessee Department of Environment and Conservation, Division of Water Resources as a standardized site protection document for compensatory mitigation sites within the Nashville District area of responsibility in Tennessee. The template must be completed with all exhibits attached before submitting it to the Corps and TDEC for review. Any modifications to this template must be identified using track changes or other electronic comparison and explained in comments or an attached addendum. This template should not be construed or relied upon as legal advice or opinion on any specific facts or circumstances. (Version Date: February 26, 2019)***

---

**CONSERVATION EASEMENT DEED**

THIS CONSERVATION EASEMENT DEED ("Conservation Easement") is made this ______ day of _______, 20__, by [*full legal name(s) of granting landowner(s)*], [*address of granting landowner(s)*] ("Grantor"), in favor of [*full legal name of holder of the conservation easement*], [*address of holder*] ("Holder"), with reference to the following facts:

RECITALS

A. Grantor is the sole owner in fee simple of certain real property consisting of approximately ____ acres, located at [*address*] in _______ County, Tennessee (the "Protected Property"), as described in Deed Book [*cite deed book and page numbers*] in the records of the Register of Deeds for _____ County, Tennessee, and as more particularly described and depicted in **Exhibit A**, attached and incorporated into this Conservation Easement by reference.

> [*NOTE: Grantor must attach a legal description (i.e. metes and bounds) and survey of the Protected Property signed and stamped by a licensed surveyor in an exhibit identified as Exhibit A to the Conservation Easement. If the Protected Property consists of less than the whole property described, also include a separate, clearly identifiable legal description of the conservation area(s) and clearly delineate the Protected Property on the survey. In addition, Grantor must include on a scaled drawing of the areas subject to the Conservation Easement, the location and extent of all known, existing easements, property interests, rights-of-ways, utilities, drainage ditches, storm water facilities, cattle crossings, and structures.*]

B. Holder, which has as its primary purpose [*describe Holder's mission or purpose, i.e. to protect and preserve natural lands or resources in their natural, scenic, agricultural, forested, or open space condition or use*], is a [*describe Holder's legal status as either a public body legally empowered to hold an interest in real property or charitable corporation, association or trust*], qualified as a tax-exempt non-profit organization under Sections 501(c)(3) and 170(h) of the Internal Revenue Code, as amended, is authorized to hold this Conservation

Easement pursuant to the Conservation Easement Act of 1981, Tenn. Code Ann. §§ 66-9-301, *et seq.*, and has agreed to accept this grant.

C. The United States Army Corps of Engineers, Nashville District (the "Corps") has approved use of the Protected Property for compensatory mitigation pursuant to and as defined in 33 C.F.R. Part 332.

[*NOTE: Include the following recital for a mitigation bank.*]

D. This Conservation Easement is granted pursuant to the Mitigation Banking Instrument ("MBI") for the _____ Mitigation Bank, authorized by Department of the Army Permit No. ____ ("DA Permit") issued by the Corps pursuant to section 404 of the Clean Water Act and Aquatic Resource Alteration Permit No. _____ ("ARAP") issued by TDEC pursuant to section 401 of the Clean Water Act and Tennessee Water Quality Control Act of 1977 (TWQCA), by and between [*insert Bank Sponsor name*] ("Bank Sponsor"), Grantor [*if different from Bank Sponsor*], and [*include name(s) of any agencies party to the MBI*: the Corps, Region 4 of the U.S. Environmental Protection Agency ("USEPA"), the U.S. Fish and Wildlife Service ("USFWS"), the Natural Resources Conservation Service ("NRCS"), the Tennessee Valley Authority ("TVA"), the Tennessee Department of Environment and Conservation ("TDEC"), and the Tennessee Wildlife Resources Agency ("TWRA")], referred to jointly as the Interagency Review Team ("IRT"), entered into concurrently with this Conservation Easement. The full MBI is incorporated into this Conservation Easement by this reference. A final, approved copy of the MBI and any amendments thereto approved by the IRT will be kept on file at the respective offices of the IRT members.

[*NOTE: Include the following recital for an in-lieu fee program*.]

D. This Conservation Easement is granted pursuant to an amendment to the ______ In-Lieu Fee ("ILF") Program Instrument, hereinafter referred to as the ________ Project, authorized by Department of the Army Permit No. ______ ("DA Permit") issued by the Corps pursuant to section 404 of the Clean Water Act and Aquatic Resource Alteration Permit No. _____ ("ARAP") issued by TDEC pursuant to section 401 of the Clean Water Act and Tennessee Water Quality Control Act of 1977 (TWQCA), by and between [*insert In-Lieu Fee Program Sponsor name*] ("ILF Program Sponsor") and [*include name(s) of any agencies party to the ILF Program Instrument*: the Corps, Region 4 of the U.S. Environmental Protection Agency ("USEPA"), the U.S. Fish and Wildlife Service ("USFWS"), the Natural Resources Conservation Service ("NRCS"), the Tennessee Valley Authority ("TVA"), the Tennessee Department of Environment and Conservation ("TDEC"), and the Tennessee Wildlife Resources Agency ("TWRA")], referred to jointly as the Interagency Review Team ("IRT"), approved concurrent with this Conservation Easement. The full ILF Program Instrument is incorporated into this Conservation Easement by reference. A final, approved copy of the ILF Program Instrument and any amendments thereto approved by the IRT will be kept on file at the respective offices of the IRT members.

[*NOTE: Include the following recital for a permittee-responsible compensatory mitigation project.*]

D. Grantor has agreed to make the Protected Property subject to the restrictions and prohibitions described in this Conservation Easement as a condition of DA Permit No. ______ ("DA Permit"), issued by the Corps pursuant to section 404 of the Clean Water Act, dated _____, and ARAP No. ______ ("ARAP") issued by TDEC pursuant to section 401 of the Clean Water Act and Tennessee Water Quality Control Act of 1977 (TWQCA), dated _____ , both of which are incorporated into this Conservation Easement by reference.

E. The natural condition of the Protected Property has been or will be restored, established, enhanced, or preserved pursuant to the mitigation plan approved for the DA Permit and ARAP ("Mitigation Plan"), incorporated into this Conservation Easement by reference, a copy of which will be kept on file at the offices of the Corps, TDEC and [Grantor *or* Bank Sponsor *or* ILF Program Sponsor].

F. The Protected Property possesses natural resources of significant aquatic, ecological, environmental, aesthetic, educational, historical, recreational, and scientific value and importance to the Grantor and Holder, the people of _____ County, the State of Tennessee, and the United States. The Protected Property will provide high quality natural, restored, or enhanced habitat for wildlife and endangered, threatened, or rare species, including [*specify listed and sensitive plant and/or animal species*], and contain [*list habitats, native and/or non-native*]. These values include jurisdictional waters of the United States, as defined in 33 C.F.R. Part 328, adjacent uplands, native vegetation and wildlife. Individually and collectively, these natural resources comprise the "Conservation Values" of the Protected Property.

[*NOTE: Include any additional recitals describing the conservation resources on site, including available information concerning the contribution they provide in terms of functions and services.*]

G. The Conservation Values of the Protected Property are documented and included in or with the Mitigation Plan, which consists of [*reports, maps, aerial and on-site photographs, other details or documents contained in or with the approved compensatory mitigation plan*], and other documentation the Grantor and Holder agree provide, collectively, an accurate representation of the Protected Property at the time of the grant of this Conservation Easement, and which is intended to serve as an objective information baseline for the monitoring of and compliance with the terms of this Conservation Easement.

H. Grantor recognizes the Conservation Values of the Protected Property and agrees to the creation of these conservation-based limitations and affirmative obligations for the purpose of preserving and protecting the Conservation Values and natural condition of the Protected Property in perpetuity.

NOW, THEREFORE, in consideration of the above, pursuant to the laws of the State of Tennessee, including, but not limited to, Tennessee Code Annotated §§ 66-9-301, *et seq.*, Grantor hereby grants and conveys to Holder a Conservation Easement in perpetuity over the Protected Property consisting of the following:

COVENANTS, TERMS, CONDITIONS AND RESTRICTIONS

1. Purpose. The purpose of this Conservation Easement is to ensure the Protected Property will be retained forever in its natural, restored, or enhanced condition, as contemplated by the Mitigation Plan, and to prevent any use of the Protected Property that will impair or interfere with the Conservation Values of the Protected Property. Grantor intends that the grant of this Conservation Easement will confine the use of the Protected Property to only those activities and uses that are consistent with the purpose of this Conservation Easement and will be implemented consistent with the DA Permit, ARAP and Mitigation Plan.

2. Holder's Rights. To accomplish the purpose of this Conservation Easement, Grantor hereby grants and conveys the following rights to Holder:

(a) To preserve and protect the Conservation Values of the Protected Property;

(b) To conserve and protect all mineral, air, water and groundwater rights necessary to protect and sustain the biological resources of the Protected Property;

(c) To enter and go upon the Protected Property at reasonable times to inspect, monitor compliance with, and otherwise enforce the terms of this Conservation Easement at Holder's sole discretion, provided that such entry will not unreasonably impair or interfere with Grantor's authorized use and quiet enjoyment of the Protected Property; and

(d) To prevent any activity on or use of the Protected Property that is inconsistent with the purpose of this Conservation Easement and to require the restoration or such areas or features of the Protected Property that may be damaged by any act, failure to act, use or activity that is inconsistent with the purpose of this Conservation Easement.

3. Prohibited Uses. Any activity on or use of the Protected Property inconsistent with the purpose of this Conservation Easement is prohibited. Without limiting the generality of the foregoing, except as specifically provided in the Mitigation Plan or as approved by the DA Permit and ARAP, the following activities and uses are expressly prohibited in, on, over, or under the Protected Property:

(a) Commercial, industrial, residential, or institutional structures, uses, or activities.

(b) Construction, reconstruction, expansion, location, relocation, alteration, installation or placement of any building, roads, utility lines or facilities, trails, walkways, pavement, benches, equipment storage, billboard or advertising sign, or any other structure or improvement of any kind, or any additions or improvements to existing structures.

(c) Filling, dumping, excavating, mining, drilling, grading, leveling, disturbing, removing, exploring or extracting minerals, loam, soil, peat, sand, gravel, rocks, gas, oil, or other material on or below the surface of the Protected Property, or any alteration to the surface or general topography of the Protected Property or any portion of the Protected Property, including any discharges of dredged or fill material, or granting or authorizing surface entry to the Protected Property for any of these purposes.

(d) Draining, ditching, diking, dredging, channelizing, changing the grade or elevation, water withdrawals, underground injection wells, manipulating, impounding, or altering of any natural water course, body of water, or water circulation on the Protected Property, and any activities or uses detrimental to water quality, including but not limited to degradation or pollution of any surface or sub-surface waters.

(e) The transfer, encumbrance, sale, lease, or other conveyance of the mineral, air or water rights for the Protected Property and any portion thereof separate from the surface rights, changing the place or purpose of use of the water rights, abandoning or allowing the abandonment of, by action or inaction, any water or water rights, ditch or ditch rights, spring rights, reservoir or storage rights, wells, ground water rights, or other rights in and to the use of water historically used on or otherwise appurtenant to the Protected Property, including, but not limited to, (i) riparian water rights, (ii) appropriative water rights, (iii) rights to waters secured under contract with any irrigation or water district, to the extent such waters are customarily applied to the Protected Property, and (iv) any water from wells that exist or may be constructed in the future on the Protected Property.

(f) The placement, storage, accumulation, dumping, depositing, abandoning, discharging, disposing or releasing of any gaseous, liquid, solid, or hazardous waste substance, yard waste, soil, ashes, trash, rubbish, refuse, grass clippings, cuttings, bio-solids, waste materials or debris of whatever nature, whether temporarily or permanently, on, in, over, or underground or into surface or ground water.

(g) The planting, introduction, or dispersal of non-native or exotic animal or plant species.

(h) Use of herbicides, insecticides, biocides, fungicides, pesticides, rodenticides, fertilizers or other agricultural chemicals, weed abatement activities, incompatible fire protection activities, or other biological controls.

(i) The mowing, cutting, clearing, burning, pruning, removal of any kind, disturbance, destruction, or collection of any natural trees, shrubs, or other vegetation, except for:

(1) safety purposes;
(2) control in accordance with accepted scientific forestry management practices for the treatment of diseased or dead vegetation;
(3) control of non-native species and noxious weeds; or
(4) scientific or natural study.

(j) Agricultural or grazing activities of any kind, except for vegetation management activities as specifically provided in the Mitigation Plan.

(k) Use of all-terrain vehicles (ATVs), dirt bikes, motorcycles, off-road vehicles, or other motorized vehicle of any kind, except on existing roads and trails as necessary to manage the Protected Property.

(l) Any legal or de facto division, subdivision, partitioning, or any other division of the Protected Property.

(m) Engaging in any use or activity that may violate or fail to comply with relevant federal, state, or local laws, regulations, or policies applicable to Grantor, the Protected Property, or the use or activity in question.

[*NOTE: Insert additional restrictions as appropriate for the particular Protected Property considering the Mitigation Plan and Conservation Values.*]

4. Grantor's Duties. Grantor will undertake all reasonable actions to prevent the unlawful entry and trespass by persons whose activities may degrade or harm the Conservation Values of the Protected Property or that are otherwise inconsistent with this Conservation Easement. In addition, Grantor will undertake all necessary actions to perfect and defend Holder's rights under this Conservation Easement.

5. Reserved Rights. Grantor reserves to itself, its representatives, heirs, successors and assigns, all rights accruing from Grantor's ownership of the Protected Property, including the right to engage in, or permit or invite others to engage in, all uses of the Protected Property that are not prohibited or limited by, and are consistent with the purpose of, this Conservation Easement. Grantor expressly reserves the following rights:

[*NOTE: You may insert reserved rights as appropriate for the particular Protected Property and its Conservation Values. The following reserved rights are provided as examples.*]

(a) Within the terms and conditions of their permits, agreements and the law, Grantor and any holders of easements or other property rights for the operation and maintenance of pre-existing or project-related structures or infrastructure, such as roads, trails, walkways, utilities, drainage ditches, or stormwater facilities that are present on, over, or under the Protected Property, reserve the right to continue with such operation and maintenance. All pre-existing or approved project-related structures and infrastructure are shown on the accompanying plat map attached to this Conservation Easement and disclosed in the Property Assessment and Warranty attached as an exhibit to the [Mitigation Plan *or* MBI].

(b) Landscaping by the Grantor to prevent severe erosion or damage to the Protected Property or portions thereof, or significant detriment to existing or permitted uses, is allowed, provided that such landscaping is generally consistent with preserving the natural condition of the Protected Property.

(c) The right to use the Protected Property for lawful passive, non-commercial recreational uses, including hunting, fishing, non-motorized boating, primitive camping, hiking, biking, horseback riding, picnics, social events, nature interpretation and other educational programs, in accordance with the laws and regulations of the State of Tennessee and Tennessee Wildlife Resources Agency ("TWRA") or its successor agency, provided that such activities are consistent with the continuing natural condition of the Protected Property and do not adversely impact the Conservation Values of the Protected Property.

(d) Signs approved by the Corps and TDEC in the Mitigation Plan may be erected and remain on-site in legible condition, including boundary markers identifying the area as a protected compensatory mitigation property, no trespassing signs, signs identifying the Grantor as the owner of the Protected Property, or other signage conveying information on the restricted uses of the Protected Property.

(e) Grantor reserves the right to perform [*or* to allow [Bank Sponsor *or* ILF Program Sponsor *or* [name of other third-party]] to perform] restoration, enhancement, preservation or other mitigation activities in accordance with the Mitigation Plan and as required by the terms of the DA Permit and ARAP, including the use of all equipment necessary to successfully complete any mitigation requirements contained therein.

6. Holder's Remedies.

(a) If Holder determines that a violation of this Conservation Easement has occurred or is threatened, Holder will give written notice to the Grantor of such violation and demand corrective action sufficient to cure the violation. Where the violation involves injury to the Protected Property resulting from any use or activity inconsistent with the purpose of this Conservation Easement, Holder will demand corrective action sufficient to restore the portion of the Protected Property so injured to its prior condition in accordance with a plan approved by the Holder. In addition to the notice provided to the Grantor, Holder will provide concurrent written notice to the Corps, TDEC, and any other third-party beneficiaries of any non-compliance with the terms and conditions of this Conservation Easement.

(b) If Grantor fails to cure the violation within thirty (30) days after receipt of a notice of violation, or, under circumstances where the violation cannot reasonably be cured within a thirty (30) day period, fails to begin curing said violation within the thirty (30) day period, or fails to continue diligently to completely cure such violation, Holder may bring an action at law or in equity in a court of competent jurisdiction for any or all of the following: (i) to recover any damages to which Holder may be entitled for violation of the terms of this Conservation Easement or for any injury to the Conservation Values of the Protected Property, including, without limitation, damages for the loss of scenic, aesthetic, or environmental values; (ii) to enjoin the violation, *ex parte* as necessary, by temporary or permanent injunction without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies; (iii) to pursue any other legal or equitable relief, including but not limited to, the restoration of the Protected Property to the condition in which it existed prior to any violation or injury; (iv) or to otherwise enforce this Conservation Easement. Without limiting the liability of Grantor, Holder may apply any damages recovered to the cost of undertaking any corrective action on the Protected Property.

(c) If Holder, in its sole discretion, determines that circumstances require immediate action to prevent or mitigate significant damage to the Conservation Values of the Protected Property, Holder may pursue its remedies under this section without prior notice to Grantor or without waiting for the period provided for cure to expire. Holder's rights under this section apply equally to actual or threatened violations of this Conservation Easement. Holder will notify the Grantor, the Corps and TDEC within thirty (30) days of such an occurrence.

(d) Grantor agrees that Holder's remedies at law for any violation of this Conservation Easement are inadequate and that Holder will be entitled to the injunctive relief described in this section, both prohibitive and mandatory, in addition to such other relief to which Holder may be entitled, including specific performance of this Conservation Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. Holder's enforcement rights and remedies granted in this Conservation Easement are cumulative and in addition to all enforcement rights and remedies available to Holder now or hereafter existing at law or in equity. The failure of Holder to discover a breach or violation or to take immediate legal action will not bar Holder from taking such action at a later time.

7. <u>Costs of Enforcement</u>. Grantor will bear any and all costs incurred by the Holder, where Holder is the prevailing party, to enforce the terms and conditions of this Conservation Easement against the Grantor, including, but not limited to, the costs of suit and attorneys' and experts' fees, and any costs of restoration necessitated by the violation or breach of the terms of this Conservation Easement.

8. <u>Third-Party Beneficiaries</u>. Grantor and Holder acknowledge that the Corps and TDEC [and *include any other federal or state agencies that will be third-party beneficiaries, as*

*applicable*] [(*the "Third-Party Beneficiaries")*] is [*or* are] a third-party beneficiary[*ies*] with the discretionary right to enforce all provisions of this Conservation Easement and with all rights and remedies conveyed to the Holder under this Conservation Easement. These enforcement rights are in addition to, and do not limit, any rights available to the Corps, TDEC, or the IRT under the DA Permit and ARAP, any other applicable permit or certification, or other provisions of law or equity. The Corps reserves the right to be represented by the United States Department of Justice in any state or federal court action and to remove a legal action affecting jurisdictional waters of the United States or federally-listed species to the United States District Court of the district in which the Protected Property lies.

9. Access. Grantor conveys to the Corps and TDEC [*or Third-Party Beneficiaries*], and its [*or* their] successors, assigns, agents, representatives, invitees, and licensees, the right to access, enter and go upon any portions of the Protected Property to take actions necessary to verify or monitor compliance with the terms and conditions of this Conservation Easement. This Conservation Easement does not convey a right of access or entry to the general public to any portion of the Protected Property.

10. Costs of Ownership. Grantor retains all responsibilities and will bear all costs and liabilities of any kind related to the ownership, operation, upkeep, and maintenance of the Protected Property, including the maintenance of adequate liability insurance coverage. Grantor remains solely responsible for obtaining any applicable governmental permits and approvals required for any activity or use permitted by this Conservation Easement. Grantor agrees that neither Holder nor the Corps nor TDEC [*or Third-Party Beneficiaries*] have any duty or responsibility for the operation, upkeep or maintenance of the Protected Property, the monitoring of hazardous conditions on it, or the protection of Grantor, the public, or any third parties from risks related to conditions on the Protected Property.

11. Taxes and Liens. Grantor will pay before delinquency all taxes, assessments (general and special), fees, and charges of whatever description levied on or assessed against the Protected Property by competent authority, including any taxes imposed on or incurred as a result of this Conservation Easement, and will furnish Holder with satisfactory evidence of payment upon request. Grantor will keep the Protected Property free from any liens (other than a security interest that is expressly subordinated to this Conservation Easement in a recorded document approved by the Corps and TDEC), including liens arising out of work performed, materials furnished, or obligations incurred by the Grantor.

12. Liability and Indemnification. Grantor will hold harmless, protect, indemnify and defend Holder, the Corps, TDEC [*or Third-Party Beneficiaries*], and their members, directors, officers, employees, agents, representatives and contractors, and the heirs, personal representatives, successors, and assigns of each of them from and against all liabilities, penalties, costs, losses, damages, expenses, causes of action, claims, demands, orders, liens or judgments, including reasonable attorneys' fees and experts' fees, arising from or in any way connected with the existence or administration of this Conservation Easement, or other matter related to or

occurring on or about the Protected Property, unless Holder, the Corps or TDEC [*or Third-Party Beneficiaries*], or any of their agents have committed a deliberate act that is determined by a court to be the sole cause of the injury or damage.

13. Warranty of Title. Grantor represents and warrants that Grantor is the sole owner in fee simple of the Protected Property and has the right to grant and convey this Conservation Easement. Grantor also represents and warrants that, except as specifically disclosed to the Corps in the Property Assessment and Warranty dated ____, attached as an exhibit to the [Mitigation Plan *or* MBI], and incorporated into this Conservation Easement by reference, the Protected Property is free and clear of any and all liens, loans, claims, restrictions, easements, encumbrances or other interests that may conflict or are inconsistent with this Conservation Easement. Grantor has identified all other parties that hold any interest in the Protected Property and notified such parties of Grantor's intent to grant this Conservation Easement. [*Add the following sentence, if applicable*: Any mortgages, conservation, utility and right-of-way easements of record, liens, encumbrances, or other interests in the Protected Property that may conflict with this Conservation Easement have been expressly subordinated to this Conservation Easement by recorded document attached as **Exhibit B**.] If any easement, right, interest, or lease on or to the Protected Property not listed in the Property Assessment and Warranty and prior in time and recording to this Conservation Easement, or unrecorded, is exercised in such a manner that conflicts with or voids the uses of the Protected Property set out in this Conservation Easement, then the Grantor will be responsible for providing alternative compensatory mitigation in such amounts and of such resource type and function as the Corps or any enforcer of this Conservation Easement determines in accordance with the DA Permit and ARAP.

