

US Army Corps
of Engineers
Memphis District

Public Notice

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**NOTICE DATE:
March 1, 2019**

Attn: Postmaster,
Please Post Until

**EXPIRATION DATE:
April 1, 2019**



Public Notice

U.S. Army Corps of Engineers

AUTHORITY: Pursuant to 33 CFR 332.8(d)(4) (Mitigation banks and in-lieu fee programs, public review and comment), this notice announces a prospectus submitted for the development of the Big Muddy Creek Tributaries Site of the West Tennessee Umbrella Stream Mitigation Bank (WTUSMB).

BANK SPONSOR: West Tennessee River Basin Authority (WTRBA)
3628 Eastend Drive
Humboldt, Tennessee 38343

LOCATION: The Big Muddy Creek Tributaries site of the WTUSMB is situated on land owned by the State of Tennessee property near the intersection of State Route 222 and Stanton-Somerville Road near Stanton, Haywood County, Tennessee. The project site lies within the Mississippi Valley Loess Plains (74) Level III Ecoregion, and the Loess Plains (74b) Level IV Ecoregion. The project's HUC8 is 08010208 (Lower Hatchie River) and the HUC12 is 080102080402 (Lower Big Muddy Creek). Project coordinates are 35.4078°N, -89.4132°W. See attached maps.

BACKGROUND: The WTRBA is a legislatively created organization that exists within the Tennessee Department of Environment and Conservation with the purpose of restoring and maintaining the waters within western Tennessee and providing leadership for the same. The Site is situated in the southeast portion of the Memphis Regional Megasite. The Megasite is a 4,100-acre parcel that has been prepared for future industrial development by the Tennessee Department of Economic and Community Development. The proposed mitigation Site will restore and protect aquatic resources at the gateway area to the Megasite.

PURPOSE: The purpose of this notice is to inform the public of the proposed WTUSMB, Big Muddy Creek Tributaries stream mitigation site that would generate credits that would be used to meet compensatory mitigation requirements for permits issued under Section 404 of the Clean Water Act for the deposition of dredged or fill material into waters of the United States or under Section 10 of the Rivers and Harbors Act of 1899 for work within navigable waters of the United States. If approved, this mitigation site would also be used to satisfy permitting requirements of the Tennessee Department of Environment and Conservation under the Tennessee Water Quality Control Act. The following is a summary of the prospectus for this project; please contact the Memphis District (see contact info below) for further information.

OBJECTIVES: The sponsor's stated objectives are as follows: The project includes the restoration of two first order tributaries to Muddy Creek; Unnamed Tributaries 1 (UT1) & 2 (UT2). Together the tributaries constitute 5,737 linear feet of incised channel. UT1 and UT2 will be elongated during the restoration process by constructing a meandering stream channel in place of the current streambeds. Construction of the meandering channel will mimic that of a natural streambed. UT1 will be extended from its current length of 3,202 feet to 3,438 feet. UT2 will be extended from its present length of 2,535 feet to 2,587 feet. Once completed, UT1 and UT2 will be extended a distance of 236 feet and 52 feet, respectively, for an overall restoration length of 6,025 linear feet. An analysis of historic aerial photography (Figure 4) indicates that historic land use disturbances associated with agriculture have caused significant straightening and channelization, which has greatly degraded the stream system. These modifications have disconnected the channel from the surrounding floodplain and have caused a loss in natural geomorphology and ecological function, as well as widespread bank instability. The goal of this

project is to address these deficiencies and restore both tributaries to type “C” and/or “E” stream channel conditions, as described in the Rosgen Classification of Natural Rivers (See Appendix A).

Hydrology Objective: Reduce erosion and turbidity by restoring channel with stable bank dimensions and gradual channel slope, as well as establishing necessary riparian buffer and channel dimensions to reduce runoff impacts from adjacent land use and manage flow from offsite ditches to avoid future incision of the new channel. Implement swales or other storm water management along the lower portions of lateral ditch systems where concentrated flow is currently causing channel bank erosion.