14. Additional Interests. Grantor will not grant any additional easements, rights of way, or other interests in the Protected Property, other than a security interest expressly subordinated to this Conservation Easement, nor will Grantor grant, transfer, abandon or relinquish any mineral, air, or water right or any water associated with the Protected Property, without first obtaining the written consent of Holder, the Corps and TDEC. Such consent may be withheld if Holder, the Corps or TDEC determines that the proposed interest or transfer is inconsistent with the purpose of this Conservation Easement or may impair or interfere with the Conservation Values of the Protected Property. Grantor will provide a copy of any approved recorded or unrecorded grant or transfer document to Holder, the Corps and TDEC. This provision does not prohibit transfer of a fee or leasehold interest in the Protected Property that is subject to this Conservation Easement and complies with Section 22.

15. Environmental Matters.

(a) Grantor represents and warrants that it has no knowledge or notice of a material or threatened release of hazardous substances or wastes or underground storage tanks existing, generated, treated, stored, used, released, disposed of, deposited or abandoned in, on, under, or from the Protected Property, or transported to or from or affecting the Protected Property, or the Protected Property's use as a landfill or dump, in violation of federal, state or local laws, statutes, regulations or ordinances. The term "hazardous materials" includes, without limitation, (a) material that is flammable, explosive or radioactive; (b) petroleum products, including by-products and fractions thereof; and (c) hazardous materials, hazardous wastes, hazardous or toxic substances, or related materials defined in CERCLA, the Resource Conservation and Recovery Act of 1976 ("RCRA"), 42 U.S.C. §§ 6901, *et seq.*, the Hazardous Materials Transportation Act ("HTA"), 49 U.S.C. §§ 5101, *et seq.*, and in the regulations adopted and publications promulgated pursuant to them, or any other applicable environmental laws now in effect or enacted after the date of this Conservation Easement. The term "environmental laws" includes, without limitation, CERCLA, RCRA, HTA, and any other federal, state, local or administrative agency statute, ordinance, rule, regulation, order or requirement relating to pollution, protection of human health or safety, the environment, or hazardous materials. Grantor represents, warrants, and covenants to Holder, the Corps and TDEC [*or Third-Party Beneficiaries*] that all activities upon and use of the Protected Property by Grantor, its agents, employees, invitees and contractors will comply with all environmental laws.

(b) Without limiting the obligations of Grantor under Section 12, Grantor hereby releases and agrees to indemnify, protect and hold harmless Holder, the Corps, TDEC [*or Third-Party Beneficiaries*], and any of their agents from and against all litigation, claims, demands, penalties and damages, including reasonable attorneys' and experts' fees, arising from or connected with any actual or alleged release of hazardous waste, presence of underground storage tanks, use of the Protected Property as a landfill or dump, or violation of or failure to comply with any federal, state or local environmental laws associated with the Protected Property. Notwithstanding the foregoing, Grantor has no obligation to defend or indemnify Holder, the Corps or TDEC [*or Third-Party Beneficiaries*] against litigation, claims, demands, penalties, damages or attorneys' fees arising out of or connected to releases of hazardous substances or wastes caused by Holder, the Corps, TDEC [*or Third-Party Beneficiaries*], or any of their agents.

16. <u>Notice of Legal Action</u>. Grantor will provide Holder, the Corps and TDEC [*or Third-Party Beneficiaries*] written notice of any legal action affecting this Conservation Easement, including, but not limited to, foreclosure proceedings, tax sales, bankruptcy proceedings, zoning changes, adverse possession, abandonment, condemnation proceedings, and the exercise of the power of eminent domain. For any legal action that might result in this Conservation Easement being voided or modified, such notice will be provided at least sixty (60) days before such action would be taken. This Conservation Easement is intended to survive any legal actions affecting the Protected Property.

17. <u>Eminent Domain</u>. If the Protected Property is taken in whole or in part by exercise of the power of eminent domain or acquired by purchase in lieu of condemnation, whether by public, corporate, or other authority, so as to terminate this Conservation Easement, Grantor and Holder will act jointly to recover the full value of the interests in the Protected Property subject to the taking or in lieu of purchase and all direct or incidental damages resulting therefrom. This Conservation Easement constitutes a real property interest immediately vested in

Holder. In the event that all or a portion of this Protected Property is sold, exchanged, or involuntarily converted following the extinguishment or the exercise of eminent domain, Holder will be entitled to the fair market value of this Conservation Easement. The consequential loss in the value of the Protected Property is the cost of the replacement of the conservation functions, services and value of the aquatic and terrestrial resources on the Protected Property with other property in the same watershed. Holder will use all such proceeds in a manner consistent with the DA Permit, ARAP, and this Conservation Easement.

18. Duration. This Conservation Easement will constitute a servitude running in perpetuity with the Protected Property regardless of ownership or use, and will be binding on and inure to the benefit of, the parties and their respective heirs, executors, administrators, successors, representatives, devisees, assigns, lessees, or other occupiers and users, as the case may be, as long as said party has any interest in any part of the Protected Property. A party's rights and obligations under this Conservation Easement terminate upon transfer of the party's interest in the Conservation Easement or Protected Property, except that liability for acts, omissions or breaches occurring prior to transfer will survive transfer.

19. Funding. Endowment funding for the perpetual management, maintenance and monitoring of the Protected Property is specified in and governed by the Mitigation Plan for the DA Permit and ARAP [*or* MBI].

20. Filing. Grantor will record this Conservation Easement in the official land records of the Register of Deeds of ______ County, Tennessee, as soon as practicable after execution of the instrument, and Holder may re-record the Conservation Easement at any time as the Holder deems necessary to preserve its rights in this Conservation Easement. Grantor will provide the Holder, the Corps and TDEC with a copy of the recorded instrument within thirty (30) days of any recordation.

21. Amendment. This Conservation Easement may be amended or modified only by the written agreement of Grantor and Holder and with the written approval of the Corps and TDEC [*or Third-Party Beneficiaries*]. The party seeking to amend or modify the Conservation Easement must give written notice to the Corps and TDEC of the intent to amend or modify the Conservation Easement at least sixty (60) days prior to the effective date of the amendment. Any such amendment will be recorded in the official land records of county in which the Protected Property is located, will be consistent with the purpose of this Conservation Easement, will not affect its perpetual duration, and will not permit impairment of the Conservation Values of the Protected Property. The Corps and TDEC has no obligation to allow any amendment. Amendments to the Conservation Easement for the purpose of proposing additional impacts are not favored and will be considered only in rare circumstances following Corps or TDEC regulations, policy, and procedures, as applicable. Additional compensatory mitigation may be required for impacts resulting from the amendment.

22. Subsequent Transfers or Conveyances by Grantor. Grantor agrees to incorporate the terms and conditions of this Conservation Easement by reference in any subsequent deed or other legal instrument by which Grantor divests itself of any interest in all or any portion of the Protected Property, including, without limitation, a leasehold or possessory interest in any portion of the Protected Property. Grantor further agrees to give written notice to Holder, the Corps and TDEC [*or Third-Party Beneficiaries*] of the intent to transfer or convey title or any interest in or on the Protected Property at least sixty (60) days prior to the date of such transfer. The notice will include the name, address, and telephone number of the prospective transferee, a copy of the proposed deed or other documentation evidencing the conveyance, and a survey map that shows the boundaries of the portion of the Protected Property affected by the transfer. The new transferee will provide the Corps and TDEC a letter acknowledging the terms and conditions of the [Mitigation Plan *or* MBI] and recorded Conservation Easement. [*Add for ILF projects or mitigation banks*: No further mitigation credits from the [_______ Project *or* Mitigation Bank] will be sold or credited toward fulfilling mitigation requirements pending review and approval of the transfer by the Corps and TDEC.] Holder, the Corps and TDEC [*or Third-Party Beneficiaries*] have the right to prevent any transfers in which prospective subsequent claimants or transferees are not given notice of the terms, covenants, conditions, and restrictions of this Conservation Easement, including the exhibits and documents incorporated by reference in it. The failure of Grantor to perform any act provided in this section will not impair the validity of this Conservation Easement or limit its enforceability in any way.

23. Assignment or Transfer by Holder. Holder may assign or transfer the benefits of this Conservation Easement only upon the following conditions: (i) Holder must require that the purpose of this Conservation Easement continues to be carried out; (ii) the assignee or transferee, at the time of assignment or transfer, must be qualified and authorized to acquire and hold conservation easements under Tennessee Code Annotated §§ 66-9-301, *et seq.*, and the laws of the United States; (iii) Holder must give Grantor, the Corps and TDEC at least sixty (60) days prior written notice of the proposed assignment or transfer; and (iv) the assignment or transfer of the Conservation Easement is subject to the written approval of the Corps and TDEC. Holder will require the assignee or transferee to record the assignment in the land records of the county in which the Protected Property is located. As a condition of such assignment or transfer, the assignee or transferee must agree in writing that the conservation purpose this Conservation Easement is intended to advance will continue to be fulfilled. The failure of Holder to perform any act provided in this section will not impair the validity of this Conservation Easement or limit its enforceability in any way. In the event of the termination of Holder's existence without advance notice, the rights and obligations of the Holder will, without any further action on the part of any entity, be deemed assigned or transferred to an entity approved by the Corps or TDEC, or through judicial proceedings in a court of competent jurisdiction.

24. Merger. The doctrine of merger will not operate to extinguish this Conservation Easement if the Conservation Easement and Protected Property become vested in the same party. If, despite this intent, the doctrine of merger applies to extinguish the Conservation Easement, then, unless Grantor, Holder, the Corps and TDEC [*or Third-Party Beneficiaries*] otherwise

agree in writing, a replacement conservation easement containing the same protections embodied in this Conservation Easement will be recorded against the Protected Property.

25. Other Permits. Any permit application, or request for certification or modification, which may affect the Protected Property made to any governmental entity with authority over waters of the United States must expressly reference and include a copy, with the recording stamp, of the terms of this Conservation Easement.

26. Notices. Any notices, demands, requests, consent, approval, or other communication required under this Conservation Easement will be sent in writing by registered or certified mail to the following addresses or to such addresses as hereafter may be specified by written notice. Copies of a communication sent to one party must be sent to all other parties. Notice will be deemed effective upon delivery in the case of personal delivery or delivery by overnight courier, or, in the case of delivery by first-class mail, three (3) days after deposit into the United States mail.

TO GRANTOR: [*Name, address, attention block*]

TO HOLDER: [*Name, address, attention block*]

TO CORPS: U.S. Army Corps of Engineers
Attn: Regulatory Division Chief
3701 Bell Road
Nashville, TN 37214

TO TDEC: Tennessee Department of Environment and Conservation
Attn: Director of the Division of Water Resources
William R. Snodgrass Tennessee Tower, 11th Floor
312 Rosa L. Parks Ave.
Nashville, TN 37243

[*NOTE: Add contact information for any other federal or state agencies that are Third-Party Beneficiaries to this Conservation Easement.*]

27. No Waiver. Enforcement of the terms of this Conservation Easement is at the discretion of Holder, the Corps and TDEC [*or Third-Party Beneficiaries*]. The failure, delay, omission, or forbearance of Holder, the Corps or TDEC [*or Third-Party Beneficiaries*], for any reason whatsoever, to exercise any right or remedy under this Conservation Easement in the event of any breach or violation of any term of this Conservation Easement will not be construed a waiver or estoppel of such term, any subsequent breach of the same or any other term of this Conservation Easement, or impair any rights or remedies of Holder, the Corps or TDEC [*or Third-Party Beneficiaries*] under this Conservation Easement.

28. Severability. Should any portion of this Conservation Easement or the application thereof to any person or circumstance be found invalid or unenforceable, the remainder of the provisions of this instrument, or application of such provisions to persons or circumstances other than those as to which they are found to be invalid or unenforceable, as the case may be, will continue in full force and effect.

29. Extinguishment. If circumstances arise in the future that render the preservation of Conservation Values or the purpose of this Conservation Easement impossible to accomplish, this Conservation Easement may be terminated or extinguished, in whole or in part, by mutual agreement of Grantor and Holder and with the written approval of the Corps and TDEC, or by judicial proceedings in a court of competent jurisdiction.

30. Controlling Law. The interpretation and performance of this Conservation Easement will be governed by the laws of the United States and the State of Tennessee, disregarding the conflicts of law principles of the state.

31. Liberal Construction. Despite any general rule of construction to the contrary, this Conservation Easement will be liberally construed to accomplish the purpose of this Conservation Easement and the policy and purpose of Tennessee Code Annotated §§ 66-9-301, *et seq*. If any provision in this Conservation Easement is found to be ambiguous, an interpretation consistent with the purpose of this Conservation Easement that would render the provision valid will be favored over any interpretation that would render it invalid.

32. Captions. The captions in this instrument have been inserted solely for convenience of reference and are not part of this instrument and will have no effect upon its construction or interpretation.

33. Jurisdictional Waters. The Protected Property will remain protected even though it may later be determined, through case law decisions or otherwise, not to have jurisdictional waters of the United States.

34. Entire Agreement. This instrument, including its exhibits and documents incorporated by reference in the instrument, together set forth the entire agreement of Grantor, Holder, the Corps, and TDEC [*or Third-Party Beneficiaries*] with respect to the Conservation Easement and supersede all prior discussions, negotiations, understandings, or agreements of such parties relating to the Conservation Easement. No alteration or variation of this Conservation Easement will be valid or binding unless contained in an amendment in accordance with Section 21.

35. General Disclaimer. The Corps and TDEC, its employees, agents, and assigns disclaim and will not be held responsible for Holder's or Grantor's negligent acts or omissions or Holder's or Grantor's breach of any representation, warranty, covenant, or agreements contained in this Conservation Easement, or violations of any federal, state, or local laws, including all

environmental laws including, without limitation, those that give rise to liabilities, claims, demands, losses, expenses, damages, fines, fees, penalties, suits, proceedings, actions, costs of actions, or sanctions asserted by or on behalf of any person or governmental authority, and other liabilities (whether legal or equitable in nature and including, without limitation, court costs, and reasonable attorneys' fees and attorneys' fees on appeal) to which Grantor or Holder may be subject to or incur relating to the Protected Property.

36. Exhibits. The following exhibits referenced in this Conservation Easement are attached to and incorporated by reference herein:

Exhibit A – Legal Description and Survey of Protected Property
Exhibit B (*if applicable*) – Consent and Subordination Agreement(s)

TO HAVE AND TO HOLD this Conservation Easement together with all and singular the appurtenances and privileges belonging or in any way pertaining thereto, either in law or in equity, either in possession or expectancy, for the proper use and benefit of the Holder, its successors and assigns, forever.

IN WITNESS WHEREOF, Grantor has executed this Conservation Easement as of the day, month and year first above written.

GRANTOR:

______________________________________
______________________________________
______________________________________

[*Notarization required*.]

[*Include Holder's certificate or acknowledgement of acceptance here, i.e. "Holder, _____, does hereby accept the above Conservation Easement Deed."*]

HOLDER:

____________________________________
____________________________________
____________________________________

[*Notarization required.*]

**APPENDIX 7**
**CULTURAL RESOURCES REPORT AND**
**USFWS IPAC REPORT**

# PHASE I ARCHAEOLOGICAL SURVEY FOR THE PROPOSED LONE OAKS FARM SHOOTING RANGE, HARDEMAN COUNTY, TENNESSEE

By Howard J. Haygood and Howard J. Cyr

Prepared for:
**Tony Hopson, Director**
**University of Tennessee**
**Capital Projects**
**Knoxville, Tennessee 37996**

Lead Agency:
**Tennessee Division of Archaeology**
**State Permit No. 000882**

Michael G. Angst, Archaeologist-in-General Charge
Howard J. Cyr, MS, Archaeologist-in-Direct-Charge

Archaeological Research Laboratory
University of Tennessee
Department of Anthropology
Room 237, Middlebrook Building
Knoxville, Tennessee 37996-0060
Phone: (865) 946-1882
Fax: (865) 946-1883

September 2016

The University of Tennessee does not discriminate on the basis of race, sex, color, religion, national origin, age, disability or veteran status in provision of educational programs and services or employment opportunities and benefits. This policy extends to both employment by and admission to the University.

The University does not discriminate on the basis of race, sex or disability in its education programs and activities pursuant to the requirements of Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) of 1990.

Inquiries and charges of violation concerning Title VI, Title IX, Section 504, ADA or the Age Discrimination in Employment Act (ADEA) or any of the other above referenced policies should be directed to the Office of Equity and Diversity (OED), 1840 Melrose Avenue, Knoxville, TN 37996-3560, telephone (865) 974-2498 (V/TTY available) or 974-2440. Requests for accommodation of a disability should be directed to the ADA Coordinator at the UTK Office of Human Resources, 600 Henley Street, Knoxville, TN 37996-4125.

# MANAGEMENT SUMMARY

From August 8 to August 12, 2016 the University of Tennessee's (UT) Archaeological Research Laboratory (ARL) carried out a Phase I archaeological investigation for the proposed shooting range at the Lone Oaks Farm in Hardeman County, Tennessee. Lone Oaks Farm is administered by the UT Extension, a unit of the University of Tennessee Institute of Agriculture (UTIA). The area of potential effect (APE) encompasses 33.3 hectares (82.3 acres) within the 485.6 hectares (1200 acres) farm. The goal of the Phase I archaeological survey was to identify all archaeological properties within the APE and provide recommendations with regard to National Register of Historic Places (NRHP) eligibility.

Prior to the initial fieldwork, an investigation of historic maps and Tennessee archaeological site files was carried out to identify potential historic structures and previously recorded archaeological sites within the APE. No previously recorded sites are located within the APE. An examination of the USGS Hebron quadrangle, surveyed in 1950 and printed in 1981, identified three structures depicted within the southwestern portion of the APE. These locations were examined via archaeological excavation and transect based pedestrian survey.

The field investigation employed two specific methodologies based on topographic characteristics. Areas exhibiting greater than 10 percent slope were visually inspected with archaeologists spaced at 30-m intervals. Areas exhibiting less than 10 percent slope were tested using shovel test pits (STPs) spaced at 30-m intervals. The location of each STP was digitally mapped prior to fieldwork using the fishnet function in ArcGIS 10.4. The data were then transferred to a Trimble Geo7X global positioning system (GPS) capable of sub-meter accuracy. Using the GPS, STP locations were then marked within the APE. STPs measured 30-cm in diameter and were excavated to sterile subsoil. All fill was screened through 0.25-in mesh screen. Detailed descriptions of the encountered soils were recorded on standardized ARL STP forms. When artifacts were encountered, additional STPs were placed at 15-m intervals to the north, south, east, and west of the positive STP. Artifacts recovered during the Phase I archaeological survey were collected, bagged, and returned to the ARL for further analysis.

STPs revealed a thin topsoil layer overlying undisturbed subsoil. No buried surfaces were detected in any of the shovel test probes. A total of 191 STPs were excavated during the Phase I survey, seven (7) of which contained historic archaeological material. Of the positive STPs, three (3) were within the initial 30-m grid and four (4) were 15-m radials. All artifacts found were late historic/early modern. Recovered artifacts include fencing wire, cut and wire nails, scraps of flat metal, bottle glass fragments, and whiteware ceramic fragments. All artifacts were recovered from the topsoil layer (i.e. within the upper 10-cm of the modern surface). While historic artifacts were recovered, no historic structures or features were identified during this survey.

Based on the results of the investigations, ARL recommends no further archaeological testing for the proposed Lone Oaks Farm shooting range installation and that the project should be allowed to proceed as planned.

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

**Table** **Page**

# INTRODUCTION

At the request of Tony Hopson of the Department of Capital Projects at the University of Tennessee, the Archaeological Research Laboratory (ARL) at The University of Tennessee (UT) conducted a Phase I archaeological investigation for the proposed shooting range at the Lone Oaks Farm in Hardeman County, Tennessee (Figure 1). Since the project is on State of Tennessee property, ARL applied for and received a state permit for archaeological work. The work was conducted under Archaeological Permit No. 000882.