Hydraulics Objective: Reconnect channel to the floodplain by constructing new channel with appropriate dimensions and grade, establishing an entrenchment ratio greater than 2.2 and a bank height ratio of 1.0-1.2. Enhance floodplain drainage conditions by providing vegetative swales and reduced bank slopes to encourage sheet flow and surface storage.

Geomorphology Objectives: Establish a buffer of at least 50 feet on both sides of the new channel by pulling the proposed alignment away from roads and obstacles to vegetation wherever possible. Establish 90% coverage of channel banks with vegetation representing all 4 major classes (mature trees, understory trees, shrubs, and ground cover) and allow vegetation to grow naturally. Remove and monitor for invasive species.

Reduce sedimentation from stream bank erosion by creating channels that will remain stable with less than 10% of the banks actively eroding and attain a “Functioning” dominant BEHI/NBS rating. Reestablish necessary riparian buffer and bank stability conditions to reduce dominant bank erosion rate to 10% or less.

Restore a channel with riffles and pools utilizing woody debris and other installed structures for bed stability and to provide aquatic habitat. The established channel should provide greater than 70% stable habitat available for colonization by macroinvertebrates and fish. Produce pattern and profile in new channel that achieves an average riffle slope of <3% for between 60%-70% of the channel, and a pool to pool spacing ratio of between 4-5, with a pool max depth ratio >1.2.

Physicochemical Objective: Reduce turbidity, minimize fine organic sediment and increase presence of woody and leafy detritus, and increase water quality by removing areas of active erosion and enhancing the riparian buffer.

SERVICE AREA: The service area for the restoration project is the South Hatchie Obion Geographic Service Area. The South Hatchie Obion Geographic Service Area is comprised of the following 8-digit HUC watersheds: 08010100 (Lower Mississippi-Memphis), 08010207 (Upper Hatchie), 08010208 (Lower Hatchie), 08010209 (Loosahatchie), 08010210 (Wolf), 08010211 (Horn Lake-Nonconnah). This service area is located in the Mississippi River Basin in West Tennessee, and it measures approximately 3,972 mi². It includes the municipalities of Memphis, Bartlett, Bolivar, Collierville, Covington, Germantown, Ripley, and Somerville. The Lower Hatchie 8-digit HUC watershed comprises 37% of the Geographic Service Area.

PROPOSED CREDIT GENERATION: The Sponsor proposes to generate 6,025 credits by restoring UT1 and UT2 from their presently degraded and incised channel length of 5,737 linear feet, to 6,025 linear feet of stream channel by way of constructing meandering stream channels in place of the present stream channels.

PROPOSED OWNERSHIP AND LONG-TERM MANAGEMENT: After the required monitoring period is complete, performance standards are met, and the project is formally closed out, the long term stewardship of this project will be the responsibility of the WTRBA. The long-term steward will focus on ensuring easement integrity is maintained and that the landowner is observing the established restrictions for the easement. Long-term management consists of annual inspection of projects to assure that conservation easements or other site

protection management agreements are not being violated. Sufficient funds have been retained to cover the costs of the annual site inspections, and for enforcing land use restrictions through litigation if necessary.

QUALIFICATIONS OF SPONSORS: The Sponsor for this project is the WTRBA. Along with its partners, which are both public and private entities, the WTRBA has restored over 30,000 feet of streams in the last 5 years. For this project, the WTRBA is working with Kimley-Horn for assistance in the development, design, and implementation of the WTUSMB and its component Sites.

ENDANGERED SPECIES: There are two federally listed species that are known to have a range that includes the project area. They are the federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened northern long-eared bat (*Myotis septentrionalis*). This project is being coordinated with the United States Fish and Wildlife Service. Any comments they may have regarding endangered or threatened wildlife or plants, or their critical habitat, will be considered in our evaluation of the described work.

CULTURAL RESOURCES: The Memphis District will evaluate information provided by the State Historic Preservation Officer, federally-recognized Tribes and the public in response to this public notice and we may conduct or require a survey of the project area.

FLOODPLAIN: In accordance with 44 CFR Part 60 (Floodplain Management and Use), participating communities are required to review all proposed development to determine if a floodplain development permit is required. Floodplain administrators should review the proposed public notice and apprise this office of any floodplain development permit requirements.

PUBLIC INTEREST REVIEW: The purpose of this public notice is to advise all interested parties of the proposed activities and to solicit comments and information necessary to evaluate the probable impact on the public interest.

The decision whether to authorize this mitigation plan will be based on an evaluation of the probable impact including cumulative impacts of the activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from the project must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the project will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and in general, the needs and welfare of the people.

The Corps of Engineers is soliciting comments from the public; federal, state and local agencies and officials; federally-recognized Tribes; and other interested parties in order to consider and evaluate the proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to authorize this request. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

PUBLIC HEARING: Any person may request, in writing, within the comment period specified in this notice that a public hearing be held to consider this prospectus. Requests for a public hearing shall state, with particularity, the reason for holding a public hearing. The District Engineer will determine if the issues raised are substantial and whether a hearing is needed for making a decision. If a public hearing is held, it will be for the

purpose of obtaining additional information that we could not otherwise obtain through a public notice process and not to inform the public about the specific details of the project in greater detail than what is found in this notice. This is not a Corps of Engineers project. We are not a proponent nor are we an opponent of the project. We are merely the permitting authority of Section 404 and Section 10 permits required by our office.

COMMENTS: To request additional information or provide comments on this notice, please contact Charles Keating using the information below:

Charles D. Keating
Corps of Engineers – Memphis District
167 N. Main Street, Room B-202
Memphis, Tennessee 38103-1894
Email: charles.d.keating@usace.army.mil
Phone: (901) 544-0733
Fax: (901) 544-0211

Comments may be sent via mail or email. The Corps of Engineers may provide copies of all comments, (including name & address of those providing comments) to the applicant for consideration and response prior to a decision. Comments must be received by the expiration date listed on page one of this notice.

For Final Individual Permits actions in the Memphis District, go to the following link: <http://geo.usace.army.mil/egis/f?p=340:2:0::NO:RP>. Using the Filter by district drop down box, select MVM-Memphis District, then select the year and month (information will populate in the table below). All pending individual permits can be located by selecting the “Pending IP” tab above. All of the environmental documents and statements of findings supporting issuance or denial of the permit decisions are available upon written request and where applicable, upon the payment of administrative fees. They are also available at the Memphis District, Regulatory Branch office for examination.



Gregg Williams
Chief
Regulatory Branch

Attachments



FINAL PROSPECTUS

West Tennessee Umbrella Stream Mitigation Bank

BIG MUDDY CREEK TRIBUTARIES SITE

JANUARY 2019



FINAL PROSPECTUS | JANUARY 2019

West Tennessee Umbrella Stream Mitigation Bank

BIG MUDDY CREEK TRIBUTARIES SITE

Sponsor:

West Tennessee River Basin Authority
3628 Eastend Drive
Humboldt, Tennessee 38343
Contact: David Blackwood
David.Blackwood@tn.gov

Prepared For:

Interagency Review Team
Representing:
U.S. Army Corps of Engineers, Memphis District
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Tennessee Department of Environmental Quality
Tennessee Wildlife Resources Agency
Natural Resources Conservation Service
Tennessee Valley Authority

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1.0 OWNER

Project Sponsor

West Tennessee River Basin Authority
3628 Eastend Drive
Humboldt, Tennessee 38343
Contact: David Blackwood (David.Blackwood@tn.gov)

The West Tennessee River Basin Authority is a legislatively created organization that exists within the Tennessee Department of Environment and Conservation with the purpose of restoring and maintaining the waters within western Tennessee and providing leadership for the same. Along with its partners, which are both public and private entities, the WTRBA has restored over 30,000 feet of stream in the last 5 years.