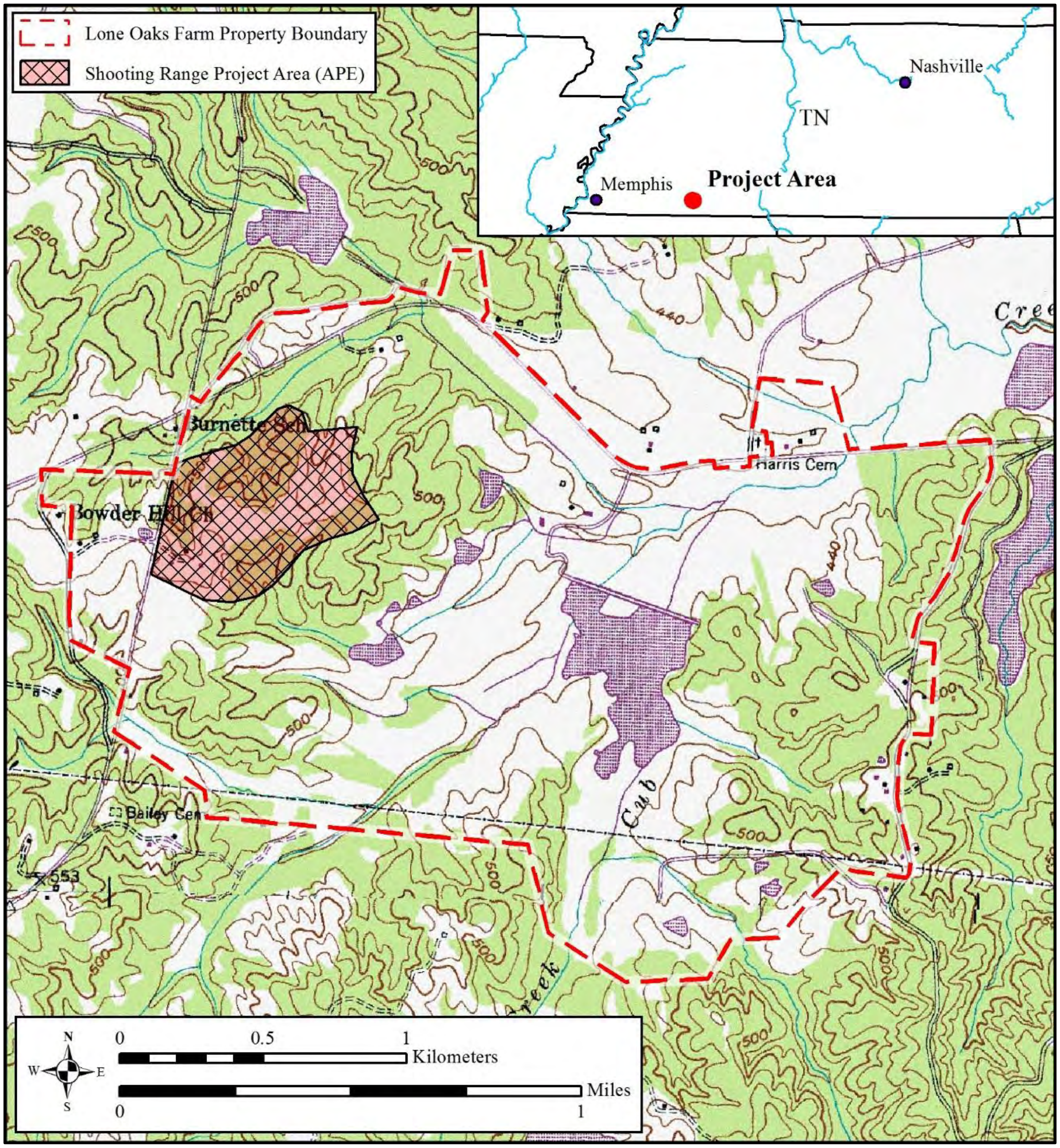



**Figure 1. Lone Oaks Farm area of potential effect (APE) within the Lone Oaks property boundary (Base map: Hebron 7.5' Quadrangle, USGS 1981).**

The area of potential effect (APE) encompasses 33.3 hectares (82.3 acres) within the 485.6 hectares (1200 acres) farm. The project area occupies a small upland plateau and bordered by deeply dissected gullies. The western extent of the APE is delineated by Sain Road. The east and south margins largely follow modern gravel trails. The north edge of the project area is approximately 0.2-km south of Lake Hardeman Road.

The purpose of the Phase I archaeological survey was to identify all archaeological properties within the APE and provide recommendations with regard to National Register of Historic Places (NRHP) eligibility. The investigation fulfills the obligations outlined in the scope of work proposed by ARL as well as those outlined in Section 106 of the National Historic Preservation Act (16 U.S.C. 470f, 36 CFR part 800). Michael G. Angst served as Principal Investigator (Archaeologist-in-General-Charge) for the project; Howard J. Cyr served as Field Director (Archaeologist-in-Direct-Charge) and Geoarchaeologist; Charles Cianciolo, Lindsey Cochran, and Howard Haygood served as archaeological technicians.

# ENVIRONMENTAL SETTING

*Howard J. Cyr and Michael G. Angst*

## PHYSIOGRAPHY AND GEOLOGY

Lone Oaks Farm is located in the East Gulf Coastal Plain section of the Coastal Plain province. In general, the area is characterized by broad undulating upland plateaus, highly dissected upland slopes, and flat bottom lands. The underlying geology consists of irregularly bedded sand of the Claiborne formation locally interbedded with lenses and beds of gray to white clay and silty clay (Hardeman 1966).

The geomorphology of the immediate project area is characterized by a rolling upland plateau bordered to the north and south by deeply incised drainages (Figure 2). These drainages are broad, severely eroded, and heavily forested with side slopes ranging between 10 and 30 degrees.

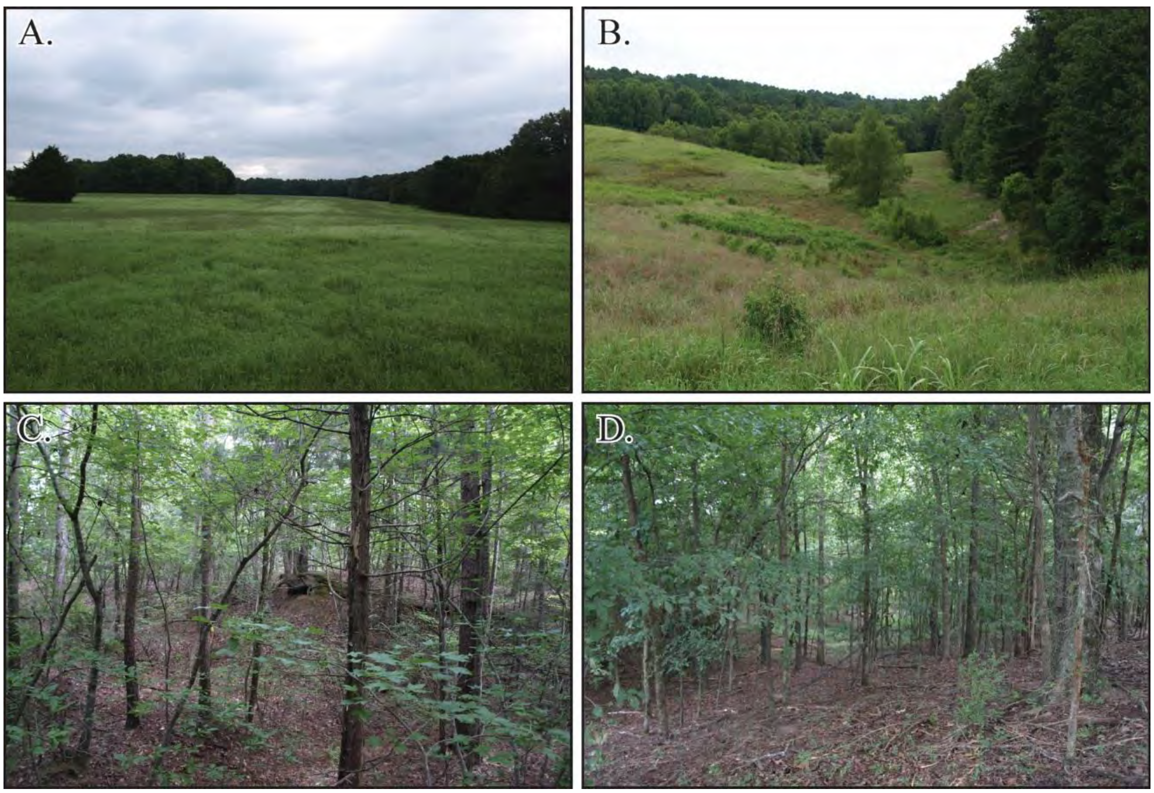



**Figure 2. A. Rolling upland plateau at the center of the APE (view to the northwest); B. Deeply incised drainage located in the north-central portion of the APE (view to the north); C and D. Steep slopes and deep gullies characterizing the forested drainages (views to the north and the south).**

## SOILS

Modern soil characteristics within the project area closely reflect the local geomorphology and erosion patterns. The soil within the upland plateau is represented by the Lexington-Providence series. Located within well to moderately drained severely eroded upland ridgetops and side slopes, the Lexington-Providence series consists of a thin brown, mottled, silt loam surface horizon underlain by a strong brown silty clay loam subsoil (Thomas 1997). Soil within the deeply eroded gullies and drainages are represented by the Smithdale loam soil series. Occurring along steeply sloped hillsides with a high erosion potential and high runoff rate, soils within the Smithdale series consist of a very shallow and highly eroded surface horizon, characterized as a reddish brown, mottled, loam, underlain by a yellowish red, sandy clay loam (Thomas 1997).

The soil profiles exposed in the shovel test probes correspond well with the reported soil series. STPs from the upland survey area are within the reported extent of the Lexington-Providence soil series. These STP soil profiles consist of a very thin (2 to 5-cm thick), mottled brown, silt loam A horizon overlying an eroded yellowish brown, silty clay loam subsoil (B) horizon (Figure 3). The soil is heavily eroded with little remaining of the historic A horizon. The degree of soil erosion possibly resulted from historic and early modern cotton farming in the area.

**Figure 3. Representative upland STP soil profiles characteristic of the Lexington-Providence soil series. Note the very thin surface horizon and well-weathered subsoil horizon.**

Profile exposures within the gullied areas revealed a thin (2-cm thick), grayish brown, organic-rich, silty loam A horizon overlying eroded subsoil. Neither soil profiles from the upland plateau section nor the gullied areas contained buried surface soils. The eroded subsoil exposed in both areas represent well-weathered residuum.

## FLORA

The study area falls near the border of the Carolinian and Austroriparian biotic provinces. The Carolinian province is characterized by a richly diversified hardwood forest. The climate is under cyclonic control year round and the temperature and humidity levels fluctuate frequently. Precipitation is adequate to support the hardwood forests with most falling in the fall and winter. The Austroriparian province covers much of the Southeast, is characterized by pine and hardwood forests, and contains numerous swamps and marshes. Mild winters and hot, humid summers typify the province and precipitation is moderately heavy. Climax vegetation is hardwood forest, but much of the uplands are covered by subclimax pine forest. Oaks, magnolias and hickories are the most important trees of the upland hardwood forests, while gums and cypresses dominate the swamps (Dice 1943:16-20).

Braun (2001) classifies the area as part of the Mississippi Embayment Section of the Western Mesophytic Forest Region. The difference is in name only, however. The native vegetation "displays a mosaic of unlike vegetation types, of prairie, oak-hickory forest, swamp forest and mixed mesophytic communities" (Braun 2001:157).

Oak-hickory forest occupied much of the rolling to moderately dissected uplands in the northern section of the biotic province. White oak (*Quercus alba*) is generally abundant and becomes dominant in ravines and between knolls. Southern red oak (*Q. falcata*) typically dominates on low hills. Several other species, including post (*Q. stellata*), blackjack (*Q. marilandica*), black (*Q. velutina*), and chinquapin (*Q. muehlenbergii*) oaks occur. Hickories (*Carya* spp.) are present throughout, but in variable amounts and species. Tuliptree (*Liriodendron tulipifera*) is frequent in white oak communities. To the south, yellow pine (*Pinus* spp.) mixes with the oaks, especially in strongly dissected and sandy areas, marking the transition into the Oak-Pine region. The understory of the oak-hickory forest includes young members of the canopy species, along with dogwood (*Cornus florida*), wild black cherry (*Prunus* sp.), winged elm (*Ulmus alata*), sour gum (*Nyssa sylvatica*), persimmon (*Diospyros virginiana*), mulberry (*Morus* spp.), white ash (*Fraxinus americana*), sassafras (*Sassafras albidum*), and sometimes holly (*Ilex* spp.). Shrubby species include Devil's walkingstick (*Aralia spinosa*), elderberry (*Sambucus canadensis*), American hazelnut (*Corylus americana*), upland swampprivet (*Forestiera ligustrina*), coralberry (*Symphoricarpos orbiculatus*), poison ivy (*Rhus radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) (Braun 2001).

In Kentucky, northern Tennessee and portions of northern Mississippi, prairie areas or "barrens" were frequent, but are now mostly in cultivation. They were somewhat similar to the barrens on the Highland Rim (surrounding the Nashville Basin) (Braun 2001).

The broad alluvial valleys are occupied by swamp forests. Principal tree species include willow oaks (*Quercus phellos*), chestnut oaks (*Q. prinus*), pin oaks (*Q. palustris*), overcup oaks (*Q. lyrata*), water oaks (*Q. nigra*), downy poplars (*Populus heterophylla*), cottonwoods (*P. deltoides*), white elms (*Ulmus americana*), winged elms (*U. alata*), hackberries (*Celtis laevigata*), river birches (*Betula nigra*), pecans (*Carya illinoinensis*), sycamores (*Platanus occidentallis*), red maples (*Acer rubrum*), silver maples (*A. saccharinum*), boxelders (*A. negundo*), sweetgums (*Liquidambar styraciflua*), black willows (*Salix nigra*) and bald cypress (*Taxodium distichum*). These swamp forests are extensions of the forests of the Mississippi River alluvial plains and merge with them on the western edge of the section (Braun 2001).

### FAUNA

Mammals of the Tennessee Coastal Plain include opossums (*Didelphis virginiana*), shrews (*Sorex longirostris*, *Cryptotis parva*, *Blarina carolinensis*), and eastern moles (*Scalopus aquaticus*). Numerous bat species occur, including little brown bats (*Myotis lucifugus*), southeastern bats (*M. austroriparius*), gray bats (*M. grisescens*), Keen's bat (*M. keenii*), Indiana bats (*M. sodalis*), small-footed bats (*M. leibii*), eastern pipistrelles

(*Pipistrellus subflavus*), big brown bats (*Eptesicus fuscus*), red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), evening bats (*Nycticeius humeralis*), and Rafinesque's big-eared bats (*Plecotus rafinesqii*). Rodents include groundhogs (*Marmota monax*), eastern chipmunks (*Tamius striatus*), gray squirrels (*Sciurus carolinensis*), fox squirrels (*S. niger*), southern flying squirrels (*Glaucomys volans*), beaver (*Castor canadensis*), eastern woodrats (*Neotoma floridana*), cotton rats (*Sigmodon hispidus*), rice rats (*Oryzomys palustris*), eastern harvest mice (*Reithrodontomys humulis*), common deer mice (*Peromyscus maniculatus*), white-footed mice (*P. leucopus*), cotton mice (*P. gossypinus*), golden mice (*Ochrotomys nuttalli*), prairie voles (*Microtus ochrogaster*), woodland voles (*Microtus pinetorum*), muskrats (*Ondatra zibethicus*), and meadow jumping mice (*Zapus hudsonius*). Other mammals include eastern cottontail (*Sylvilagus floridanus*), swamp rabbit (*S. aquaticus*), black bear (*Ursus americanus*), raccoon (*Procyon lotor*), minks (*Mustela vison*), long-tailed weasels (*Mustela frenata*), striped skunks (*Mephitis mephitis*), eastern spotted skunks (*Spilogale putorious*), river otters (*Lutra canadensis*), red foxes (*Vulpes vulpes*), gray foxes (*Urocyon cinereoargenteus*), red wolves (*Canis rufus*), cougar (*Felis concolor*), bobcats (*Lynx rufus*), white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), and bison (*Bison bison*) (Brown 1997; Kellogg 1939).

Coyotes (*Canis latrans*) are commonly thought to be native to the U.S. Southwest, not entering the region until the early twentieth century (Brown 1997:165-166; Kellogg 1939:267). The adaptive nature of coyotes makes it much more likely that they were native to the Southeast, but extirpated very early in the Historic period. Some researchers feel that coyotes are native to the entire Nearctic region (Tokar 2001), and are probably now simply reclaiming old territory. Wild boar (*Sus scrofa*) may have been introduced as early as the 1500s with Spanish explorers. European or Russian wild boars were introduced to North Carolina, Tennessee and Georgia in 1912 (Brown 1997:181).

Water birds of the Coastal Plain included pied-billed grebe (*Podilymbus podiceps*), double-crested cormorant (*Phalacrocorax auritus*), herons (*Ixobrychus exilis*, *Ardea herodias*, *A. alba*, *Egretta caerulea*, *Butorides virescens*, *Nycticorax* spp.), Canada goose (*Branta canadensis*), ducks (*Aix sponsa*, *Anas* spp.), hooded merganser (*Lophodytes cucullatus*), American coot (*Fulica americana*), and others (Nicholson 1997; Roedel and Kennedy 2005).

Carrion eaters and birds of prey included vultures (*Coragyps atratus* and *Cathartes aura*), osprey (*Pandion haliaetus*), bald eagles (*Haliaeetus leucocephalus*), hawks (*Accipiter* spp. and *Buteo* spp.), falcons (*Falco* spp.), and owls (*Otus asio*, *Megascops asio*, *Bubo virginianus* and *Strix varia*). Game birds would have included at least ruffed grouse (*Bonasa umbellus*), wild turkey (*Meleagris gallapavo*), and northern bobwhite (*Colinus virginianus*). Additional birds included rails (*Rallus* spp.), American woodcock (*Scolopax minor*), mourning dove (*Zenaida macroura*), woodpeckers (*Melanerpes* spp. and *Dryocopus pileatus*), purple martin (*Progne subis*), blue jay (*Cyanocitta cristata*), common raven (*Corvus corax*), yellow-billed cuckoo (*Coccyzus americanus*), common nighthawk (*Chordeiles minor*), whip-poor-will (*Camprimulgus vociferus*), chickadees (*Poecile* spp.), tufted titmouse (*Baeolophus bicolor*), nuthatches (*Sitta* spp.), eastern bluebird (*Sialia sialis*), wood thrush (*Hylocichla mustelina*), American robin (*Turdus migratorius*), brown thrasher (*Toxostoma rufum*), vireos (*Vireo* spp.), warblers

(*Dencroica* spp., *Helmitheros* spp., *Seiurus* spp., *Opornis* spp., *Geothlypis* spp.), tanagers (*Piranga* spp.), northern cardinal (*Cardinalis cardinalis*), indigo bunting (*Passerina cyanea*), passenger pigeon (*Ectopistes migratorius*), and Carolina parakeet (*Conuropsis carolinensis*) (Nicholson 1997; Roedel and Kennedy 2005).

Other birds, such as killdeer (*Charadrius vociferus*), eastern kingbird (*Tyrannus tyrannus*), northern mockingbird (*Mimus polyglottos*), and some sparrows and finches were probably not as common prehistorically as they are today. These birds prefer open spaces and would have been limited to burned or cleared areas, such as prehistoric habitation sites or horticultural and agricultural plots (Nicholson 1997).

The Tennessee, Obion, and Mississippi rivers and their tributaries were rich with fish, including paddlefish (*Polyodon spathula*), sturgeon (*Acipenser fulvencens* and *Scaphirhynchus platorynchus*), varieties of gar (*Lepisosteus* sp.), grindel (*Amia calva*), herrings or shad (*Alosa* spp., *Pomolobus* spp., *Dorosoma* spp.), suckers (*Cycleptus elongates*, *Megastomatobus cyprinella, Ictiobus bubalus, Carpiodes* spp., *Erimyzon* spp., *Minytreme melanops, Moxostoma* spp., *Placopharynx carinatus, Lagochila lacera*), minnows (*Nocomis* spp., *Hybopsis* spp., *Erimystax* spp., *Extrarius aestivalis hyostomus, Rhinichthys* spp., *Semotilus atromaculatus, Hemitremia flammea, Clinostomus vandoisulus, Chrosomus erythrogaster, Opsopoedus emiliae, Notemigonus chrysoleucas, Notropis* spp., *Ericymba buccata, Phenacobius* spp., *Hybognathus nuchalis, Ceratichthys vigilax taurocephalus, Pimephales promelas, Hyborhynchus notatus, Campostoma anomalum*) catfish (*Ictalarus* spp., *Pilodictis olivaris*, *Ameiurus* spp., *Notorus flavus, Schilbeodes* spp.), western mud-minnow (*Umbra limi*), pickerel (*Esox* spp.), American fresh-water eel (*Anguilla bostoniensis*), topminnows (*Fudulus* spp.), mosquito fish (*Gambusia affinis*), pirate perch (*Aphredoderus sayanus*), white bass (*Lepibema chrysops*), yellow bass (*Morone interrupta*), black basses (subfamily Micropterinae), sunfish (subfamily Lepominae), pigmy sunfish (*Elassoma zonatum*), glassy minnow (*Medinia audens*), Brook silversides (*Labidesthes sicculus*), drum (*Aplodinotus grunniens*), and others (Kuhne 1939). Abundant freshwater mussels and freshwater and terrestrial gastropods have also been recorded (Bogan and Parmalee 1983; Parmalee and Bogan 1998).

Amphibians of the Coastal Plain include toads (*Bufo* spp.), treefrogs (*Hyla* spp., *Pseudacris* spp.), eastern narrowmouth toads (*Gastrophryne carolinensis*), eastern spadefoot toads (*Scaphiopus holbrookii*), true frogs (*Rana* spp.), mole salamanders (*Ambystoma* spp.), three-toed amphiuma (*Amphiuma tridactylum*), mudpuppies (*Necturus maculosus*), lungless salamanders (*Eurycea* spp., *Plethodon* spp.), eastern newts (*Notophthalmus viridescens*) and lesser sirens (*Siren intermedia*) (Duellman and Sweet 1999; Scott and Redmond 1996).

Reptiles of the Coastal Plain include turtles, lizards and snakes. Turtle genera and species include alligator snapping turtles (*Macrochelys temminckii*), eastern box turtles *(Terrapene carolina*), eastern mud turtles *(Kinosternon subrubrum*), eastern musk turtles (*Sternotherus odratus*), map turtles (*Graptemys* spp.), painted turtles (Chrysemys spp.), pond sliders (Trachemys scripta), river cooter (Pseudemys concinna), snapping turtles *(Chelydra serpentine*) and spiny softshells (Apalone spinifera). Lizards include green anoles (*Anolis carolinensis*), eastern fence lizards (*Sceloporus undulatus*), slender glass lizards (*Ophisaurus attenuatus*), six-lined racerunners (*Aspidoscelis sexlineatus*) and various skink species (*Plestiodon* spp., *Scincella lateralis*). Snakes include coachwhips (*Coluber flagellum*), common gartersnakes *(Thamnophis sirtalis)*, copperheads *(Agkistrodon contortrix)*, cottonmouths *(Agkistrodon piscivorus*), Dekay's brownsnake (Storeria dekayi), diamond-backed watersnake (Nerodia rhombifer), eastern hog-nosed snakes (Heterodon platirhinos), eastern ribbonsnakes (Thamnophis sauritus), eastern wormsnake (Carphophis amoenus), gray ratsnake *(Pantherophis spiloides*), Kirtlands snakes (Clonophis kirtlandii), milk and kingsnakes (Lampropeltis spp.), North American racers (Coluber constrictor), pinesnakes (Pituophis melanoleucus), red-bellied mudsnakes (Farancia abacura), red-bellied snakes (Storeria occipitomaculata), red cornsnakes (Pantherophis guttatus), ring-necked snakes (Diadophis punctatus), earthsnakes (Virginia spp.), rough greensnakes *(Opheodrys aestivus*), scarletsnakes (*Cemophora coccinea*), southeastern crowned snake (*Tantilla coronata*), timber rattlesnakes (*Crotalus horridus*) and watersnakes *(Nerodia* spp.) (Scott and Redmond 2008).