Landowner

State of Tennessee
312 Rosa L. Parks Ave., 27th Floor
Nashville, TN 37243
Contact: Jimmy West (Jimmy.West@tn.gov)

2.0 AGENT

Kimley-Horn
115 N. Liberty Street
Jackson, Tennessee 38138
Contact: Dusty Mays (Dusty.Mays@kimley-horn.com)

Kimley-Horn is working with the WTRBA, providing consulting services in the development, design, and implementation of the West Tennessee Umbrella Stream Mitigation Bank and its component Sites.

3.0 UMBRELLA BANK SERVICE AREA AND PROJECT LOCATION

3.1 OVERALL UMBRELLA BANK

The West Tennessee Umbrella Stream Mitigation Bank (the “Bank”) is being developed by the WTRBA in recognition of the need for compensatory stream mitigation in western Tennessee and in furtherance of the organization’s purpose. The proposed Bank Service Area (Figure A) includes the 20 counties that are currently under the WTRBA’s purview and their associated watersheds.

Mitigation sites will be selected based on watershed analyses and consideration of market demands for compensatory mitigation. Sites will be selected to provide an improvement in the function of the aquatic resources through restoration, rehabilitation or enhancement. At the watershed scale, impairment may be determined by watershed and waterbody classifications as documented by the state and federal water quality agencies. Waterbodies that are listed as impaired on the state’s 303(d) list or watersheds for which a total maximum daily load (TMDL) has been established are prime areas for mitigation projects. Watershed data is available from the Environmental Protection Agency’s (EPA) Water Quality Assessment Report for Tennessee¹. In addition to impaired waters, the watershed approach will consider the presence of any “Exceptional” waters. TDEC maintains a database of Exceptional Streams that is organized by county and HUC². Inclusion on this list is generally based on location of waterways near state or federal natural areas or protected species.

3.2 SITE SPECIFIC

The 78.4-acre Tributaries to Muddy Creek Mitigation Site is located in southwestern Tennessee, approximately 5 miles south of the town of Stanton in Haywood County (Figure 1). The intersection of State Road TN-222 and Stanton-Somerville Road lies within the Site boundary. The Site is situated in the southeast portion of the Memphis Regional Megasite. The Megasite is a 4,100-acre parcel that has been prepared for future industrial development by the Tennessee Department of Economic and Community Development. A jurisdictional determination has been made regarding all aquatic resources within the Megasite Boundary. The proposed mitigation Site will restore and protect aquatic resources at the gateway area to the Megasite.

3.2.1 HUC WATER WIELDS

This mitigation site is situated in 8-digit Hydrologic Unit Code (HUC-8) 08010208 (Lower Hatchie) and 12-digit Hydrologic Unit Code (HUC-12) 080102080402 (Lower Hatchie - Lower Big Muddy Creek) (Figure 2). The Lower Hatchie watershed is one of the larger watersheds in the Umbrella Bank area and includes portions of Tipton, Lauderdale, Haywood, Fayette, Madison, Hardeman, and Chester Counties.

1 https://iaspub.epa.gov/tmdl_waters10/attains_state.control?p_state=TN

2 <https://tn.gov/environment/article/tdec-dataviewers>

West Tennessee Umbrella Stream Mitigation Bank

BIG MUDDY CREEK TRIBUTARIES SITE

The Upper Hatchie includes portions of Hardeman and Chester Counties and most of McNairy County. The Hatchie National Wildlife Refuge encompasses 11,556 acres and 23 miles of the Hatchie River in Haywood County. The NWR is approximately 11 miles northeast of the Site.

The vast majority of streams within the Lower Hatchie Basin, including the subject streams, are listed as impaired¹. Stream stability and habitat as well as E. Coli and phosphorus are the primary causes of stream impairment. Looking at the land cover in Figure 4, it is most likely that agriculture is the primary contributor to impairment. As with other watersheds where this is the case, stream restoration projects in agricultural land will have a beneficial effect on water quality.

No stream mitigation banks currently exist in the Lower Hatchie Watershed².

3.2.2 ECOREGIONS

The mitigation site sits in the Mississippi Valley Loess Plains Level III ecoregion; the Level IV ecoregion designation is 74b – Loess Plains.

3.2.3 LAT/LONG (NAD 83, DECIMAL FORM)

The Site coordinates are 35.4078, -89.4132 (Figure 3).

4.0 ACCESS TO PROPERTY (SITE SPECIFIC)

The project is located within an undeveloped parcel owned by the State of Tennessee. Written access permission will be provided upon request.

5.0 PROJECT GOALS

5.1 OVERALL

The overall goal with the establishment of the Umbrella Bank is to provide functionally based compensatory mitigation to offset permitted impacts to waters of the United States within the identified geographic Service Area (Figure A), as authorized under section 404 of the Clean Water Act. Stream credits will be generated in accordance with state and federal regulations and guidance and result in the enhancement, restoration, and preservation of valuable aquatic resources in western Tennessee. Sites will be identified based on the presence and

type of aquatic resource, the size of the impacted area, and the overall needs of the service area that the site serves.

5.2 SITE SPECIFIC

The project includes the restoration of two first order tributaries to Muddy Creek (UT1 and UT2). Together the tributaries constitute 5,737 existing linear feet of incised channel. An analysis of historic aerial photography (Figure 4) indicates that historic land use disturbances associated with agriculture have caused significant straightening and channelization, which has greatly degraded the stream system. These modifications have disconnected the channel from the surrounding floodplain and have caused a loss in natural geomorphology and ecological function, as well as widespread bank instability. The goal of this project is to address these deficiencies and restore both tributaries to C/E channel conditions, based on the Rosgen Classification of Natural Rivers.

6.0 PROJECT OBJECTIVES

6.1 OVERALL

The West Tennessee River Basin Authority (“WTRBA”) Umbrella Stream Mitigation Bank exists to aid in the improvement of water quality and ecological function across the state. This goal is achieved through the restoration and enhancement of impacted stream systems by addressing significant deficiencies in existing stream conditions, as well as the preservation of essential aquatic resources throughout Tennessee.

The Tributaries to Muddy Creek site has 5,737 existing linear feet of stream that is separated into two tributaries. UT1 is 3,202 linear feet, and improvements to the system will be achieved through a combination of priority I and priority II restoration. This includes raising portions of the existing channel to reconnect with the existing floodplain, removal and replacement of a box culvert under Stanton Sommerville road that disconnects the channel at the road crossing, and the construction of a new channel downstream to restore natural pattern and profile to the system as it approaches the confluence with UT2 offsite. The upstream portions of UT1 will be restored by a priority II approach with a goal of elevating the stream channel so that a priority I approach will be implemented in the lower half of UT1. UT2 is 2,535 linear feet and will be restored through a

¹ See <http://tdeconline.tn.gov/dwr/>, accessed July 25, 2018.

² See https://ribits.usace.army.mil/ribits_apex/f?p=107:158:85488831158::NO::, accessed July 25, 2018.

combination of priority I and II restoration. Priority II sections will include the excavation of a new valley/floodplain and connected channel adjacent to the existing incised channel. This new stream channel will be along new alignment and will have restored cross-sectional dimensions, pattern, and profile. Appropriate pool-to-pool spacing and channel stability, as well as in-stream structures will be added to provide bedform diversity and aquatic habitat. The goal of the upstream priority II restoration along UT2 will be to elevate the stream bed so that the lower portion of UT2 can be restored by a priority I restoration approach.

6.2 SITE SPECIFIC

Specific objectives and quantitative metrics for success have been identified for each project goal, and are outlined in Table 1 on page 4.