# PREHISTORIC BACKGROUND

*Michael G. Angst, Matthew D. Gage, Valerie Altizer, and Bradley A. Creswell*

Prehistoric occupation of the southeastern United States began with the migration of people into North America sometime during the final glacial episodes of the late Pleistocene; however, the specifics of this migration, including the exact dates and routes of travel, are a matter of ongoing research and debate. Archaeological and genetic evidence indicates that human occupation is likely to have occurred continuously for at least the last 12,000 years. Over this vast amount of time, major changes have taken place in settlement patterns, subsistence practices, technology, social organization, population density, and many other aspects of human behavior. The following discussion provides a general overview of human development in the region as documented in the archaeological record of western Tennessee and throughout the larger region of the American Southeast. Archaeological research on the Tennessee Gulf Coastal Plain has been somewhat limited. As a result, what is known or anticipated about the archaeology of the region is largely gathered from neighboring areas. Therefore, the following chronology borrows from the more intensively studied lower Tennessee River valley and its environs. The cultural chronology of the last 12,000 years of prehistoric human occupation has been organized into four major stages: Paleoindian, Archaic, Woodland, and Mississippian.

## PALEOINDIAN STAGE (11,500 B.C.–8500 B.C.)

Throughout most of the eastern United States, evidence of Paleoindian occupation is generally identified by isolated, fluted point surface finds rather than intact cultural deposits. Paleoindian adaptation is characterized by small, highly mobile bands that moved across the landscape as preferred resources were depleted and new resources sought. Environmentally, the stage marks the end of the Late Glacial era, when sea levels were rising and the Gulf shoreline was transgressing towards its present position. Changing hydrologic regimes associated with the glacial retreat and increased precipitation at the end of the Pleistocene probably destroyed and deeply buried many of the Paleoindian sites along river valleys. Deeply buried sites on the Cumberland River, such as the Johnson-Hawkins site (40DV313) near Nashville and the Puckett site (40SW228) in north central Tennessee, tend to corroborate this suggestion. The Johnson-Hawkins site has yielded the earliest evidence of human occupation in Tennessee, a calibrated radiocarbon date of 11,700 +/- 980 BP from charcoal associated with Paleoindian artifacts (Broster and Norton 1996).

The most common diagnostic artifact of the Paleoindian period is the lanceolate-shaped, basally-ground projectile point such as the fluted and unfluted Clovis, Cumberland, and Redstone types (Anderson 1996). The Paleoindian tool kit also includes some bifacial and unifacial tools that have been found in association with Clovis projectile points (Williams 1957). Anderson's (1990, 1995a, 1995b) research on Paleoindian diagnostics in the Eastern Woodlands led him to subdivide this stage into three periods, designated Early (circa 10,500 to 8900 B.C.), Middle (circa 8900 B.C. to 8500 B.C.), and Late (circa

8500 B.C. to 8000 B.C.) (Anderson et al. 1996). This chronology is based primarily on changes in hafted biface morphology.

Archaeological evidence indicates that Early Paleoindians in the broader Southeast hunted some megafauna, including giant tortoise and mastodon, before these animals became extinct around 8800 B.C. (Anderson 1996:51). However, smaller game animals and plant foods were probably a more significant part of the Paleoindian diet (Chapman 1985a, 1985b; Hollenbach 2009; McNutt et al. 1975; Meltzer and Smith 1986; Walker et al. 2001; Walthall 1980). These include deer, wild turkeys, and waterfowl, as well as nuts, wild fruits, and seeds of weedy plants.

In the Gulf Coastal Plain of western Tennessee, Paleoindian occupations are characterized by isolated surface finds in the loess hills (Smith 1996). Surveys of drainages in the region have failed to locate additional evidence of Paleoindian occupation (Anderson et al. 1987) and the early portion of the prehistoric sequence is still poorly understood. Just to the east of the project area, the lower Tennessee River valley has one of the densest concentrations of Paleoindian artifacts in North America. According to the Paleoindian Database of the Americas (PIDBA), more Paleoindian artifacts have been recovered from the five counties along the lower Tennessee River in Tennessee (Benton, Humphreys, Houston, Henry and Stewart) than have been recorded in the remainder of the state (Anderson et al. 2010). These sites tend to be located on high terraces at the mouths of tributaries to the Tennessee River (Broster et al. 1996:1). While many of these sites are low density scatters or isolates, there are sites in the valley that appear to be repeatedly occupied. Broster and Norton (1996:291) note that eight sites in the Kentucky Lake region have produced over 100 Paleoindian artifacts. Analysis of collections from these sites suggests that many of them probably served as both quarry/workshops as well as base camps (Adair 1976; Ellerbusch 2004; Lewis and Kneberg 1958; McNutt and Graham 1967; McNutt et al. 2008; Norton and Broster 1992a, 2008). These sites tend to cluster within a number of river miles of the mouth of the Duck River as it empties into the Tennessee, and the abundance of high quality chert (Bradbury and Carr 2009) is undoubtedly an important draw. Jones et al. (2010) have classified a number of these sites as the Tennessee-Duck River Paleoindian Complex (TDRPC). Data from these related sites have been used to describe lithic resource use through the Paleoindian stage. Statistically significant patterns document a general decrease in raw material variability as well as an intensification of use of high-quality Dover chert from the Early to Late Paleoindian periods. Ongoing research (e.g., Ellerbusch 2004; Jones et al. 2010; McNutt et al. 2008), and in particular studies at the Carson-Conn-Short site (Broster and Norton 1996; Nami et al. 1996; Norton and Broster 2008; Stanford et al. 2006) in the Kentucky Lake region will add significant data on the Paleoindian period.

### ARCHAIC STAGE (8500 B.C.–900 B.C.)

The Archaic stage is marked by a shift in material culture, undoubtedly associated with changes in the ecology of the region. As the glaciers moved northward with the end of the Pleistocene, the last of the North American megafauna reached extinction. Vegetation throughout the Midsouth shifted from patchy boreal forest/parkland environments to mesic oak-hickory forests and are believed to have been firmly established by about 8000

B.C. (Anderson and O'Steen 1992; Anderson et al. 1996). These environments would have provided a much more diverse resource base than that available in the previous 13,000 years. The result was a shift in available faunal and floral resources. Faunal remains from Stanfield-Worley bluff shelter and Russell Cave indicate white-tailed deer and turkey were the two major sources of meat. Squirrel remains were the most common species identified with raccoon and box turtle rounding out the list of the most commonly found animal remains (Chapman 1985a; Futato 1983; Parmalee 1962; Weigel et al. 1974). Hickory nuts and acorns were the most common plant remains from Stanfield-Worley and Dust Cave (Hollenbach 2009). The changes in available food resources were reflected by the shifts in material culture and settlement patterns. Technological changes are marked by the cessation of fluted point manufacture, and the development of numerous regional projectile point forms, as well as a variety of other specialized artifact types. A slightly more sedentary lifestyle is evidenced in the archaeological record by larger, more densely occupied sites. In general, the onset of the Archaic tradition is associated with the environmental changes that occurred at the terminal Pleistocene/early Holocene transition, and the corresponding shift in adaptive strategies employed by prehistoric populations.

The Archaic stage has been divided into three periods based largely on temporal changes in projectile point types: Early (circa 8500 B.C.–6000 B.C.), Middle (circa 6500 B.C.–3000 B.C.), and Late (circa 3000 B.C.–900 B.C.).

### *Early Archaic Period*

The Early Archaic period (circa 8500 B.C.–6000 B.C.) coincides with the initiation of the Holocene epoch in the Southeast. Differing, sometimes imperceptibly, from Late Paleoindian period occupation trends, the seasonal dichotomy model has been promoted for much of the mid- and lower-Southeast. Anderson and Hanson (1988) elaborated on this model, suggesting that social organization included band- and macroband-level social systems. At the band level, groups of roughly 50 to 150 individuals would have been responsible for seasonal movements within a single drainage basin with some migration into portions of surrounding drainages. At selected seasonal intervals, gatherings of 500 to 1,500 people would have occurred, facilitating mating networks and economic and social interaction (Anderson 1996).

Early Archaic occupation in the lower Tennessee Valley continues to suggest a concentration of prehistoric peoples following the end of the Pleistocene. A pattern of occupation, similar to that suggested by Futato (1982) and Hubbert (1989) for the Paleoindian stage, is also suggested for the Early Archaic period. This pattern, based on seasonal habitation of upland and lowland areas, would have mirrored the seasonal availability of exploitable resources (Hollenbach 2009). These changes can be identified in the number of sites in both riverine and upland contexts and the density of artifacts. The continuity is also seen on sites in west Tennessee that have both substantial Paleoindian and Early Archaic occupations (e.g., Broster et al. 2006; McNutt et al. 2008; Norton and Broster 1992a, 1992b).

The chronological organization of data from Archaic complexes is the result of excavations of buried deposits in cave and rockshelter sites (DeJarnette et al. 1962; Driskell 1992, 1994, 1996; Griffin 1974; Sherwood et al. 2004), well-stratified open air sites predominantly situated in riverine environments (Cable 1996; Chapman 1977; Coe

1964; Davis 1990; Lewis and Lewis 1961), and surface collection from throughout the Southeast.

Evidence for the Early Archaic diet shows wide variability evidenced by the range of stone implements and faunal and ethnobotanical remains recovered from these sites. Grinding stones, butchering, and hide-working tools suggest a diversified subsistence pattern that included deer, bear, turkey, raccoon, squirrel, and opossum. Faunal remains from Dust Cave indicate a shift from a Late Paleoindian exploitation pattern heavy on the hunting of avifauna, including passenger pigeon and waterfowl, to a greater reliance on fish and terrestrial mammals during the Early Archaic (Walker 2000). Hickory nuts, acorns, and other nuts were increasingly exploited throughout the period as well (Chapman 1994:43–46; Yarnell and Black 1985). Hollenbach's (2009) examination of plant remains at four rockshelter sites in northwest Alabama showed relatively little change in the plant foods utilized between the Late Paleoindian and Early Archaic periods. Instead, she has highlighted the use of certain sites within different environments for specialized resource acquisition, including acorn, hickory nut, black walnut, hazel, and various fruits and seeds.

The material culture of the Early Archaic period is distinguished from the earlier Paleoindian by changes in PP/K forms. Beginning in about 10,000 BP, the PP/Ks became smaller, took on more triangular shapes as opposed to earlier lanceolate forms, and began to have notched bases. The diagnostic artifacts for the Early Archaic include Early Side Notched (Big Sandy), Thebes cluster, Kirk Corner Notched cluster, bifurcated and Kirk stemmed/serrated projectile points/knives (PP/Ks) (Driskell 1994, 1996; Justice 1987; Meeks 1994). Pitted cobbles, unifacial (thumbnail) scrapers, and drills are also frequently associated with Early Archaic components (Chapman 1994:38–41). Early Archaic components in western Tennessee are identified using the same hafted biface types found in adjacent regions.

It has been postulated that the population density in most areas of the Southeast increased from the Early Archaic Periods (e.g. Anderson 1989; McNutt and Weaver 1985).

### *Middle Archaic Period*

The Middle Archaic period (circa 6500 B.C.–3000 B.C.) coincided with the Mid-Holocene, Hypsithermal or Altithermal Interval, a time of warmer temperatures and drier conditions in the mid-continent. The Hypsithermal (approximately 6000 B.C.–2000 B.C.) considerably altered the environment and likely influenced the settlement and procurement strategies of peoples living in the region. This environmental shift created challenges for prehistoric populations, with local inhabitants experiencing long droughts and corresponding changes in resource availability. It was during the Middle Archaic that foraging groups began to create massive shell middens along the middle and lower Tennessee River.

By 4000 B.C., major environmental changes had taken place across the Southeast. The effects of the Hypsithermal are noted from pollen data collected in St. Clair County, Alabama, Georgia, coastal Alabama, and the Tennessee valley. The oak-hickory, mixed hardwood, and mixed-oak hickory and southern pine forests were firmly developed across the area (Delcourt et al. 1983). Even with the changing environment, increased populations – evidenced by site density – suggest increased settlement pressures, resulting in greater social stress factors. Walthall (1980:57–58) suggested an increase in territorialism and provincial diversity as environments evolved into modern regional patterns.

Material culture can be distinguished from the Early Archaic by an increase in ground stone tools, and a more diverse stone tool kit (Coe 1964). Atlatl weights appeared for the first time and give conclusive evidence for the use of the atlatl or spear thrower (Lewis and Lewis 1961). Stone net sinkers have been found in the archaeological record and suggest new technologies for fishing (Chapman 1977; Davis 1990). Diagnostic bifaces found in western Tennessee include basally notched Eva and Calf Creek points and side notched Hickory Ridge and Cache River projectile points (Barrett and Karpynec 2006). Middle Archaic peoples continued to use acorns, black walnuts, and hickory nuts (Chapman 1977:125; Lewis and Lewis 1961:40–43), with some evidence that hickory nut use increased significantly at this time (Carmody 2009).

Extensive trade networks start to appear during the Middle Archaic. These large interaction spheres are highlighted by the similarity in ceremonialism over broad areas. Complex mortuary practices involving specialized grave goods such as the large, finely chipped Benton point and blade caches found with burials of the Benton Mortuary Complex, the presence of red ochre, and other "killed" artifacts, such as burned bifaces, found with human interments show similar belief systems integrated into the archaeological record of sites across the Midsouth (Deter-Wolf et al. 2004; Meeks 2000:36–38).

Benton occupations are well documented in the middle and lower Tennessee Valley and in western Tennessee (Futato 1983; Lewis and Lewis 1961; Mainfort 1994; Peterson 1973; Smith 1996). They occur toward the end of the Middle Archaic and continue into the early Late Archaic. Meeks (2000) placed the date of core Benton occupations between 4000 and 3000 B.C. Benton PP/Ks are associated with both shell midden (Lewis and Lewis 1961) and non-shell sites (Bentz 1996; Deter-Wolf et al. 2004).

Bentons were recovered from a non-shell bearing stratum (VII) at the Spring Creek site in Perry County, Tennessee. In addition to Benton PP/Ks, a limited array of stone tools (due to limited excavations) included knives and unifacial scrapers. A carbon date of 2645±210 is probably too late to be attributable to Benton occupations. A deeper stratum (Bank Stratum VI) noted in the cut bank consisted of a dense shell midden that may be associated with a Benton occupation. A radiocarbon date of 3055±260 B.C. was obtained from this stratum (Peterson 1973). This date falls at the tail end of Meeks' (2000) core date range for Benton sites.

The Eva site, in Benton County, was excavated by Lewis and Lewis (1961) prior to the creation of Kentucky Lake and produced much of the baseline data for what is known about the Middle Archaic in the region. When it was occupied, a substantial shell and organic midden accumulated at the site on a floodplain rise adjacent to the Tennessee River. The chipped stone tool industry included Eva basally notched and stemmed PP/Ks; large, trianguloid knives and bifaces; adzes; large and small unifacial scrapers that occasionally have graver spurs; and large drills. Other stone artifacts include atlatl weights, gorgets, pendants, hammer and anvil stones, pestles, nutting stones, and honing stones. Due in large part to the quantity of shell in the midden, faunal preservation at Eva was excellent and a significant bone and antler tool industry was recovered. These tools include several types of awls, scrapers, projectile points, fish hooks, wrenches, beads and atlatl hooks. Nearly 200 human interments were also excavated. Typically fully flexed, just under one-third of the burials contained associated artifacts including ochre, PP/Ks, bone awls and needles, atlatls and ornaments such as turtle shell rattles and beads. Eighteen dog interments were also excavated (Lewis and Kneberg 1947, 1959; Lewis and Lewis 1961).

### *Late Archaic Period*

The Late Archaic period (circa 3000 –900 B.C.) was a time of a rapid population increase as evidenced by larger and more numerous sites. Chapman (1985a:150) refers to Late Archaic sites as “widespread and frequent.” Sites interpreted as single-family occupations along the first river terraces are manifested by rock-filled firepits. Larger, multi-family sites, represented by a denser pattern of these firepits, suggest these sites were established on a relatively long-term basis (Chapman 1994:51–53).

By the beginning of the Late Archaic, modern climatic conditions were well established. The period is marked by a continued increase in population and evidence for social institutions, more stable settlement patterns, and increased trade interaction. Social institutions and ceremonialism are noted with the appearance of monumental architecture in portions of the Southeast and the inclusion of grave goods. Non-local artifacts at large sites hint at continued regional interaction and trade of material goods.

During this time, exploitation of environments continued to be specialized with shell middens along many of the major rivers and increasing harvest of white-tailed deer. Hickory nuts continued to dominate the plant remains of Late Archaic sites, but a gradual shift is noted throughout much of the Midsouth and Southeast. Large storage pits filled with nutshells, primarily hickory, are known from terminal Archaic sites in the Tennessee Valley and Highland Rim (Bentz 1996; Bowen 1979; Crites 1996; Futato 1983; Oakley 1975). However, plant remains from the Tennessee Valley, the Cumberland Plateau in eastern Kentucky, and the Coastal Plain indicate that by the Late Archaic some peoples had begun cultivating at least some seed crops, including sunflower, maygrass, chenopod, and gourd, namely cucurbits (Chapman et al. 1982; Chapman and Shea 1981; Chapman and Watson 1993; Gremillion 1996, 2004; Yarnell 1993; Yarnell and Black 1985).

In the middle and lower Tennessee Valley, several relatively large, stemmed, hafted biface types, including Ledbetter, Wade, and Little Bear Creek (Cambron and Hulse 1975; Futato 1983; Little et al. 1997), serve as hallmarks of the Late Archaic/Gulf Formational material culture.

In the upper Duck River valley, Ledbetter Phase (3000-1000 B.C.) sites consist of seasonal hunting and gathering camps, apparently occupied by single family units. Sites contained storage pits, hearths, shallow basins, occasional burials and postmolds. At the Bailey site in the lower Elk River drainage, Ledbetter Phase occupation appears to be year round. Structures (both winter and summer), storage pits, earth ovens and burials were all reported. Subsistence was based on gathering nuts and the exploitation of a wide variety of faunal resources. Burials were flexed and typically without accompanying artifacts. In addition to Ledbetter cluster PP/Ks, the lithic assemblage included bifaces, unifacial tools, ground stone tools and debitage. Modified bone and antler were also present (Bentz 1996:307-308, 314-315; Faulkner and McCollough 1973:420-421).

Peterson (1973) described the Perry Zone from excavations at the Spring Creek site in the lower Tennessee Valley. The Perry Zone shows similarities to the Ledbetter Phase, including the diagnostic PP/Ks. He intentionally refused to identify the type by name. Rather, Peterson (1973) referred to the dominant type as "Stemmed Archaic" PP/Ks, characterized as typically larger than Little Bear Creeks, roughly made, many being asymmetrical, with straight stems and broad blades. Justice (1978:150) later noted that Ledbetters, in addition to PP/Ks identified as Cotaco Creek, Mulberry Creek, and Little Bear Creek, were recovered from the Perry Zone. Other artifacts associated with the Perry occupation zone include knives, many being broad-bladed and small unifacial tools, including gravers and denticulates. No pottery was recovered from the Perry Zone. Finally, Peterson (1973) noted a possible relationship with Poverty Point culture based on similarities in micro-tool assemblages. Radiocarbon dates from the site bracket the Perry Zone between 2500 and 1400 B.C. (Peterson 1973:35-37, 44).

Data from Late Archaic sites in the Tennessee Gulf Coastal Plain, especially excavation data, are lacking. Peterson (1979a, 1979b; in Mainfort 1994:9) identified multiple Late Archaic sites on terraces in the Loosahatchie and Wolf river drainages, but additional research would be necessary to verify settlement patterning.

The Poverty Point culture (2,200 B.C. -ca. 700 B.C.) is represented during the Terminal Late Archaic period in western Tennessee. This culture can be identified based on several distinctive artifactual and architectural remains. Mounds and earthworks, clay cooking balls, lapidary objects, microblades, and exotic raw materials indicate Poverty Point contacts in the region. Fiber-tempered pottery is diagnostic of this period in the middle and western Tennessee Valley (Morse and Morse 1983). Some examples of this type have been found occasionally at Terminal Late Archaic sites in West Tennessee (Smith 1996) and examples have also been found at the French Lick Site in downtown Nashville (Walling et al. 2000). Poverty Point diagnostic hafted bifaces include Gary, McIntire, Mulberry Creek, and Etley forms (Justice 1987; Smith 1979).

By the end of the Archaic, the environment had again shifted. The Late Holocene environment had fluctuated throughout the Archaic and by the terminal Late Archaic had reached a warmer and wetter trend. With the end of the Hypsithermal, the ecosystem of the Midsouth came to include vegetation resembling modern forests, with an increase in coniferous pines resulting from an increased dominance of the tropical maritime air mass rising from the Gulf of Mexico and abundant year-round precipitation (Delcourt 1978). These significant changes affected cultural adaptation in the Southeast. By ca. 3000 BP, pottery manufacturing and incipient horticulture spread throughout the region, giving rise to the Woodland period. The Late Archaic period marks the end of the Archaic Stage and the preceramic occupation of the Southeast.

## GULF FORMATIONAL STAGE (2500 B.C.–100 B.C.)

The Gulf Formational stage is geographically limited to the Atlantic Coastal Plain of South Carolina, Georgia, and Florida, and the Gulf Coastal Plain states of Alabama, Mississippi, west Tennessee, and Louisiana. The hallmark for the stage is the appearance of early fiber- and sand-tempered pottery, the earliest of which appears to be the fiber-tempered Stallings series from the Savannah River drainage (Sassaman 1993). Walthall and Jenkins (1976) argued that the appearance of fiber-tempered ceramics originated in the east and moved west over time. Rather than follow the trend of referring to the appearance of ceramics as marking Woodland (Griffin 1952; Hudson 1976), they proposed the term Gulf Formational to differentiate the early fiber-tempered vessels and subsequent sand-tempered wares of the Gulf Coast region from slightly later ceramic traditions from nearby areas (Jenkins et al. 1986; Walthall 1980).

Gulf Formational component sites tend to center around riverine and swampy environments. By the Late Gulf Formational, more permanent occupations are evidenced by the presence of large, often bell-shaped storage pits. These pits were also used for interments of both cremated and flexed burials. The trend towards use of these types of environments and the presence of large storage pits may correspond with the onset of the Subatlantic Period and colder, drier conditions (Jenkins et al. 1986; Walthall 1980).

The Gulf Formational stage is divided into the Early (circa 2500 B.C.–1200 B.C.), Middle (circa 1200 B.C.–500 B.C.), and Late (circa 500 B.C.–100 B.C.) periods. The Early Gulf Formational period occurs along the Atlantic coast and likely began with the Stallings Island pottery (Sassaman 1993; Walthall and Jenkins 1976).