7.0 SITE CONSTRAINTS (SITE SPECIFIC)

Both reaches are predominately located in agricultural fields where lateral and vertical constraints are minimal. However, just before flowing offsite, a series of vegetative swales required consideration when designing the location and pattern of both tributaries. Other design constraints related to roads and above ground powerlines do exist for UT1. These constraints are located where UT1 crosses just north of the intersection of Stanton-Somerville Road, and Tennessee State Road TN-222. Powerlines run along Stanton-Somerville Road crossing UT1 just before it flows through a box culvert and beneath the road. The stream continues eastward for approximately 200 feet before continuing beneath State Route 222. These two upstream road crossings will limit the restoration approach in this area to priority II. The streams design planforms and profiles will consider the locations and elevations of all these constraints to avoid impacting infrastructure while maintaining stream function. Project goals and objectives are achievable through proper design and due diligence.

8.0 RESOURCE ASSESSMENT FORMS

8.1 CATCHMENT ASSESSMENT FORM (SITE SPECIFIC – STREAM)

The site-specific catchment area was evaluated in accordance with the Catchment Assessment Form version 1.0 to assess the restoration potential of the project. This assessment is summarized in Table 2 below. The site condition is most

prominently impacted by the proximity of adjacent agricultural land use, the lack of riparian vegetation, and the proximity to major roadways. The goals and objectives outlined in this report define the mitigation activities the Bank Sponsor intends to implement to combat each significant area of poor condition. Establishing stabilized channel conditions and restoring mature vegetative buffers around the sites aquatic resources will greatly improve the condition of the site area and will benefit downstream conditions. Original catchment assessment forms can be viewed in Appendix A.

Table 2. Catchment Assessment Summary

Categories	Condition
Concentrated Flow	Poor
Impervious Cover	Good
Land Use Change	Good
Distance to Roads	Poor
Watershed Hydrology	Fair
Percent Forested	Poor
Riparian Vegetation	Fair
Sediment Supply	Fair
303d list	Good
Agricultural Land Use	Poor
NPDES Permits	Good
Watershed Impoundments	
Organism Recruitment	Fair
Percent of Catchment being Enhanced or Restored	Poor

9.0 EXISTING AND PROPOSED REACH-LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA FORM

A stream function-based rapid assessment field data form was completed for both reaches on the project site. A Summary of this evaluation is presented in Table 3 on page 5. Based on the field evaluation, there is significant potential for uplift in geomorphology, physiochemical and biological processes, and channel hydraulics. Mechanisms for uplift are discussed in the goals and objectives section, as well as the mitigation approach section. The proposed mitigation approach does not offer significant targeted approaches to improve runoff conditions, but developing a mature riparian buffer will provide some separation from adjacent land use and may benefit the project in this area. Completed data forms can be seen in Appendix B.