### *Middle Gulf Formational Period*

In the western middle Tennessee Valley, the earliest pottery is found in the Pickwick Basin during the Middle Gulf Formational period (circa 1200 B.C.–500 B.C.). Fiber-tempered Wheeler pottery appears first in the western portion of the basin and moves out towards the Wheeler and Guntersville basins.

The Wade Phase (1200-450 B.C.) occurs in the date range listed above for the Middle Gulf Formational period. Diagnostic chipped stone artifacts include Wade, Little Bear Creek, Motley, McIntire, Limestone and Cotaco Creek PP/Ks. In the upper Duck River drainage, Wade Phase sites are seasonally occupied hunting-and-gathering encampments. Additional stone tools consisted of digging implements, sandstone and steatite vessels, and gorgets. Bone tools are also documented. Subsistence is based on seasonal gathering of nuts, possibly herbaceous seeds and a wide variety of faunal resources. Small, apparently seasonal structures or windbreaks are reported at multiple sites. Burials were flexed, interred on their sides or occasionally in a seated position, located on the margins of occupation areas. Artifact inclusions in burials ranged from none/few to numerous, including non-local material (Bentz 1996:308-309; Herbert 1986; Keel 1978). Keel (1978:154) considered steatite vessels to be a true diagnostic of the Wade Phase. Although the Wade Phase was considered adamantly pre-ceramic (Keel 1978:153), fiber- and sand-tempered pinched sherds have been reported on late Wade sites (Bentz 1996:309; Kerr 1996:26).

Kerr (1996:669) only recovered one fiber-tempered sherd in his survey of the lower Tennessee valley. Peterson (1973), on the other hand, identified the Kirby Zone at the Spring Creek site based partly on the occurrence of plain, fiber-tempered pottery. Chipped stone artifacts from the Kirby Zone include Little Bear Creek and Motley PP/Ks, elongated and straight-sided bifaces, long knives and flake gravers. Other artifacts include one hematite hoe, a steatite gorget, and bone awls and pins. Additionally, a semi-subterranean structure was identified in the Kirby Zone. The investment of time and effort to build such a structure indicates a certain degree of permanency at the site. The fact that it was semi-subterranean also suggests a winter occupation. Additional support for seasonality, in the form of floral and faunal material, was not recovered. A non-descript hearth was identified just outside of the structure and may have been related. Charcoal from the house pit was dated at 1370±160 B.C. Based on this date and data above and below, the Kirby Zone is thought to date between 1400 B.C. and 800 B.C. (Peterson 1973).

### *Late Gulf Formational Period*

The Late Gulf Formational period is differentiated based on the appearance of sand-tempered pottery. The Alexander Series is typically a middle Tennessee Valley ware, appearing only rarely in the lower valley, where it is considered an Early Woodland type (Kerr 1996:670).

## WOODLAND STAGE (900 B.C.–A.D. 900)

Woodland occupations in west Tennessee and the lower Tennessee Valley, especially those at the beginning of the stage, are not very well understood. Most of what is written about it is based on excavation data outside the region, in particular the data generated in the upper Duck River valley. While the Works Progress Administration (WPA) work in the lower Tennessee Valley certainly encountered Woodland occupations, satisfactory excavation data and interpretation of that data are lacking. Discussing the end of the Late Archaic and beginning of the Early Woodland, Kerr summarized the data deficiency, stating:

> [I]t is clear that population persistence in the Western Valley from Archaic to Woodland cannot be interpreted as cultural persistence. The changes in the organization of prehistoric populations in the interim were considerable and the Kneberg interpretation [1952] effectively obscures the importance of these changes, rather than emphasizing them, much less explaining them. Just because there is a temporal succession of Woodland ceramic types on sites also occupied during the Archaic—and we know Western Valley Woodland best from these multi-component contexts—does not mean that there was a persistence of settlement organization or an absence of significant social evolution. Quite the contrary was the case although this cannot be adequately documented with extant Western Valley data but rather through comparison with neighboring areas [Kerr 1996:24].

### *Early Woodland Period*

Like the Archaic, the Woodland period is divided into three sub-periods. Although use of pottery likely has its roots in the Late Archaic period in Tennessee, as elsewhere in the South (e.g. Sassaman 1993, 2006), the widespread manufacture and use of ceramics traditionally marks the beginning of the Woodland period. Tempering agents, surface treatments, and vessel forms serve as temporal indicators throughout the Woodland period (Bense 1994). The earliest ceramic tradition in the central Tennessee River valley is the Wheeler series fiber-tempered pottery. The Wheeler series appears to have originated with groups occupying the lower section of the Tennessee River valley, although examples of this type are found infrequently in western Tennessee. Low frequencies have been reported from surface collections and from the lower stratigraphic levels of one multicomponent site in Memphis (Childress and Wharey 1990; Mainfort 1985). Use of soapstone bowls for cooking purposes appears to have continued as well, at least through the first part of the Early Woodland period (Faulkner and Graham 1966:52; Truncer 2004; Ward and Davis 1999:141; Wells 2006; Wells et al. 2014).

Based on the results of his Kentucky Lake survey, Kerr (1996:271) proposed that Early Woodland (1000 B.C. to 300 B.C.), which overlaps Late Gulf Formational, settlement followed a pattern similar to what Kimball (1985) and Davis (1990) outlined for the Little Tennessee River drainage. Residential bases were generally larger, close to the river and had thick midden deposits. Middens contained limited ceramics, dense fire-cracked rock (FCR), lithics and features, indicating intensive but not permanent occupations. Smaller extractive camps were located on valley margins and uplands. The reduced number of sites recorded in the valley may be the result of a decrease in population or simply difficulty in accurately defining Early Woodland.

Peterson (1973) investigated one site that sheds some light on the early part of the Woodland. The Spring Branch Zone at the Spring Creek site was identified by a dense midden deposit containing snail and some mussel shell. Adena PP/Ks are common and diagnostic. Drills are also common and chipped stone knives are rather long, similar to those in the preceding Kirby Zone. Flake tools, including unifacial scrapers, gravers, denticulates and artifacts on retouched blades, are part of a well-documented micro-tool industry. Although no blade cores were recovered, utilized and retouched blades were. Faunal preservation was good in the midden and numerous bone tools were recovered, including one awl, three pins, an antler flaker and one partially sawed antler tine. One broken steatite cone and a broken, undrilled limestone gorget were the only pieces of ground stone recovered from the midden. Ceramics were all limestone tempered, with check stamping on the vast majority of the sherds. Fabric-impressed sherds, many smoothed over, and plain sherds were minor types. The Spring Branch Zone is thought to date between 800 and 200 B.C. (Peterson 1973).

The Fulmer site (40SY527) is located above an unnamed tributary to the Loosahatchie River on the western edge of the Loess Hills in southwest Tennessee. Excavations identified scattered remnants of midden and a well-defined activity area surrounding a central hearth. Other features and dateable carbon were rare. Ceramic vessels included bowls, jars and flared-rim bowls with fabric-impressed, slipped, punctated, and cord-impressed surface treatments. The entire artifact assemblage is consistent with the Early Woodland Tchula period, with an estimated occupation between ca. 400 – 100 B.C. (Weaver et al. 1999). Additional, fairly large (>2 ha) Tchula period sites are known from western Tennessee (Mainfort 1994; Rolingson and Mainfort 2002:23). Tchula pottery and sites occur in the lower Mississippi River basin, including parts of Mississippi, Louisiana, Arkansas, and west Tennessee (Kidder 2002:68-72; Rafferty 2002:205-207), but do not appear to reach the lower Tennessee Valley.

### *Middle Woodland Period*

Larger villages and associated middens, as well as monumental architecture and localized artifact assemblages, point to an increase in sedentism throughout the Southeast. Middle Woodland (200 B.C. to A.D. 600) subsistence practices focused on hunting, fishing, and collecting shellfish, as well as gathering wild plant foods and harvesting cultivated crops. Animal resources include deer and other wild game, such as black bear, raccoon, opossum, beaver, turkey, frogs/toads, box and other aquatic turtles, non-poisonous snake, catfish, redhorse, suckers, drum, gastropods, and mussels (Bogan 1982:41; Cridlebaugh 1981; Schroedl 1978, 1990; Wetmore et al. 2000:142). Wild nuts and fruits, including the standard hickory, acorn, and walnut, as well as hazelnut, chestnut, grape, cherry/plum, hawthorn, honey locust, persimmon, maypop, sumac, blueberry, blackberry/raspberry, and hackberry occur. Horticulture had become firmly established, with small grains being a major diet component (Gremillion 2002; Yarnell and Black 1985). Horticultural practices are indicated by the recovery of chenopod, sunflower, sumpweed, little barley, maygrass, amaranth, knotweed, and smartweed (Chapman and Shea 1981; Cridlebaugh 1981; Schroedl 1990:68-71; Tickner 2007; Wetmore 2002:260, 265; Wetmore et al. 2000:141-142). Weedy seeds such as bedstraw, carpetweed, copperleaf, purslane, sedge, and members of the Aster, Grass, Legume, Rose, and Spurge families (Chapman and Shea 1981; Cridlebaugh 1981; Tickner 2007; Wetmore 2002:260; Wetmore et al. 2000:142) also point to the presence of disturbed ground (gardens) in the vicinity of Middle Woodland sites. Additional economic plants represented at Middle Woodland sites include bearsfoot, cattail, and pokeweed (Chapman and Shea 1981; Wetmore 2002:265).

Much of what is known about the Middle Woodland period in west Tennessee is due to research at Pinson Mounds. Pinson Mounds figuratively and literally dominate the archaeological landscape of western Tennessee. The complex covers in excess of 400 acres and stretches for approximately two miles above the Forked Deer River. At least 12 mounds occur at the site, including the second tallest mound in the United States (Mound 9 is 22 m [72 ft.] tall). Ceremonial habitation areas and a roughly circular enclosure are also present. Numerous burials included mica, galena, copper, copious amounts of *Marginella* beads, freshwater pearl necklaces, engraved rattles carved from human parietals, ground stone artifacts, chipped stone tools and micro-blades of exotic cherts. Pan-regional interaction is evident from the trade items brought from the upper Midwest, Atlantic Coastal region, and the Gulf Coast (Walthall 1980). Excavation at Pinson Mounds in Madison County has yielded pottery and stone tools of Ohio Hopewell origin, indicating Middle Woodland cultures in Tennessee were engaged in some interaction with the Hopewell culture centered on the Ohio River Valley. This site was likely part of a broader exchange system among Middle Woodland people that reached as far south as Crystal River, Florida. Cranial deformation, non-local burial goods, and monumental architecture highlight the intricate ceremonialism associated with the Middle Woodland. Nearly 40 dates show the main activity at Pinson occurring from the first through third century A.D. (Mainfort 1986; Mainfort and McNutt 2004; Rolingson and Mainfort 2002; Thunen 1998).

The introduction of sand-tempered, cord-marked ceramics is a standard temporal marker for the beginning of the Middle Woodland period on the Coastal Plain. Excavations at Pinson Mounds have yielded sand, sand and clay, and clay tempered ceramic sherds, all with nearly identical surface treatment (Mainfort 1986). Diagnostic Middle Woodland projectile points in western Tennessee consist of a tapered shoulder cluster, lanceolate expanding haft element cluster, and lanceolate spike cluster (Ensor 1981).

Autry and Hinshaw (1981:63) noted that numerous sites in the lower Tennessee Valley have Middle Woodland occupations. Unfortunately, most of those sites are not well documented, typically lacking controlled excavation data, analysis, and/or write up. They felt that Middle Woodland ceramics from the lower Tennessee Valley indicate wider relationships with groups in middle Tennessee and the middle Tennessee Valley. Kerr (1996:272-277) noted a significant increase in the number of Middle Woodland sites in the lower valley. He also identified at least a dozen different ceramic types, many of them common to the middle section of the valley. Numerous phases have been identified in middle Tennessee and the middle valley that may be relevant to the lower valley and west Tennessee.

Owl Hollow Phase (A.D. 300-A.D. 800) sites are highly organized, have dense middens, and are only located in broader river valleys. Smaller extractive camps have not been documented. Domestic structures are characterized by large, oval winter houses with double earth ovens paired with warm-season oval or square houses. Houses were occasionally built around a midden-free, plaza-like area. Maize occurs occasionally in food-processing pits, and deep storage pits have been documented. These factors indicate that horticulture on the broad floodplains had become an important part of the subsistence pattern. Burial patterns included cremation clusters as well as in-flesh interments. Ceramics continued to be limestone tempered, with simple stamping and, later, plain surface treatments. Shallow side-notched and spike-type PP/Ks are diagnostic, along with a distinctive chert micro-tool industry. After A.D. 600, the Owl Hollow Phase is not as well documented, but it may continue through A.D. 800 or later (Faulkner 2002:196-199).

Toward the end of the WPA work in the lower Tennessee Valley, excavations turned to sites with Woodland occupation for the sake of studying the Woodland, rather than excavating through those zones in order to focus on Archaic occupations. One of those sites was the Burton's Landing site (40DR6) in the Busseltown unit of the Tennessee National Wildlife Refuge (TNWR). Excavation focused on several shell deposits that contained Middle Woodland artifacts, but no structures or pit features. Five separate strata were investigated. Long Branch Fabric Marked and Mulberry Creek plain sherds were recovered in lower strata while Flint River Cord Marked and Mulberry Creek cord marked sherds were recovered from the upper strata. Lithic materials included Little Bear Creek and Copena variants. Burton's Landing, along with several other sites (Hog Creek, Burton's Spring Site, 40DR1, 40DR11 and 40DR43), were used to define the Decatur Focus in the lower valley. The Decatur Focus appears to be entirely too broad today to be a useful classification, as it includes cultural material spanning at least from the Gulf Formational/Early Woodland through the Late Woodland periods (Autry and Hinshaw 1981:63-64; Lewis and Kneberg 1947).

Peterson (1973) also investigated a Middle Woodland occupation at the Spring Creek site in the lower valley. The mostly plowed-out Copena occupation included a hearth and small pit, which were the only features identified. Several Copena PP/Ks were recovered from the plowzone. Ceramics associated with the hearth were all limestone tempered, with plain, fabric impressed and check stamping being the dominant surface treatments. A single Cormorant Cord Impressed rim sherd was also recovered.

Kerr (1996:33-34) also noted Crab Orchard and Baumer foci in the lower Tennessee and Cumberland River valleys. Ceramics are the primary distinguishing characteristic between the two. Baumer ceramics are grog/limestone tempered, while Crab Orchard series tend to be grog/grit tempered. Both series are typically fabric marked with some cord marking. Crab Orchard ceramics are associated with Adena/Cypress Stemmed cluster PP/Ks, with Snyders cluster PP/Ks occurring later. Settlements are typically large with dense concentrations of midden and features.

### *Late Woodland Period*

The Late Woodland Period (A.D. 900-1650) in middle Tennessee is not as well understood as other time periods. It is often viewed as a culturally less complex time, with smaller and more dispersed sites (Kerr 1996:35). Fewer, less intensively occupied sites have been identified, marking a significant shift from the previous Owl Hollow Phase. This period marks the decline and in some areas the disappearance of inter-regional trade and earthwork construction that marked the socio-cultural peak of the Middle Woodland period. Hunting and gathering, along with some horticulture, continues to be the main source of subsistence.

Autry and Hinshaw (1981:64-66) and Kerr (1996:278-282) noted that Late Woodland sites are rather numerous in the lower Tennessee Valley. They are also consistently part of much larger multi-component sites. Controlled excavations on Late Woodland sites/components are lacking and surface collections and shovel testing can only provide so much information. Diagnostic artifacts include Jacks Reef and small triangular (Hamilton, Madison) PP/Ks. A shift from larger projectile points to smaller triangular projectile points (Madison, Hamilton) which can be Late Woodland or Mississippian is thought to reflect the advent of the bow and arrow in Late Woodland times. Ceramics characterized by grog tempering appear widely in western Tennessee. Diagnostic types in the lower valley include Wheeler Check Stamped, McKelvey Plain, Coles Creek Incised, and a predominance of Mulberry Creek Cord Marked over Baytown Plain (Smith 1996). During the Late Woodland, population in the Mississippi River valley, like the Tennessee Valley, remained constant or even increased. An argument has been made, however, that the west Tennessee Coastal Plain was largely abandoned at that time (Mainfort 1994:16).

## MISSISSIPPIAN STAGE (A.D. 900–A.D. 1600)

The Mississippian stage is marked by a distinct shift in political, social, and general cultural conditions in the Southeast. The foundation for Mississippian society is believed to have its source in the Mississippi Valley, but quickly spread east and incorporated local variations. Pottery with shell tempering appeared; small, triangular points (Hamilton and Madison types) were prevalent; and floodplain horticulture centered on maize agriculture, and eventually the triad of maize, beans, and squash was cultivated. Massive ceremonial centers, such as Cahokia and Moundville, were constructed. The Mississippian is divided into Early (roughly A.D. 900–A.D. 1300) and Late (roughly A.D. 1300–A.D. 1450) periods, each with more regional phases. As with much of the archaeological data from the region, most of the excavations of Mississippian sites in the lower Tennessee Valley were conducted by the WPA prior to reservoir inundation. Nearly all of these data, especially in Tennessee, remain unanalyzed and unpublished.

### *Early Mississippian Period*

In the lower Tennessee Valley in Kentucky, the Early Mississippian phase is known as Jonathan Creek (A.D. 900-1300). The phase classification is based on excavations at the type site, a large fortified town with three large mounds and a central plaza in Marshall County, Kentucky (Webb 1952). Early structures ringed the plaza and mounds, and were more or less square with individual set posts. Later structures were constructed by setting posts in wall trenches. Nearly 90 structures were identified in the southern portion of the village. Eight separate palisade lines, not all necessarily dating to the Jonathan Creek Phase, encircled the village. The palisaded area ranged from five to eleven acres. Burials at Jonathan Creek were limited; some contained small open bowls or water bottles, and bone artifacts; one included a celt. At least some of the interments were in stone boxes. The economy was most likely based on maize agriculture, hunting and gathering. Diagnostic PP/Ks are small, triangular PP/Ks (Madison cluster). Pottery tends to be shell-tempered plain jars, bowls and pans. Specific types include Mississippian Plain, Bell Plain, Kimmswick Fabric Impressed and McKee Island Cord Marked. Although the Jonathan Creek site itself is a large, palisaded village, smaller sites such as individual farmsteads have been reported (Autry and Hinshaw 1981:67-68; Clay 1979; Kerr 1996:38; Lewis 1986:132-133; Webb 1952).

In the lower Tennessee Valley in Tennessee, multiple sites including Odle (40BN23), Patterson (40HS12), Hobbs (40HS44), Lick Creek (40BN30), Williams (40HY1), Thompson Village (40HY5), Gray Farm (40SW1) and Standing Rock (40SW2) were investigated by WPA crews but, again, published data are lacking and distinguishing between Early and Late Mississippian is difficult. Based on at least photographic data, Autry and Hinshaw (1981:68) attributed structures at Hobbs and Odle to the Jonathan Creek Phase, indicating at least Early Mississippian occupations at those sites.

A few Early Mississippian sites, many mound complexes, have been recorded in the west Tennessee Coastal Plain. The Kenton group (40OB4) is a cluster of several mounds marked by a paucity of artifacts (Mainfort 1994:17, 109-110). Mainfort (1992, 1994) has interpreted the site as one of a number of vacant ceremonial centers. More recently, Goddard (2011) has reported on the Early Mississippian occupation at the Ames site (40FY7). The site had been described as the "empty ceremonial center at 40FY7" (Peterson 1979a, in Goddard 2011:15), similar to Kenton and others. Systematic research, including surface collection, shovel testing, extensive geophysical work and test unit excavation, has identified multiple domestic structures, a palisade line and a series of large, midden-filled pits (Goddard 2011). Although surface collection failed to recover a significant artifact assemblage, it certainly appears that Ames was not as vacant as previously thought. Excavation at Kenton and similar sites should provide comparative data. A wall-trench house was also identified at Pinson that probably represents an isolated Early Mississippian farmstead. Surveys in the general area have identified other small sites that are probably comparable (Mainfort 1986).

### *Middle to Late Mississippian Periods*

In the lower Tennessee Valley in Kentucky, the Late Mississippian period is known as the Tinsley Hill Phase (ca. A.D. 1300-1450). The settlement systems and economy of Tinsley Hill Phase are consistent with the previous Jonathan Creek Phase. The Tinsley Hill site was a small Mississippian center with an associated cemetery and a sub-structure mound. Pottery is shell tempered and contains much more decoration than Jonathan Creek assemblages. Both share the same types mentioned above, but Kimmswick Plain, Nashville Negative Painted, var. Nashville, Matthews Incised, vars. Matthews, Beckwith and Manly, O'Byam Incised, var. Stewart, and Tolu Interior Fabric Impressed were also recovered from the Tinsley Hill site (Clay 1979; Lewis 1986:145-147). Several excavated but unpublished sites on the Tennessee side of the lower valley probably are Tinsley Hill Phase. Structural data are available that supplement the Tinsley Hill data. Excavations at Thompson Village (40HY5), Gray (40SW1) and William (40HY1) all identified Late Mississippian occupations. Three structure types were identified: 1) square with posts set in trenches; 2) rectangular, about four to six meters on a side, with posts in trenches and rounded corners; and 3) square to rectangular with posts set in individual holes without wall trenches (Autry and Hinshaw 1981:68).

In addition to data on Late Mississippian structures, over 200 burials were excavated on the aforementioned and earlier Mississippian sites. Autry and Hinshaw (1981:75) suggested that accompaniments of exotic materials in burials indicate social stratification. Additionally, many of the burials were in stone boxes.

In a survey of the Kentucky Lake region, Kerr (1996) recorded 40 habitation sites with Mississippian occupations. Six earth and two stone mounds were recorded on seven of the Mississippian sites. The mounds are probably Mississippian, but survey data could not verify that, as several of the sites were multi-component. It was also difficult to distinguish Early vs. Late Mississippian components based on the ceramic assemblages. While surface collections of mostly plain, shell-tempered sherds are of limited utility beyond indicating they are Mississippian, some of the difficulty in establishing chronology comes from the lack of published excavation data, especially on the Tennessee side of the lower valley.

Similar to the Late Woodland, Late Mississippian sites tend to cluster along the Mississippi and Tennessee rivers. Sites in the interior, however, are generally absent (Mainfort 1994:18).

# HISTORIC BACKGROUND

*Valerie Altizer*

Hardeman County lies within the West Tennessee Uplands ecoregion, a region that served as a hunting territory of the Chickasaw Indians at the time of European contact. The range of the Chickasaws, based in northern Mississippi and Alabama, included all of West Tennessee and a portion of Middle Tennessee (Satz 1998). Despite the acceleration of Chickasaw-European contact after 1763, the Chickasaw remained in control of the region throughout the 1700s. The American government in 1786 formally recognized Chickasaw land claims in Tennessee and began sending trade goods to the Lower Chickasaw Bluffs on the Mississippi River near present-day Memphis. In 1792, William Blount signed a treaty of peace with the Chickasaws, who provided a barrier between the Cumberland settlements and hostile tribes such as the Creeks. The United States subsequently established a trading house on the Lower Chickasaw Bluffs in 1802. Encouraged to buy on credit, the Chickasaw became increasingly dependent upon trade goods. Through treaties negotiated by Andrew Jackson in 1805, 1816, and 1818, economic coercion among other tactics was used to acquire nearly 20 million acres of land in Tennessee from the Chickasaws. With the Jackson Purchase Treaty of 1818, the Chickasaw relinquished control of all their lands in West Tennessee. Hardin and Shelby counties were created after the Jackson Purchase in 1818. Hardin County included the lands that would later be designated Hardeman County by the Tennessee General Assembly in 1823 after Thomas Jones Hardeman, a veteran of the War of 1812. Euro-American settlers began arriving quickly, with most migrating from Middle Tennessee, Virginia, South Carolina, North Carolina, and Kentucky. The county seat was established on the Hatchie River and named Hatchie Town. Due to its location on the river, the early town suffered from flooding and was relocated a mile to the south after about a year. In 1824, the county commissioners officially named the town Bolivar in honor of South American patriot Simon Bolivar, and the town was incorporated in 1847 (Davidson 2009).

Chickasaw tribal members continued to hunt in this area after the 1818 treaty, but when the Indian Removal Bill was passed in 1830, President Andrew Jackson met with tribal leaders and secured a provisional removal agreement. Removal of the Chickasaw to the west was carried out in 1837 (Satz 1998). A detachment of the Cherokee tribe, under the direction of John Bell, passed through Bolivar and Hardeman County in November of 1838 during the removal. The detachment crossed the Hatchie River by ferry near what was known as the "Stage Road to Purdy" and continued on the Bolivar-Somerville Road into Fayette County (Nance 2001:37).

The economy of Hardeman County has historically focused on the production of cotton and lumber (Davidson 2009). Hardeman County was quickly identified as a good location to grow cotton in the early 1800s. The plentiful, relatively cheap agricultural lands proved conducive to the rise of Southern plantations in the county; however, this economy was dependent upon the institution of slavery. The location of Bolivar on the Hatchie River, which feeds into the Mississippi, allowed it to serve as a port to ship the product. The production of cotton as a cash crop in Fayette and Hardeman Counties increased significantly from 1840 to 1860, and this region of West Tennessee in general experienced a period of prosperity for the landowners. A significant steamboat trade operated on the Hatchie River during the 1830s and 1840s, allowing goods manufactured in the north to be transported to the plantation homes built in the area (Davidson 2009). Census schedules reveal that this reliance upon slave labor resulted in a population of 7,108 enslaved African-Americans in 1850, or 41 percent of the total population (DeBow 1850; Barrett and Karpynec 2006).

With the arrival of the railroad in Hardeman County in 1854, the town of Grand Junction was established at the junction of the Memphis and Charleston and the Mississippi Central Railroads, previously known as Moore’s Crossroads. In 1856, the Mississippi Central Railroad extended a line to Bolivar. The operation of the railroad eventually led to the demise of the river port at Bolivar in the 1880s (Davidson 2009). The presence of the railroad lines also made Hardeman County a target for both Union and Confederate armies during the Civil War who wanted to control the rail lines. Major battles took place in the county, including the Battle of Davis Bridge near Pocahontas on the Hatchie River, which involved more than 20,000 soldiers. Other battles occurred near Middleburg and Bolivar, destroying much of those towns as Union and Confederate troops fought for control of the railroad (APTA 2001).

As the Union Army entered the heavily slaveholding region of West Tennessee, they encountered large numbers of hungry fugitive slaves, many of whom had been supplying forced labor for the Confederates. In August of 1862, Chaplain John Eaton was ordered by General Ulysses S. Grant to establish the first “Contraband Camp” for fugitive slaves at the town of Grand Junction, so named for the formerly enslaved African Americans who were considered contraband under the Confiscation Act. By March of 1863 the “contrabands” at Grand Junction numbered 1,713. The army put those able to work at fifty cents per day on abandoned farms, government-supervised plantations, and military projects (Lovett 2009).

Recovery after the devastation of the Civil War was difficult since Hardeman County’s economy had been based largely on slave labor. This led to labor shortages after the war, and most farmers turned to sharecropping and borrowing money from the government to cover costs until harvests could be sold. Cotton prices fell sharply due to overproduction, and farmers began to diversify, planting corn, wheat, rye, rice, and growing livestock. The presence of the railroad allowed the shipment of lumber out of the county, and the economy of Hardeman County continued to focus on the production of hardwood and the county became known as the “Hardwood Capital of Tennessee” (APTA 2001).

In 1890, the Western State Mental Hospital opened near Bolivar on the farm of Paul T. Jones. During the twentieth century, the hospital became a major employer for the county. The number of patients grew to over 2,000 by the 1960s, but the hospital was plagued from its inception by inadequate state funding and poor living conditions for the patients. In more recent decades, the “deinstitutionalization” of the mentally ill has resulted in a marked decrease in the patient population although the hospital is still in operation (Austin 2009).

The current project area is located about nine miles south of the town of Bolivar in an area that has remained rural and agricultural. A 1923 map shows a few community buildings just outside of the western boundary of the project area, including Bowden

Chapel, Russell School, and Burnetts Mill (Figure 4). The Bowden Hill Christian Methodist Episcopal Church (CME) is the only one of these structures still standing. This church was established by African Americans as the center of the Bowden Hill community. The first CME church congregation was formed by African Americans in Nashville shortly after the end of the Civil War in 1866. This church was founded as the Capers Memorial Colored Methodist Episcopal Church, and its leaders had a prominent role in the creation of the formal CME convention four years later in 1870. In that year, Capers Church members, along with about forty other black Methodists in West Tennessee, broke from the Methodist Episcopal Church, South and formed their own independent denomination that they felt was more reflective of issues central to the black community. These issues included advanced education, community involvement through outreach, and spiritual growth. This founding group became the Colored Methodist Episcopal Church in America (CME) on December 16, 1870 in Jackson, Tennessee. In 1954 the CME Church changed its name from the Colored Methodist Episcopal Church to the Christian Methodist Episcopal Church (Van West 2000). Bowden Hill Church is still an active congregation led by the Reverend Jellory Stokes.

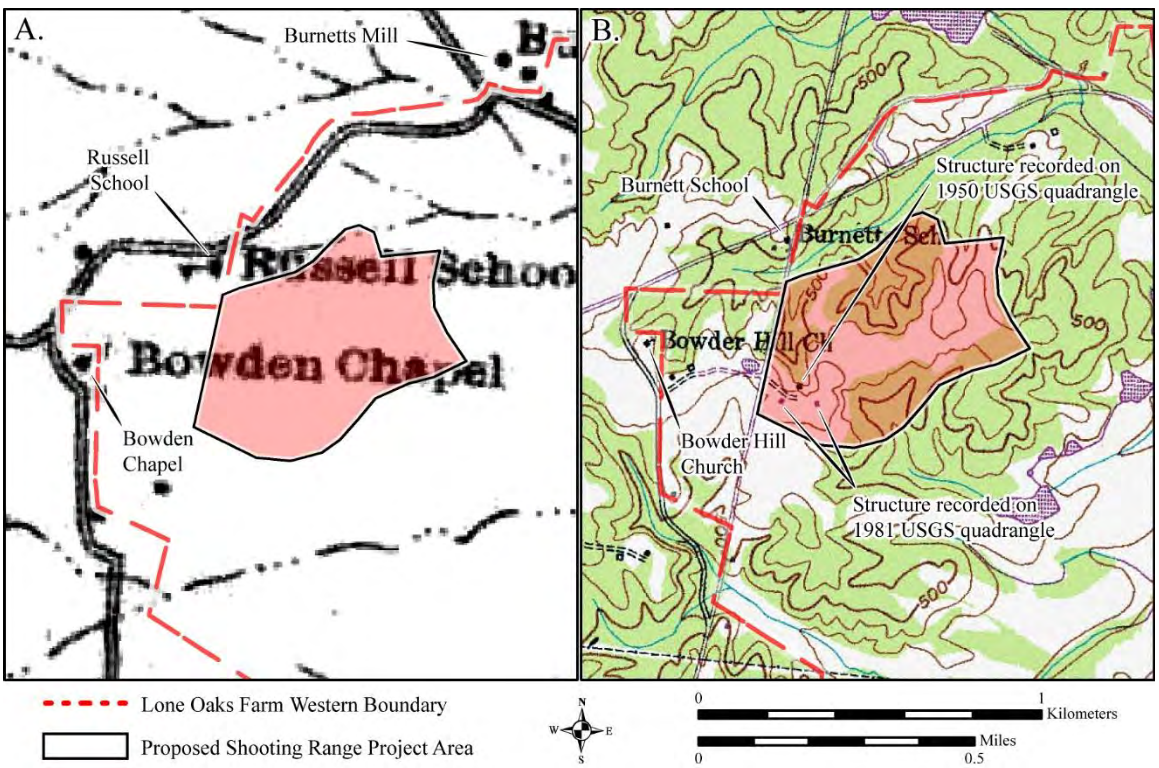



**Figure 4. A. 1923 map of Hardeman County, TN (Tennessee Board of Natural Resources 1923) illustrating the location of Burnetts Mill, Russell School, and Bowden Chapel with reference to the western boundary of the Lone Oaks Farm and the proposed shooting range project area. B. 1981 reprint of the 1950 Hebron 7.5' quadrangle (USGS 1981) illustrating the location of the Burnett School (previously Russell School) and Bowder Hill Church (previously Bowden Chapel). Also illustrated is the location of a structure built after the publication of the 1923 Hardeman County map and two structures built after the 1951 publication of the Hebron 7.5' quadrangle.**

In 1998, Memphis real estate developer Scott Ledbetter and his wife Kathy purchased the first of 32 parcels of land that would eventually make up the 1,200-acre Lone Oaks Farm, the location of the current project area. The properties were largely a blank slate when purchased, with no existing buildings or roads within the farm's boundaries (Zamudio 2015). This allowed the Ledbetters to hire a landscape architect to assist in planning the farm's layout, including roads, lakes, buildings, and agricultural facilities. All of the extant buildings and roads on the property were added by the Ledbetters, who eventually built eleven residences on the property, including houses, lodges, and cabins. Farm buildings including a barn, cattle handling facility, horse stable, event center and tool museum were also constructed. The University of Tennessee's Institute of Agriculture purchased 1,200 acres of the 2,000-acre property in 2015 to turn the farm into a regional 4-H camp and conference center for the children of West Tennessee to learn about agriculture and the environment (Ferree 2015). The current project area is comprised of an approximately 90-acre portion of Lone Oaks Farm that has been designated for a proposed shooting range by the UT Extension, a unit of the University of Tennessee's Institute of Agriculture.

Another University of Tennessee System Agricultural Research and Education Center was previously established in 1950 on the Ames Plantation, which encompasses 18,400 acres in Hardeman and Fayette Counties. This property is owned by the Trustees of the Hobart Ames Foundation, and it continues to serve as the location of intensive research efforts focusing on agriculture and natural resource management by the University of Tennessee. The plantation also contains over two hundred nineteenth-century historic sites including the manor house, an antebellum mansion constructed in 1847, along with a replica mid-nineteenth-century farmstead used as a cultural resource education facility. Each February the Ames Plantation also serves as the site of the National Championship Field Trials for all-age bird dogs, conducted annually at the Ames Plantation since 1915 (Evans 2009).

Hardeman County as a whole remains largely rural today with the majority of its economy centered on agricultural products like cotton, soybeans, wheat, livestock and corn in addition to the production of hardwood. After World War II, the county saw some growth in industry with the production of goods such as automotive parts, textiles, elevators, pyrotechnics, electrical switches, and clay products. Hardeman County is also the location of two of Tennessee's three private prisons, the Whiteville Correctional Facility and the Hardeman County Correctional Center which provide employment for county residents (Davidson 2009).

# METHODOLOGY

*Howard J. Haygood*

## Background Research

Prior to the initiation of the field component of this project, an examination of Tennessee Archaeological site files and survey reports was conducted to assess the presence and characteristics of previously recorded archaeological sites within the project area as well as to develop a better understanding of the types of archaeological resources expected during the course of the field survey. In addition, historical documents and maps, aerial photos, and USGS quadrangles were examined for evidence of previously unrecorded historic resources within the project area.

No previously recorded prehistoric or historic archaeological sites are present within the Lone Oaks Farm property boundary. Very few historic records are available for the area. The 1923 Hardeman County map shows no structures or features within the APE (Figure 4). The most informative record is the USGS Hebron 7.5-minute quadrangle topographic map. Initially published in 1951 and based on 1946 and 1950 survey data, the map illustrates a single structure in the western portion of the project boundary (Figure 4). Present on the 1981 Hebron quadrangle re-print are two additional structures approximately 50-m south of the earlier structure. Between the single northern structure and the two southern structures is an east-west trending primitive road. These mapped structure locations were examined through both shovel testing and pedestrian survey.

## Field Methodology

The field investigation employed two specific methodologies based on topographic characteristics. Areas exhibiting greater than 10 percent slope (i.e. the deeply incised gullies) were visually inspected with archaeologists spaced at 30-m intervals. A total of 39.5 acres were visually inspected during the Phase I survey (Figure 5).

Areas exhibiting less than 10 percent slope (i.e. the upland plateau) were tested using shovel test pits (STPs) spaced at 30-m intervals (Figure 5). A total of 42.8 acres were examined through shovel testing. The location of each STP was digitally mapped prior to fieldwork using the fishnet function in ArcGIS 10.4. The data were then transferred to a Trimble Geo7X global positioning system (GPS) capable of sub-meter accuracy. Using the GPS, STP locations were then marked across the APE and excavated.

STPs measured 30-cm square and were excavated to sterile subsoil. All soil and sediment removed from the STPs was screened through 6.4-mm (0.25-in) mesh hardware cloth. When artifacts were encountered, additional STPs were placed at 15-m intervals to the north, south, east, and west of the positive STP. Detailed descriptions of the encountered soils were recorded on standardized ARL shovel test forms. Artifacts recovered during the Phase I survey were collected, bagged, and returned to the ARL for further analysis.

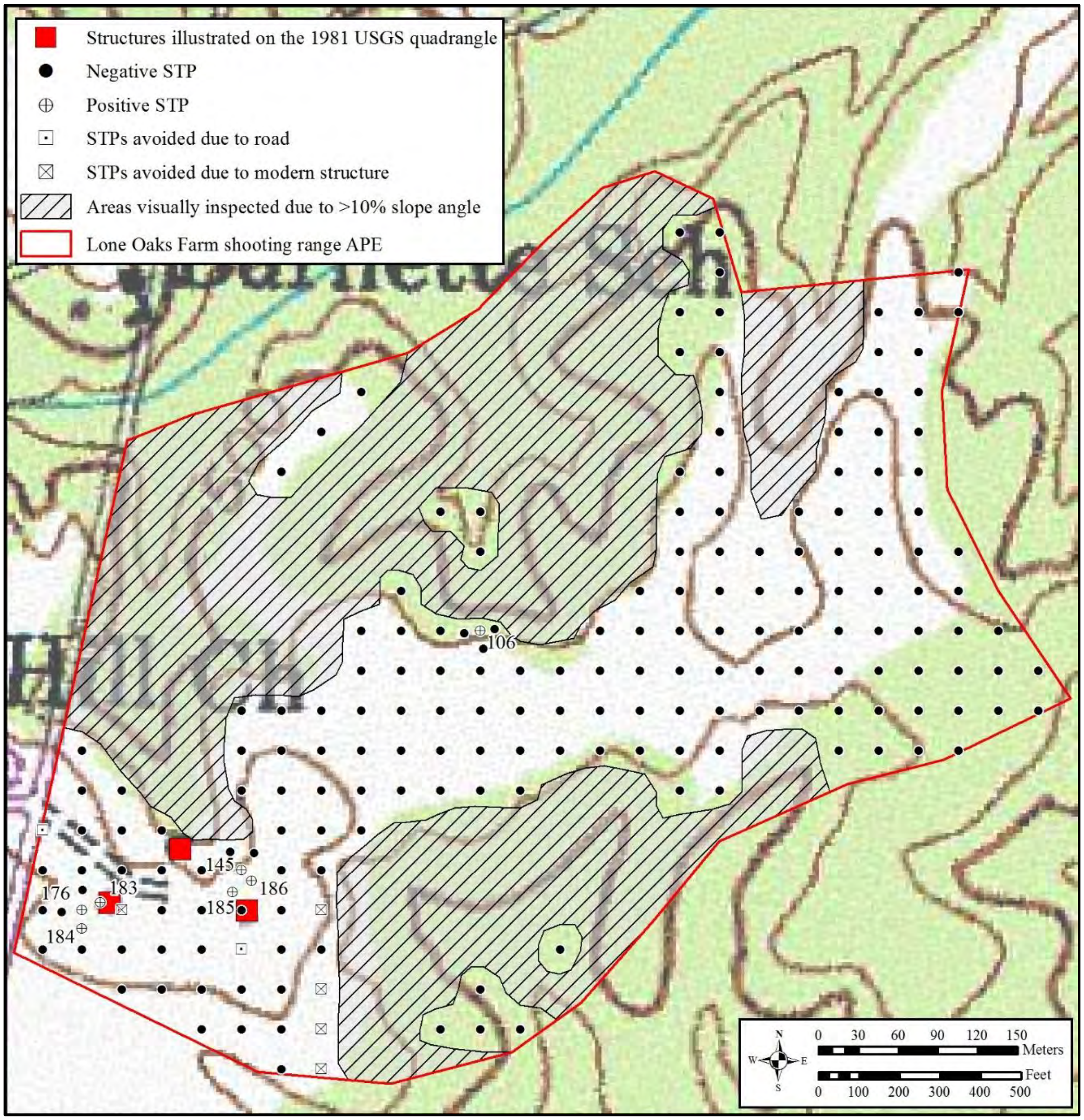



**Figure 5. Areas within the APE visually inspected and shovel tested during the Phase I archaeological survey. Also illustrated are the positive and negative STP locations and the possible structure locations previously mapped on the 1981 Hebron 7.5' quadrangle.**

## LAB METHODOLOGY

Artifacts recovered were washed, dried, and put in labeled, curation-quality bags. They and all the paperwork associated with the project will be curated at the University of Tennessee, Knoxville.

# RESULTS

No historic artifacts, features, or structures were identified during the visual inspection of the steeply sloped/gullied areas. No buried surface soil horizons were identified in either the gullied areas or in the STP profiles. As previously discussed, the soil profiles exposed in each STP revealed a thin topsoil layer (A horizon) overlying well-weathered subsoil. In places, a thin layer of the underlying subsoil was disturbed likely due to historic plowing.

A total of 191 STPs were excavated during the Phase I survey. Seven STP locations were avoided; two were located within the center of a modern road and five were located beneath modern structures. Figure 5 illustrates the location of positive and negative STPs. Table 1 lists the associated STP, recovery depth below surface (cmbs), classification, and material type of artifacts recovered.

**Table 1. Artifacts Recovered from Positive Shovel Test Pits.**

| STP | Depth (cm bs) | Artifacts | Material |
|---|---|---|---|
| 106 | 0-5 | One purple-tinted, glass bottle base fragment | Glass |
| | | One brick fragment | Brick |
| | | Three re-fitted scalloped plate whiteware fragments | Ceramic |
| 145 | 0-10 | One wire nail ~10-cm long | Metal |
| | | One segment of fencing wire ~13-cm long | Metal |
| 176 | 5-12 | One cut nail | Metal |
| 183 | 5-17 | Three small brick fragments | Brick |
| | | One scrap of flat metal | Metal |
| | | One wire nail ~5.5-cm long | Metal |
| | | One possible cut nail ~8.5cm long | Metal |
| 184 | 0-10 | One cut nail ~7-cm long | Metal |
| | | One clear glass bottle lip fragment | Glass |
| | | One clear glass bottle base fragment | Glass |
| | | One clear glass fragment | Glass |
| | | One clear flat glass fragment 2.02mm thick | Glass |
| 185 | 0-5 | One faunal rib fragment (poss. pig) | Bone |
| 186 | 0-16 | One wire segment 6-cm long | Metal |

Seven of the 191 STPs (3.7%) tested positive for cultural material. All artifacts were recovered from within 17-cm of the ground surface and date to the late historic/early modern period. Artifact assemblages consist of clear and purple-tinted glass fragments, fencing wire, brick fragments, cut and wire nails, and one faunal rib bone fragment. One positive STP (106, Figure 5) was isolated from the remainder of the positive STPs. Located near the edge of a northern facing slope adjacent to a gullied area, STP 106 consisted of three re-fitted scalloped plate-rim fragments, a single small brick fragment, and a single purple-tinted glass fragment and likely represents an isolated late historic trash dump.

Three of the positive STPs (STP 176, 183, and 184, Figure 5) were clustered near the location of the westernmost post-1951/pre-1981 structure illustrated on the 1981 Hebron 7.5' topographic map. These artifacts likely represent refuse associated with that structure. Three positive STPs (STP 145, 185, and 186, Figure 5) were clustered within 25-m of the easternmost post-1951/pre-1981 structure illustrated on the 1981 Hebron 7.5' topographic map. As with the westernmost cluster, these artifacts likely represent refuse associated with the eastern structure. No artifacts were found in the area of the post-1923/pre-1950 structure illustrated in Figure 4.

Figure 6 illustrates the field conditions of each historically mapped structure. Visual inspection and shovel testing near the structure locations illustrated on the 1951 and 1981 Hebron 7.5' quadrangle topographic map found no evidence of historic structures or features. The westernmost post-1951/pre-1981 structure location is likely beneath the recently constructed Roadhouse (Figure 6C). Given the thin and eroded nature of the surface soil horizon and the shallowness of the subsoil horizon, the likelihood of buried cultural features or structural components within any of the mapped structure locations is extremely low.