West Tennessee Umbrella Stream Mitigation Bank

BIG MUDDY CREEK TRIBUTARIES SITE

Table 1. Goals and Objectives

Functional Category	Goal	Function-based Parameter	Objectives
Hydrology	Reduce impacts from offsite land use (roads, agriculture)	runoff	Reduce erosion and turbidity by restoring channel with stable bank dimensions and gradual channel slope, as well as establishing necessary riparian buffer and channel dimensions to reduce runoff impacts from adjacent land use and manage flow from offsite ditches to avoid future incision of the new channel. Implement swales or other stormwater management along the lower portions of lateral ditch systems where concentrated flow is currently causing channel bank erosion.
Hydraulics	Reconnect channel with floodplain and stabilize banks	Floodplain Connectivity & Vertical Stability	Reconnect channel to the floodplain by constructing new channel with appropriate dimensions and grade, establishing an entrenchment ratio greater than 2.2 and a bank height ratio of 1.0-1.2. Enhance floodplain drainage conditions by providing vegetative swales and reduced bank slopes to encourage sheet flow and surface storage.
Geomorphology	Establish riparian buffer where none is present, and enhance buffer in areas where coverage is insufficient.	Riparian Vegetation	Establish a buffer of at least 50 feet on both sides of the new channel by pulling the proposed alignment away from roads and obstacles to vegetation wherever possible. Establish 90% coverage of channel banks with vegetation representing all 4 major classes (mature trees, understory trees, shrubs, and ground cover) and allow vegetation to grow naturally. Remove and monitor for invasive species.
	Proposed channel will achieve "functioning" BEHI/NBS rating and areas experiencing significant erosion with be less than 10% of bank area	Lateral Stability	Reduce sedimentation from stream bank erosion by creating channels that will remain stable with less than 10% of the banks actively eroding and attain a "Functioning" dominant BEHI/NBS rating. Reestablish necessary riparian buffer and bank stability conditions to reduce dominant bank erosion rate to 10% or less.
	Installed structures, design pattern and profile, and hydraulic considerations will result in a channel with restored C/E type geomorphology and a significant increase in habitat.	Bedform Diversity	Restore a channel with riffles and pools utilizing woody debris and other installed structures for bed stability and to provide aquatic habitat. The established channel should provide greater than 70% stable habitat available for colonization by macroinvertebrates and fish. Produce pattern and profile in new channel that achieves an average riffle slope of <3% for between 60%-70% of the channel, and a pool to pool spacing ratio of between 4-5, with a pool max depth ratio >1.2.
Physiochemical	Reductions in erosion and enhancement of buffers will improve water quality	Water Quality and Nutrients	Reduce turbidity, minimize fine organic sediment and increase presence of woody and leafy detritus, and increase water quality by removing areas of active erosion and enhancing the riparian buffer.

West Tennessee Umbrella Stream Mitigation Bank

BIG MUDDY CREEK TRIBUTARIES SITE

Table 3. Stream Function Assessment Summary

Assessment Parameter	Measurement Method	UT1	UT1 Prop	UT2	UT2 Prop
Runoff	concentrated flow	NF	FAR	NF	FAR
	flashiness	NF	NF	NF	NF
Floodplain Connectivity	BHR	NF	F	NF	F
	Entrenchment	NF	F	NF	F
	Floodplain Drainage	NF	F	NF	F
	Vertical Stability Extent	F	F	F	F
Riparian Vegetation	Buffer Width	F/NF	F/F	NF/NF	F/F
	Riparian Vegetation Zone	FAR/NF	F/F	FAR/NF	F/F
	Vegetative Protection	NF/NF	F/F	NF/NF	F/F
	Riparian Zone Invasive Species	FAR/FAR	F/F	FAR/FAR	F/F
Lateral Stability	Dominant BEHI/NBS Rating	NF/NF	F/F	NF/NF	F/F
	Dominant Bank Erosion	NF	F	NF	F
Bedform Diversity	Shelter for Fish and Macroinv.	NF	F	NF	F
	LWDI	NF	F	NF	F
	Riffle <3% Slope	NF	F	NF	F
	P-P Spacing Ratio	NF	F	NF	F
	Pool Max Depth Ratio Variability	NF	F	NF	F
Water Quality and Nutrients	Water Appearance and Enrich.	FAR	F	NF	F
	Detritus	NF	F	NF	F
Biology	SQSH	NF	F	NF	F
	Macroinv. Tolerance from NCBI	NF	F	NF	F
	Fish Presence	FAR	F	NF	F

10.0 BIOLOGICAL DATA

Macroinvertebrate samples will be collected at a later date in order to establish baseline conditions in regard to TMI and NCBI scores for the project streams. According to Greg Denton of TDEC's Division of Water Resources, there are no Biological Monitoring stations associated with UT1 and UT2.

11.0 VISUAL HABITAT ASSESSMENT

Habitat Assessment forms were compiled for all project reaches (Appendix C). Scores per criteria are provided in Table 4. These scores were compared to the regional guidance for the 74b ecoregion provided in the Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys for sites with drainage areas less than 2.5 square miles. Regional guidance identified that healthy systems had scores greater than 134 in January-June, and July-December scores of greater than 113. Both tributaries scored significantly below the guidance scores, and represent systems that have been significantly impacted by channelization and poor stream conditions. Restoration of these systems will restore healthy bedform material over time and will utilize woody structures to maintain channel grade and provide habitat along riffles and channel banks. In the long term, development of a strong riparian buffer and bank vegetation will provide natural woody material and debris along banks and in the channel bed that will help revitalize the in-stream habitat.