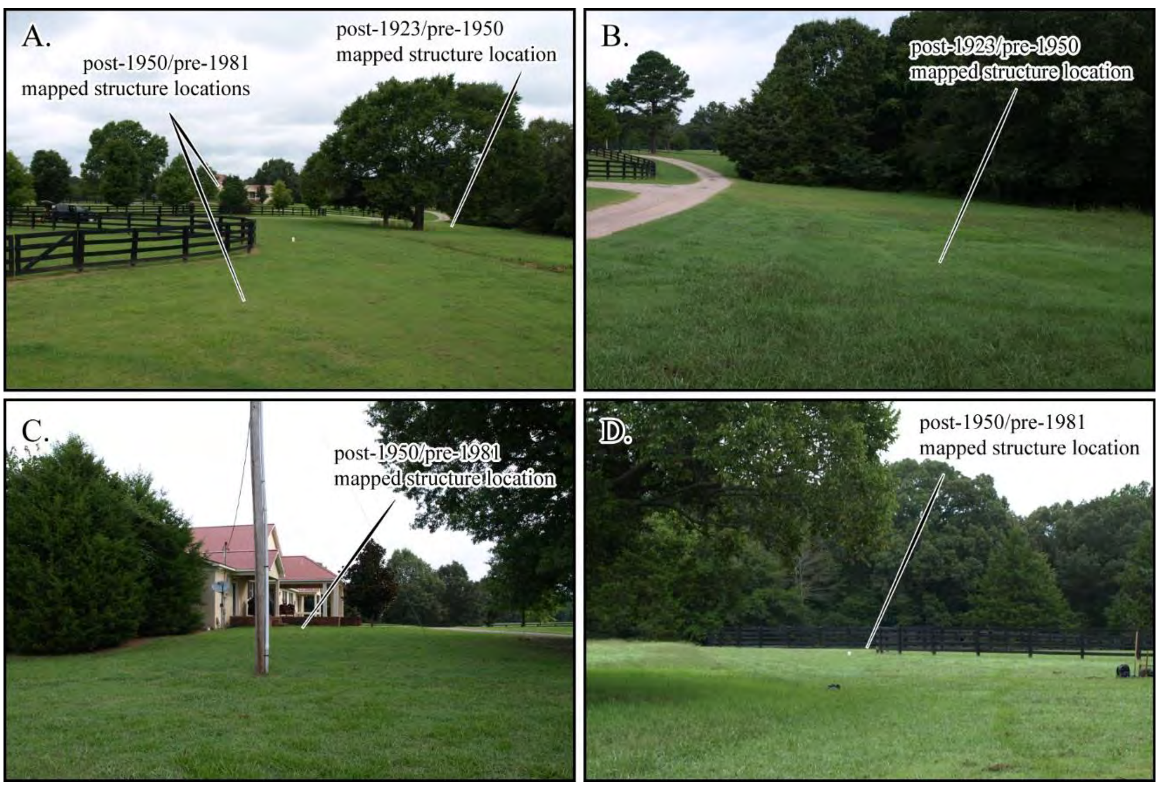



**Figure 6. A. Overview of mapped structure locations illustrated on the 1981 Hebron 7.5' topographic map (view to the west). B. Location of the post-1923/pre-1950 mapped structure (view to the northwest). C. Location of the western post-1950/pre-1981 structure (view to the north). D. Location of the eastern post-1950/pre-1981 structure (view to the east).**

# CONCLUSIONS AND RECOMMENDATIONS

From August 8 to August 12, 2016 the University of Tennessee's Archaeological Research Laboratory carried out a Phase I archaeological investigation for the proposed shooting range at the Lone Oaks Farm in Hardeman County, Tennessee. The project area encompasses 82.3 acres, 39.5 acres of which consisted of steeply sloped and gullied terrain and were visually inspected using archaeologists spaced at 30-m intervals. The remaining 42.8 acres were examined using 191 shovel test pits spaced at 30-m intervals.

Seven of the 191 STPs tested positive for cultural material. This included a distinct cluster of positive STPs near each of the two post-1951/pre-1981 structures illustrated on the 1981 Hebron 7.5' topographic map and a single isolated occurrence near the edge of a southern facing slope adjacent to a gullied area. All artifacts were recovered from within 17-cm of the ground surface and date to the late historic/early modern period.

No historic artifacts, features, or structures were identified during the visual inspection of the steeply sloped/gullied areas. Soil profiles exposed in each STP revealed a thin topsoil layer (A horizon) overlying well-weathered subsoil. No buried surface soil horizons were identified in either the gullied areas or in the STP profiles. Visual inspection and shovel testing near the structure locations illustrated on the 1951 and 1981 Hebron 7.5' quadrangle topographic map found no evidence of historic structures or features. Given the thin and eroded nature of the surface soil horizon and the shallowness of the subsoil horizon, the likelihood of buried cultural features or structural components within any of the mapped structure locations is extremely low.

Based on the results of the investigations, ARL recommends no further archaeological testing for the proposed Lone Oaks Farm shooting range installation and that the project should be allowed to proceed as planned. However, should any unanticipated artifacts, features or burials be encountered, the project must be halted and a qualified archaeologist should be contacted for an evaluation before work resumes.

# REFERENCES

Adair, Lou C.
1976 The Sims Site: Implication for Paleoindian Occupation. *American Antiquity* 41(3):325-334

Anderson, David G.
1989 The Paleoindian Colonization of Eastern North America: A View from the Southeastern United States. Paper presented at the 46th Annual Meeting of the Southeastern Archaeological Conference, Tampa, Florida.

1990 The Paleoindian Colonization of Eastern North America: A View from the Southeastern United States. In *Early PaleoIndian Economies of Eastern North America,* edited by Barry Issac and Kenneth Tankersley, pp. 163-216. Journal of Economic Anthropology Supplement No. 5.

1995a Paleoindian Interaction Networks in the Eastern Woodlands. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands,* edited by Michael Nassaney and Kenneth E. Sassaman, pp. 3-26. University of Tennessee Press, Knoxville.

1995b Recent Advances in Paleoindian and Archaic Research in the Southeastern United States. *Archaeology of Eastern North America* 23:145-176.

1996 Models of Paleoindian and Early Archaic Settlement in the Lower Southeast. In *The Paleoindian and Early Archaic Southeast,* edited by David G. Anderson and Kenneth E. Sassaman, pp. 29–57. University of Alabama Press, Tuscaloosa.

Anderson, David G., John E. Foss, Patrick H. Garrow, and Keith A. McRae
1987 Archaeological Survey Along the Obion River. Garrow and Associates, Inc., Atlanta. Report submitted to U.S. Army Corps of Engineers, Memphis District, Memphis.

Anderson, David G., and Glen T. Hanson
1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Valley. *American Antiquity* 53(2):262–286.

Anderson, David G., D. Shane Miller, Stephen J. Yerka, J. Christopher Gillam, Erik N. Johanson, Derek T. Anderson, Albert C. Goodyear, and Ashley M. Smallwood
2010 PIDBA (Paleoindian Database of the Americas) 2010: Current Status and Findings. *Archaeology of Eastern North America* 38:63-90.

Anderson, David G., and Lisa D. O'Steen
1992 Late Pleistocene/Early Holocene Environmental Conditions in the South Carolina Area. In *Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective*, edited by David G. Anderson, Kenneth E. Sassaman, and Christopher Judge. Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina.

Anderson, David G., Lisa D. O'Steen, and Kenneth E. Sassaman
1996 Environmental and Chronological Considerations. In *The Paleoindian and Early Archaic Southeast,* edited by David G. Anderson and Kenneth E. Sassaman, pp. 3–15. University of Alabama Press, Tuscaloosa.

Association for Preservation of Tennessee Antiquities (APTA)
2001 Hardeman County, Tennessee, Family History Volume II. Turner Publishing Company, Paducah, Kentucky.

Austin, Linda T.
2011 "Western State Mental Hospital." In *The Tennessee Encyclopedia of History and Culture*, Version 2.0. Electronic document, http://tennesseeencyclopedia.net/entry.php?rec=1493, accessed August 2016.

Autry, William O., Jr., and Jane S. Hinshaw
1981 *A Cultural Resource Reconnaissance of the Tennessee National Wildlife Refuge with Archaeological Survey of Selected Areas; Benton, Decatur, Henry, & Humphreys Counties, Tennessee*. Submitted to National Park Service and U.S. Fish and Wildlife Service, Region 4, Atlanta. Tanasi Archaeological Research Associates, Report No 1. Nashville, Tennessee.

Barrett, Jared and Ted Karpynec
2006 *Cultural Resources Survey of the Proposed 161-KV Hickory Valley Transmission Line, Hardeman County, Tennessee*. Submitted to the Cultural Resources Office, Tennessee Valley Authority, Knoxville, Tennessee.

Bense, Judith A.
1994 *Archaeology of the Southeastern United States: Paleoindian to World War I*. Academic Press, San Diego.

Bentz, Charles, Jr.
1996 *The Bailey Site (40GL26): Late Archaic, Middle Woodland, and Historic Settlement and Subsistence in the Lower Elk River Drainage of Tennessee*. Prepared for the Tennessee Department of Transportation, Nashville by the University of Tennessee, Transportation Center, Knoxville.

Bogan, Arthur E.
1982 Archaeological Evidence of Subsistence Patterns in the Little Tennessee River Valley. *Tennessee Anthropologist* 7(1):38-50.

Bogan, Arthur E., and Paul W. Parmalee
1983 *Tennessee's Rare Wildlife, Volume II: The Mollusks*. Tennessee Wildlife Resources Agency [and] Tennessee Conservation Department, Nashville.

Bowen, William R.
1979 The Late Archaic in the Upper Duck River Valley. *Tennessee Anthropologist* 4(2):140-159.

Bradbury, Andrew P., and Philip J. Carr
2009 Early Archaic Raw Material Use Patterns in Tennessee. *Tennessee Archaeology* 4(1-2):94-116.

Braun, Lucy E.
2001 *Deciduous Forests of Eastern North America*. Reprinted. The Blackburn Press, Caldwell, New Jersey. Originally published 1950, Hafner, New York.

Broster, John B., and Mark R. Norton
1996 Recent Paleoindian Research in Tennessee. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 288-297. University of Alabama Press, Tuscaloosa.

Broster, John B., Mark R. Norton, Bobby Hulan, and Ellis Durham
2006 A Preliminary Analysis of Clovis through Early Archaic Components at the Widemeier Site (40DV9), Davidson County, Tennessee. *Tennessee Archaeology* 2(2):120-127.

Broster, John B., Mark R. Norton, Dennis J. Stanford, C. Vance Haynes, Jr., and Margaret A. Jodry
1996 Stratified Fluted Point Deposits in the Western Valley of Tennessee. In *Proceedings of the 14th Annual Mid-South Archaeological Conference*, edited by R. Walling, C. Wharey, and C. Stanley, pp. 1-11. Panamerican Consultants, Inc. Special Publications 1.

Brown, Larry N.
1997 A Guide to the Mammals of the Southeastern United States. The University of Tennessee Press, Knoxville.

Cable, John S.
1996 Haw River Revisited: Implications for Modeling Terminal Late Glacial and Early Holocene Hunter-Gatherer Settlement Systems in the Southeast. In *The Paleoindian and Early Archaic Southeast,* edited by David G. Anderson and Kenneth E. Sassaman, pp. 107–148. University of Alabama Press, Tuscaloosa.

Cambron, James W., and David C. Hulse
1975 *Handbook of Alabama Archaeology: Part I Point Types*. The Archaeological Research Association of Alabama, Inc. Moundville, Alabama.

Carmody, Stephen Byrnes
2009 Hunter/Gatherer Foraging Adaptations during the Middle Archaic Period at Dust Cave, Alabama. Unpublished M.A. Thesis, Department of Anthropology, University of Tennessee, Knoxville.

Chapman, Jefferson
1977 Archaic Period Research in the Lower Little Tennessee River Valley—1975: Icehouse Bottom, Harrison Branch, Thirty Acre Island, Calloway Island. Report of Investigations No. 18. Department of Anthropology, The University of Tennessee, Knoxville.

1985a Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. In *Structure and Process in Southeastern Archaeology*, edited by Roy S. Dickens, Jr. and H. Trawick Ward, pp. 137-153. University of Alabama Press, Tuscaloosa.

1985b *Tellico Archaeology: 12,000 Years of Native American History*. Report of Investigations No. 43. Department of Anthropology, The University of Tennessee, Knoxville.

1994 *Tellico Archaeology: 12,000 Years of Native American History, Revised Edition*. University of Tennessee, Department of Anthropology, Report of Investigations 43. Knoxville.

Chapman, Jefferson, Paul A. Delcourt, Patricia A. Cridlebaugh, Andrea B. Shea, and Hazel R. Delcourt
1982 Man-Land Interaction: 10,000 Years of American Indian Impact on Native Ecosystems in the Lower Little Tennessee River Valley, Eastern Tennessee. *Southeastern Archaeology* 1(2):115–121.

Chapman, Jefferson, and Andrea Brewer Shea
1981 The Archaeological Record: Early Archaic Period to Contact in the Lower Tennessee River Valley. *Tennessee Anthropologist* 6:61–84.

Chapman, Jefferson, and Patty Jo Watson
1993 The Archaic Period and the Flotation Revolution. In *Foraging and Farming in the Eastern Woodlands,* edited by C. Margaret Scarry, pp. 27–38. University Press of Florida, Gainesville.

Childress, Mitchell R. and Camille Wharey
1990 Unit 4 Mound Excavations at the Chucalissa Site, 1960-1967. Paper presented at the 11th Annual Meeting of the Mid-South Archaeological Conference, Pinson, Tennessee.

Clay, R. Berle
1979 A Mississippian Ceramic Sequence from Western Kentucky. *Tennessee Anthropologist* 4(2):111-128.

Coe, Joffre L.
1964 The Formative Cultures of the Carolina Piedmont. *Transactions of the American Philosophical Society.* New Series 54(5).

Cridlebaugh, Patricia A.
1981 *The Icehouse Bottom Site: 1977 Excavations*. University of Tennessee, Department of Anthropology, Report of Investigations Number 35. Tennessee Valley Authority, Publications in Anthropology Number 34.

Crites, Gary D.
1996 Plant Remains. In *The Bailey Site (40Gl26): Late Archaic, Late Woodland, and Historic Settlement and Subsistence in the Lower Elk River Drainage of Tennessee*. Tennessee Department of Environment and Conservation Division of Archaeology, Miscellaneous Publications No. 2, edited by Charles Bentz, Jr, pp. 279–283. Tennessee Department of Transportation, Nashville.

Davidson, Faye Tennyson
2010 "Hardeman County." In *The Tennessee Encyclopedia of History and Culture*, Version 2.0. Electronic document, http://tennesseeencyclopedia.net/entry.php?rec=598, accessed August 2016.

Davis, R. P. Stephen, Jr.
1990 *Aboriginal Settlement Patterns in the Little Tennessee River Valley*. Report of Investigations No. 50. Department of Anthropology, The University of Tennessee, Knoxville.

DeBow, J. D. B.
1853 *The Seventh Census of the United States: 18*50. Robert Armstrong, Public Printer, Washington.

DeJarnette, David L., Edward B. Kurjack, and James W. Cambron
1962 Stanfield-Worley Bluff Shelter Excavations. *Journal of Alabama Archaeology* 8(1, 2):1–89.

Delcourt, Hazel R.
1978 Late Quarternary Vegetation History of the Eastern Highland Rim and Adjacent Cumberland Plateau of Tennessee. PhD dissertation, University of Minnesota, Minneapolis.

Delcourt, Hazel R., Paul A. Delcourt, and Elliot C. Spiker
1983 A 12,000-Year Record of Forest History from Cahaba Pond, St. Clair County, Alabama. *Ecology* 64(4):874–887.

Deter-Wolf, Aaron, Sean Norris, Marc Wampler, and Josh Tuschl
2004 *The Ensworth School Project: Archaeological Investigations at Site 40DV184, Davidson County, Tennessee*. Prepared for D. F. Chase, Inc. TRC, Inc., Nashville, Tennessee.

Dice, Lee
1943 *The Biotic Provinces of North America*. University of Michigan, Ann Arbor.

Driskell, Boyce N.
1992 Stratified Early Holocene Remains at Dust Cave, Alabama. In *Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective*, edited by David G. Anderson, Kenneth E. Sassaman, and Christopher Judge, pp. 273–278. Council of South Carolina Professional Archaeologists, Columbia.

1994 Stratigraphy and Chronology at Dust Cave. *Journal of Alabama Archaeology* 40(1-2):17-34.

1996 Stratified Late Pleistocene and Early Holocene Deposits at Dust Cave, Northwestern Alabama. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 315–330. The University of Alabama Press, Tuscaloosa.

Duellman, William E., and Samuel S. Sweet
1999 Distribution Patterns of Amphibians in the Nearctic Region of North America. In *Patterns of Distribution of Amphibians; a Global Perspective*, pp. 31–109, ed. by William E. Duellman. The Johns Hopkins University Press, Baltimore.

Ellerbusch, Elijah C.
2004 Paleoamerican Prismatic Blade Economy from the Nuckolls Site (40Hs60), Lower Tennessee River Valley, Tennessee. *Current Research in the Pleistocene* 21:35-38.

Ensor, H. Blaine
1981 Gainesville Lake Area Lithics: Chronology, Technology, and Use. University of Alabama, Office of Archaeological Research, Report of Investigations No. 13, Tuscaloosa.

Evans, Jamie
2010 "Ames Plantation." In *The Tennessee Encyclopedia of History and Culture*, Version 2.0. Electronic document, http://tennesseeencyclopedia.net/entry.php?rec=22, accessed August 2016.

Faulkner, Charles H.
2002 Woodland Cultures of the Elk and Duck River Valleys, Tennessee: Continuity and Change. In *The Woodland Southeast*, edited by David G. Anderson and Robert C. Mainfort, Jr., pp. 185-203. The University of Alabama Press, Tuscaloosa.

Faulkner, Charles H., and J. B. Graham
1966 *Westmoreland-Barber Site (40MI11), Nickajack Reservoir, Season 2*. Department of Anthropology, The University of Tennessee, Knoxville. Submitted to National Park Service, Contract No. 14-10-0131-01494.

Faulkner, Charles H., and Major C. R. McCollough
1973 *Introductory Report of the Normandy Reservoir Salvage Project: Environmental Setting, Typology, and Survey*. Report of Investigations 12. Department of Anthropology, The University of Tennessee, Knoxville.

Ferree, Lyda K.
2015 Lone Oaks Farm: 'A Labor of Love.' *The Jackson Sun* August 30, 2015. Jackson, Tennessee.

Futato, Eugene M.
1982 Some Notes on the Distribution of Fluted Points in Alabama. A Compilation of Fluted Points of Eastern North America by Count and Distribution: An AENA Project. *Archaeology of Eastern North America* 10:30–33.

1983 *Archaeological Investigations in the Cedar Creek and Upper Bear Creek Reservoir*. Report Submitted to the Tennessee Valley Authority. Report of Investigations 29. Office of Archaeological Research, The University of Alabama, Tuscaloosa.

Goddard, Eric
2011 Investigating Early Mississippian Community Patterning in the Mid-South Through Multiple-Method Survey of the Ames Site (40FY7) in Fayette County, Tennessee. Unpublished Master's thesis, The University of Memphis, Memphis, Tennessee.

Gremillion, Kristen J.
1996 The Paleoethnobotanical Record for the Mid-Holocene Southeast. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 99–114. University Press of Florida, Gainesville.

2002 The Development and Dispersal of Agricultural Systems in the Woodland Period Southeast. In *The Woodland Period Southeast*, edited by Robert Mainfort and David G. Anderson, pp. 483-501. The University of Alabama Press, Tuscaloosa.

2004 Seed Processing and the Origins of Food Production in Eastern North America. *American Antiquity* 69(2):215–233.

Griffin, James B.
1952 *Archaeology of Eastern United States*. The University of Chicago Press, Chicago.

Griffin, John W.
1974 *Investigations in Russell Cave, Russell Cave National Monument, Alabama.* Publication in Archaeology 13. National Park Service, Washington, D.C.

Hardeman, William, D.
1966 *Geologic Map of Tennessee, West Sheet*. State of Tennessee, Division of Geology, Nashville, Tennessee.

Hollenbach, Kandace D.
2009 Foraging in the Tennessee River Valley, 12,500 to 8,000 Years Ago. University of Alabama Press, Tuscaloosa.

Herbert, Joseph M.
1986 Archaeological Investigations at the Oldroy Site (40HI131): The Wade Phase and Terminal Late Archaic/Early Woodland Adaptations. In *Cultural Adaptations in the Shelby Bend Archaeological District*, edited by Daniel S. Amick, Mary Ellen Fogarty, and Joseph M. Herbert, pp. 132-194. Submitted to the National Park Service Southeast Archaeological Center, Tallahassee, Florida.

Hubbert, Charles M.
1989 Paleo-Indian Settlement in the Middle Tennessee Valley: Ruminations from the Quad Paleo-Indian Locale. *Tennessee Anthropologist* 14(2):148–164.

Hudson, Charles
1976 *The Southeastern Indians*. The University of Tennessee Press, Knoxville.

Jenkins, Ned J., David H. Dye, and John A. Walthall
1986 Early Ceramic Development in the Gulf Coastal Plain. In *Early Woodland Archaeology,* edited by Kenneth B. Farnsworth and Thomas E. Emerson, pp. 546–63.

Jones, J. Scott, John B. Broster, and Mark R. Norton
2010 Paleoindian Lithic Raw Material Use in the Tennessee River Valley. *Current Research in the Pleistocene* 27:105-107.

Justice, Noel D.
1987 Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States. Indiana University Press, Bloomington.

Keel, Bennie C.
1978 1974 Excavations at the Nowline II Site (40CF35). In *Sixth Report of the Normandy Archaeological Project*, edited by Major C. R. McCollough and Charles H. Faulkner, pp. 1-290. Report of Investigations 21, Department of Anthropology, University of Tennessee. Notes in Anthropology 4, Laboratory of Anthropology, Wright State University. Publications of Anthropology 19, Tennessee Valley Authority, Knoxville.

Kerr, Jonathan
1996 *Archaeological Survey of Kentucky Lake, Western Tennessee and Kentucky.* Submitted to the Tennessee Valley Authority. Cultural Resource Analysts, Inc., Contract Publication Series 96-14. Lexington, Kentucky.

Kellogg, Remington
1939 Annotated List of Tennessee Mammals. *Proceedings of the United States National Museum* 86(2):231-244.

Kidder, Tristam R.
2002 Woodland Period Archaeology of the Lower Mississippi Valley. In *The Woodland Southeast*, edited by David G. Anderson and Robert C. Mainfort, Jr., pp. 66–90. University of Alabama Press, Tuscaloosa.

Kimball, Larry R. (editor)
1985 *The 1977 Archaeological Survey: An Overall Assessment of the Archaeological Resources of Tellico Reservoir*. Report of Investigations No. 40. Department of Anthropology, The University of Tennessee, Knoxville.

Kuhne, Eugene R.
1939 *A Guide to the Fishes of Tennessee and the Mid-South*. Tennessee Game and Fish Commission, Nashville.

Lewis, R. Barry
1986 Mississippian Farmers. In *Kentucky Archaeology*, edited by R. Barry Lewis, pp. 127-159. The University Press of Kentucky, Lexington.

Lewis, Thomas M. N., and Madeline Kneberg
1947 *The Archaic Horizon in Western Tennessee*. Tennessee Anthropology Papers, Number 2. The University of Tennessee Record, Extension Series Vol. 23(4).

1958 *Tribes That Slumber: Indian Times in the Tennessee Region*. University of Tennessee Press, Knoxville.

1959 The Archaic Culture in the Middle South. *American Antiquity* 25(2):161-183.

Lewis, Thomas M. N., and Madeline Kneberg Lewis
1961 *Eva: An Archaic Site*. University of Tennessee Press, Knoxville.

Little, Keith J., Harry O. Holstein, Curtis E. Hill, and Pearl Jones
1997 *Archaeological Investigation of the Dry Creek Site*. Research Series, No. 2. Archaeological Resource Laboratory, Jacksonville State University, Jacksonville, Alabama.

Lovett, Bobby L.
2010 Contraband Camps. In *The Tennessee Encyclopedia of History and Culture*, Version 2.0. Electronic document, http://tennesseeencyclopedia.net/entry.php?rec=305, accessed August 2016.

Mainfort, Robert C., Jr.
1985 *An Archaeological Survey of Selected Localities Within the Obion-Forked Deer Drainage, West Tennessee*. Tennessee Department of Conservation, Division of Archaeology. Submitted to the U.S. Army Corps of Engineers, Memphis District.

1886a Pre- and Early Marksville Ceramics and Chronology in the Mid-South: a Perspective from Pinson Mounds. In *The Tchula Period in the Mid-South and Lower Mississippi Valley*, pp. 52-62. Mississippi Department of Archives and History, Archaeological Report No. 17.

1986b *Pinson Mounds: A Middle Woodland Ceremonial Center*. Research Series No. 7. Tennessee Division of Archaeology, Nashville.

1992 The Mississippian Period in the West Tennessee Interior. In *The Obion Site, An Early Mississippian Center in Western Tennessee*, by Elizabeth B. Garland, pp. 202-207. Report of Investigations 7, Cobb Institute of Archaeology, Mississippi State University, Starkville.

1994 *Archaeological Investigations in the Obion River Drainage: The West Tennessee Tributaries Project*. Research Series No. 10. Tennessee Division of Archaeology, Nashville.

Mainfort, Robert C., Jr., and Charles H. McNutt
2004 Calibrated Radiocarbon Chronology for Pinson Mounds and Middle Woodland in the Midsouth. *Southeastern Archaeology* 23(1):12-24.

McNutt, Charles H., John B. Broster, and Mark R. Norton
2008 A Surface Collection from the Kirk Point Site (40HS174), Humphreys County, Tennessee. *Tennessee Archaeology* 3(1):25-75.

McNutt, Charles H., and J. Bennett Graham
1967 *Archaeological Investigations at Kentucky Lake, Tennessee: 1965*. Memphis State University Anthropological Research Center, Occasional Papers, No. 1. Memphis, Tennessee.

McNutt, L. W., Jr., S. B. Marshall, and E. E. McDowell
1975 *Second Season of the Upper Delaware Valley Early Man Project.* Report Prepared for the National Geographic Society and National Science Foundation. Department of Anthropology, American University, Washington, D.C.

McNutt, Charles H. and Guy Weaver

1985 *An Above-Pool Survey of Cultural Resources Within the Little Bear Creek Reservoir Area, Franklin County, Alabama.* Memphis State University, Anthropological Research Center, Occasional Paper 13 and Tennessee Valley Authority Publications in Anthropology 45.

Meeks, Scott C.

1994 Lithic Artifacts from Dust Cave. *Journal of Alabama Archaeology* 40(1-2):79-106.

2000 The Use and Function of Late Middle Archaic Projectile Points in the Midsouth. *Office of Archaeological Services Report of Investigations* 77. The University of Alabama Museums, Office of Archaeological Services, Moundville.

Meltzer, David J., and Bruce D. Smith

1986 Paleo-Indian and Early Archaic Subsistence Strategies in Eastern North America. In *Foraging, Collecting, and Harvesting: Archaic Period Subsistence and Settlement in the Eastern Woodlands,* edited By Sarah Neusius, pp. 1-30. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Morse, Dan F., and Phyllis A. Morse

1983 Archaeology of the Central Mississippi Valley. Academic Press, San Diego, California.

Nance, Benjamin C.

2001 *The Trail of Tears in Tennessee: A Study of the Routes Used During the Cherokee Removal of 1838*. Tennessee Department of Environment and Conservation, Division of Archaeology, Nashville.

Nami, Hugo G., Mark R. Norton, Dennis Stanford, and John B. Broster

1996 Comments on Eastern Clovis Lithic Technology at the Carson-Conn-Short Site (40BN190), Tennessee River Valley. *Current Research in the Pleistocene* 13:62-64.

Nicholson, Charles P.

1997 *Atlas of the Breeding Birds of Tennessee*. The University of Tennessee Press, Knoxville.

Norton, Mark R., and John B. Broster

1992a 40HS200: The Nuckolls Extension Site. *Tennessee Anthropologist* 17:13-32.

1992b The Puckett Site (40SW228): A Paleoindian/Early Archaic Occupation on the Cumberland River, Stewart County, Tennessee. *Current Research in the Pleistocene* 9:34-35.

2008 An Overview of Paleoamerican Lithics at the Carson-Conn-Short Site (40Bn190), Benton County, Tennessee. *Current Research in the Pleistocene* 25:125-127.

Oakley, Carey B.
1975 Flora of the Bear Creek Watershed. In *Archaeological Investigations in the Little Bear Creek Reservoir*, by Carey B. Oakley and Eugene M. Futato, pp. 286–290. Report submitted to the Tennessee Valley Authority, Chattanooga by the Office of Archaeological Research, University of Alabama, University. Research Series 1. Office of Archaeological Research, University of Alabama, University.

Parmalee, Paul W.
1962 Faunal Remains from the Stanfield-Worley Bluff Shelter, Colbert County, Alabama. *Journal of Alabama Archaeology* 8(1-2):112-114.

Parmalee, Paul W., and Arthur E. Bogan
1998 *The Freshwater Mussels of Tennessee*. The University of Tennessee Press, Knoxville.

Peterson, Drexel A., Jr.
1973 *The Spring Creek Site, Perry County, Tennessee: Report of the 1972-1973 Excavations*. Memphis State University Anthropological Research Center, Occasional Papers, No. 7. Memphis State University, Memphis, Tennessee.

1979a *An Archaeological Survey and Assessment of the Wolf River Watershed.* Report submitted to the U.S. Department of Agriculture, Soil Conservation Service, Nashville, Tennessee.

1979b *An Archaeological Survey and Assessment of the Loosahatchie Watershed.* Report submitted to the U.S. Department of Agriculture, Soil Conservation Service, Nashville, Tennessee.

Rafferty, Janet
2002 Woodland Period Settlement Patterning in the Northern Gulf Coastal Plain of Alabama, Mississippi, and Tennessee. In *The Woodland Southeast*, edited by David G. Anderson and Robert C. Mainfort, Jr., pp. 204–227. University of Alabama Press, Tuscaloosa.

Roedel, Michael, and Gregory Kennedy
2005 *Compact Guide to Tennessee Birds.* Lone Pine Publishing International, Auburn, Washington.

Rolingson, Martha Ann, and Robert C. Mainfort, Jr.
2002 Woodland Period Archaeology of the Central Mississippi Valley. In *The Woodland Southeast*, edited by David G. Anderson and Robert C. Mainfort, Jr., pp. 20-43. The University of Alabama Press, Tuscaloosa.

Sassaman, Kenneth E.
1993 *Early Pottery in the Southeast: Tradition and Innovation in Cooking Technology.* University of Alabama Press, Tuscaloosa.

2006 Dating and Explaining Soapstone Vessels: A Comment on Truncer. *American Antiquity* 71(1):141-156.

Satz, Ronald N.
2010 Chickasaws. In *The Tennessee Encyclopedia of History and Culture*, Version 2.0. Electronic document, http://tennesseeencyclopedia.net/entry.php?rec=247, accessed 23 July 2011.

Schroedl, Gerald F.
1978 *The Patrick Site (40MR40), Tellico Reservoir, Tennessee*. Report of Investigations No. 25. Department of Anthropology, The University of Tennessee, Knoxville.

1990 *Archaeological Research at 40RE107, 40RE108, and 40RE124.* Report of Investigations No. 49. Department of Anthropology, The University of Tennessee, Knoxville.

Scott, A. Floyd, and William H. Redmond
1996 *Atlas of Amphibians in Tennessee*. The Center of Excellence for Field Biology, Austin Peay State University, Clarksville, Tennessee. Electronic document, http://apbrwww5.apsu.edu/amatlas/title.htm, accessed November 2013.

2008 *Atlas of Reptiles in Tennessee.* The Center of Excellence for Field Biology, Austin Peay State University, Clarksville, Tennessee. Electronic document, http://apbrwww5.apsu.edu/reptatlas/frames_file.htm, accessed November 2013.

Sherwood, Sarah C., Boyce N. Driskell, Asa R. Randall, and Scott C. Meeks
2004 Chronology and Stratigraphy at Dust Cave, Alabama. *American Antiquity* 69(3):533-554.

Smith, Gerald P.
1979 *Archaeological Surveys in the Obion-Forked Deer and Reelfoot-Indian Creek Drainages: 1966 Through Early 1975*. Chucalissa Museum, Department of Anthropology, Memphis State University, Memphis, Tennessee.

1996 The Mississippi River Drainage of Western Tennessee. In *Prehistory of the Central Mississippi Valley*, edited by Charles H. McNutt, pp. 97-118. The University of Alabama Press, Tuscaloosa.

Stanford, Dennis J., Elmo León Canales, John B. Broster, and Mark R. Norton
2006 Clovis Blade Manufacture: Preliminary Data from the Carson-Conn-Short Site (40BN190), Tennessee. *Current Research in the Pleistocene* 23:145-147.

Tennessee Board of Resources
1923 *Map of Hardeman County, Tennessee*. Electronic document: http://teva.contentdm.oclc.org/cdm/ref/collection/p15138coll23/id/65, accessed August 22, 2016.

Thomas, David W.
1997 *Soil Survey of Hardeman County, Tennessee*. USDA Natural Resources Conservation Service, Washington D.C.

Thunen, Robert L.
1998 Defining Space: An Overview of the Pinson Mounds Enclosure. In *Ancient Earthen Enclosures of the Eastern Woodlands*, edited by Robert C. Mainfort and Lynne Sullivan, pp. 57-67. University Press of Florida, Gainesville.

Tickner, Amanda

2007 Paleoethnobotanical Analysis. In *Archaeological Data Recovery investigations at 31SW311 for the ECBI EMS Building Utility Trench, Qualla Boundary, Swain County, North Carolina*, by Tasha Benyshek. TRC Garrow Associates, Inc., Chapel Hill, North Carolina. Draft report submitted to the Tribal Historic Preservation Office, Eastern Band of Cherokee Indians, Cherokee, North Carolina.

Tokar, Erik

2001 *Canis latrans*. Animal Diversity Web. Electronic document, http://animaldiversity.ummz.umich.edu/accounts/Canis_latrans/, accessed 18 August 2014.

Truncer, James

2004 Steatite Vessel Age and Occurrence in Temperate Eastern North America. *American Antiquity* 69(3):487-513.

Van West, Carroll

2000 *Powerful Artifacts: A Guide to Surveying and Documenting Rural African-American Churches in the South*. Center for Historic Preservation, Middle Tennessee State University, Murfreesboro, Tennessee.

Walker, Renee Beauchamp

2000 *Subsistence Strategies at Dust Cave: Changes from the Late Paleoindian through Middle Archaic Occupations.* Report of Investigations 78. Office of Archaeological Services, University of Alabama Museums, Moundville.

Walker, Renee B., Kandace R. Detwiler, Scott C. Meeks, and Boyce N. Driskell

2001 Berries, Bones and Blades: Reconstructing Late Paleoindian Subsistence Economy at Dust Cave, Alabama. *Midcontinental Journal of* Archaeology 26(2):169-198.

Walling, Richard, Laurence Alexander, and Evan Peacock

2000 The Jefferson Street Bridge Project: Archaeological Investigations at the East Nashville Mounds Site (40DV4) and the French Lick/Sulphur Dell Site (50DV6), Nashville, Davidson County, Tennessee. Submitted to the Tennessee Department of Transportation, Nashville by Panamerican Consultants, Inc., Memphis, Tennessee.

Walthall, John A.

1980 *Prehistoric Indians of the Southeast: Archaeology of Alabama and the Middle South*. University of Alabama Press, Tuscaloosa.

Walthall, John A., and Ned J. Jenkins

1976 The Gulf Formational Stage in Southeastern Prehistory. *Southeastern Archaeological Conference Bulletin* 19:43–49.

Ward, H. Trawick, and R.P. Stephen Davis Jr.

1999 *Time Before History: The Archaeology of North Carolina*. The University of North Carolina Press, Chapel Hill.

Weaver, Guy G., C. Andrew Buckner, Mitchell R. Childress, and Mary E. Starr
1999 *Archaeological Investigations at Three Sites Near Arlington, State Route 385 (Paul Barrett Parkway), Shelby County, Tennessee: Archaeological Testing at 40SY525 and 40SY526 and Archaeological Testing and Data Recovery at 40SY527*. Report submitted to The Tennessee Department of Transportation, Nashville, by Garrow & Associates, Inc., Memphis, Tennessee.

Webb, William S.
1952 *The Jonathan Creek Village; Site 4, Marshall County, Kentucky.* The University of Kentucky, Reports of Anthropology, Volume VIII, Number 1. University of Kentucky Press, Lexington.

Weigel, Robert D., J. Alan Holman, and Andreas A. Paloumpis
1974 Vertebrates from Russell Cave. In *Investigations in Russell Cave, Russell Cave National Monument, Alabama*, by John W. Griffin, pp. 81–85. Publication in Archeology 13. National Park Service, Washington, D.C.

Wells, Edward W., III
2006 Soapstone Vessel Chronology and Function in the Southern Appalachians of Eastern Tennessee. Unpublished Master's thesis, Department of Anthropology, University of Tennessee, Knoxville.

Wells III, Edward W., Sarah C. Sherwood, Kandace D. Hollenbach
2014 Soapstone Vessel Chronology and Function in the Southern Appalachians of Eastern Tennessee: The Apple Barn Site (40BT90) Assemblage. *Southeastern Archaeology* 33(2):168-188.

Wetmore, Ruth Y.
2002 The Woodland Period in the Appalachian Summit of North Carolina and the Valley and Ridge Province of East Tennessee. In *The Woodland Southeast*, edited by David G. Anderson and Robert C. Mainfort, Jr., pp. 249–269. University of Alabama Press, Tuscaloosa.

Wetmore, Ruth Y., Kenneth W. Robinson, and David G. Moore
2000 Woodland Adaptations in the Appalachian Summit of Western North Carolina: Exploring the Influence of Climate Change. In *The Years without Summer: Tracing AD 536 and its Aftermath.* Edited by Joel D. Gunn, pp. 139-149. BAR International Series 872. Oxford, England Archeopress.

Williams, Stephen
1957 The Island 35 Mastodon: Its Bearing on the Age of Archaic Cultures in the East. *American Antiquity* 22:359–373.

Yarnell, Richard A.
1993 The Importance of Native Crops during the Late Archaic and Woodland Periods. In *Foraging and Farming in the Eastern Woodlands,* edited by C. Margaret Scarry, pp. 13–26. University Press of Florida, Gainesville.

Yarnell, Richard A., and M. Jean Black
1985 Temporal Trends Indicated by a Survey of Archaic and Woodland Plant Food Remains from Southeastern North America. *Southeastern Archaeology* 4:93–106.

Zamudio, Maria Ines
2015 Proposed 4-H Center is Blue-Ribbon Worthy with $16M Price. The Commercial Appeal Memphis, February 1, 2015. Memphis, Tennessee.

**IPaC** **U.S. Fish & Wildlife Service**

# IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.



## Location

Hardeman County, Tennessee

## Local office

Tennessee Ecological Services Field Office

(931) 528-6481
(931) 528-7075

446 Neal Street

Cookeville, TN 38501-4027

# Endangered species

**This resource list is for informational purposes only and does not constitute an analysis of project level impacts.**

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

# Mammals

| NAME | STATUS |
| --- | --- |
| Indiana Bat Myotis sodalis<br>Wherever found<br>There is **final** critical habitat for this species. Your location does not overlap the critical habitat.<br>https://ecos.fws.gov/ecp/species/5949 | Endangered |
| Northern Long-eared Bat Myotis septentrionalis<br>Wherever found<br>No critical habitat has been designated for this species.<br>https://ecos.fws.gov/ecp/species/9045 | Threatened |
| Tricolored Bat Perimyotis subflavus<br>Wherever found<br>No critical habitat has been designated for this species.<br>https://ecos.fws.gov/ecp/species/10515 | Proposed Endangered |



# Reptiles

| NAME | STATUS |
| --- | --- |
| Alligator Snapping Turtle Macrochelys temminckii<br>Wherever found<br>No critical habitat has been designated for this species.<br>https://ecos.fws.gov/ecp/species/4658 | Proposed Threatened |

# Insects

| NAME | STATUS |
| --- | --- |
| Monarch Butterfly Danaus plexippus<br>Wherever found<br>No critical habitat has been designated for this species.<br>https://ecos.fws.gov/ecp/species/9743 | Candidate |

# Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

# Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.



Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

**The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location.** To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

| NAME | BREEDING SEASON |
| --- | --- |
| Chimney Swift *Chaetura pelagica*<br>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds Mar 15 to Aug 25 |
| Kentucky Warbler *Oporornis formosus*<br>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds Apr 20 to Aug 20 |
| Prairie Warbler *Dendroica discolor*<br>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds May 1 to Jul 31 |
| Prothonotary Warbler *Protonotaria citrea*<br>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds Apr 1 to Jul 31 |



# Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

**Probability of Presence** (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted

Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

**Breeding Season ( )**
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

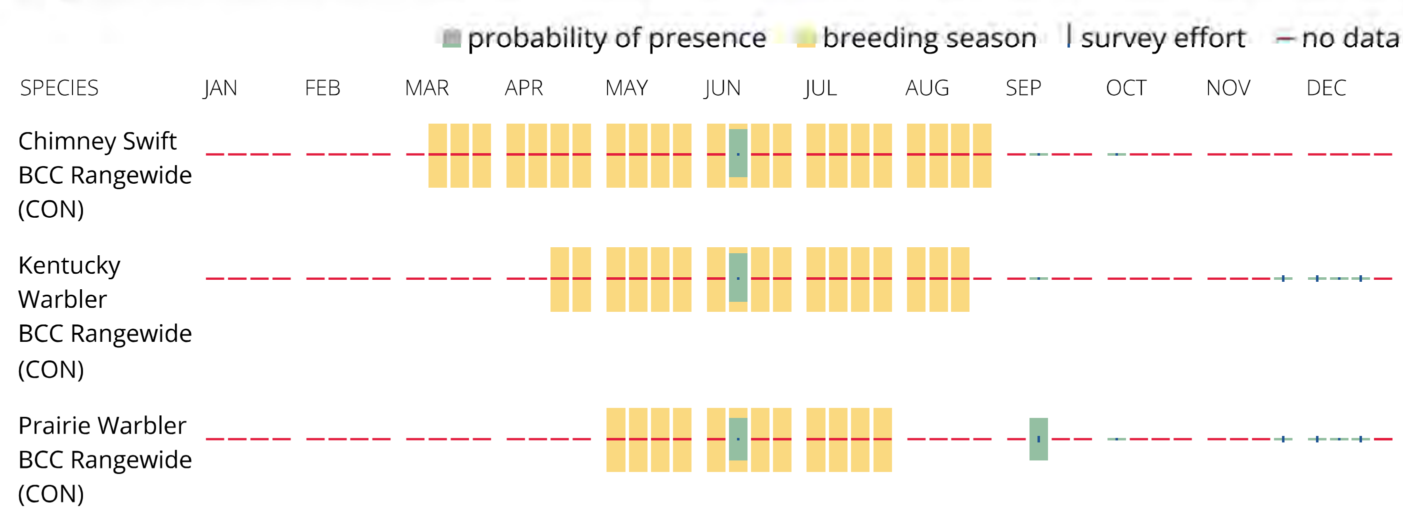
**Survey Effort** (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

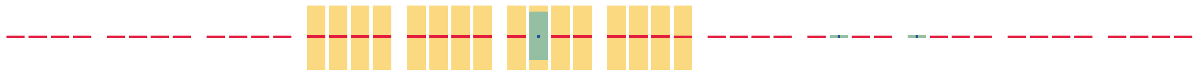
**No Data** (–)
A week is marked as having no data if there were no survey events for that week.

**Survey Timeframe**
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Prothonotary Warbler
BCC Rangewide (CON)



**Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.**

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

**What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?**

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

**What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?**

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

**How do I know if a bird is breeding, wintering or migrating in my area?**

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

**What are the levels of concern for migratory birds?**

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

**Details about birds that are potentially affected by offshore projects**

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

**What if I have eagles on my list?**

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

**Proper Interpretation and Use of Your Migratory Bird Report**

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

# Facilities

## National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

## Fish hatcheries

There are no fish hatcheries at this location.



# Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

### Wetland information is not available at this time

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

#### Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

#### Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

#### Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.