Table 4. Habitat Assessment Summary

Visual Habitat Assessment	Reach	
	UT1	UT2
Epifaunal Substrate/ Available Cover	2	3
Channel Substrate Characterization	2	2
Pool Variability	2	6
Sediment Deposition	18	13
Channel Flow Status	18	13
Channel Alteration	1	2
Channel Sinuosity	1	1
Bank Stability	5/5	1/1
Vegetative Protective	4/4	2/2
Riparian Vegetative Zone Width	0/10	3/3
Total	72	50
Comparison to Ecoregion Guidelines	BELOW	BELOW

12.0 MAPS

See all project maps in Appendix E.

13.0 SITE PHOTOS

Site photos and a photo map have been included in Appendix F.

14.0 BASELINE CONDITIONS

14.1 PROPOSED SERVICE AREA

The service area for the restoration project is the South Hatchie Obion Geographic Service Area. The South Hatchie Obion Geographic Service Area is comprised of the following 8-digit HUC watersheds: 08010100 (Lower Mississippi-Memphis), 08010207 (Upper Hatchie), 08010208 (Lower Hatchie), 08010209 (Loosahatchie), 08010210 (Wolf), 08010211 (Horn Lake-Nonconnah). This service area is located in the Mississippi River Basin in West Tennessee, and it measures approximately 3,972 mi². It includes the municipalities of Memphis, Bartlett, Bolivar, Collierville, Covington, Germantown, Ripley, and Somerville. The Lower Hatchie 8-digit HUC watershed comprises 37% of the Geographic Service Area. According to the Water Quality Management Plan for the Lower Hatchie River watershed produced by TDEC in 2007, land use classification within the watershed consists of approximately 49.5% agricultural land (row crops and pasture). A combination of forest types (deciduous, evergreen, and mixed) represent approximately 36.1% of the watershed while woody wetlands cover approximately 12.0%. The primary threats to aquatic resources throughout the geographic service area are: altered hydrologic regimes, altered instream physical habitat conditions and near-stream habitat conditions, sedimentation, nutrient loading, thermal alteration, and toxins and other contaminants. This site offers the opportunity to address many of these aquatic impacts, as described in the goals and objectives.

14.2 SUMMARY OF CATCHMENT ASSESSMENT FORMS AND OTHER SITE SELECTION DATA INCLUDING, WATERSHED INFO, STATE WILDLIFE ACTION PLANS, 319 GRANT PROJECTS, ETC.

The Tennessee Catchment Assessment forms identify the viability and potential of a site for mitigation based on its functional condition in four broad categories, including hydrology, geomorphology, biology, and physicochemical processes, as well as its proximity to additional NPDES permitted impacts and the overall percentage of the catchment within the project conservation boundaries. Table 5 outlines the performance of the site against each subcategory of the catchment assessment. The original assessment form is located in Appendix A.

Table 5. Catchment Assessment Summary

Broad Categories	Sub Categories	Condition
Hydrology	Concentrated Flow	Poor
	Impervious Cover	Good
	Land Use Change	Good
	Distance to Roads	Poor
	Watershed Hydrology	Fair
	Percent Forested	Poor
Geomorphology	Riparian Vegetation	Fair
	Sediment Supply	Fair
Physicochemical	303d list	Good
	Agricultural Land Use	Poor
Biology	NPDES Permits	Good
	Watershed Impoundments	
	Organism Recruitment	Fair
Area	Percent of Catchment being Enhanced or Restored	Poor

Catchment Assessment: UT1 and UT2 – A major portion of UT1 is immediately adjacent to (and crossed by) two significant roads, and both UT1 and UT2 are adjacent to large areas of agricultural land use. These conditions have greatly impacted surface hydrology, contributing to a high potential for concentrated flow from runoff as both streams have historically been repositioned and channelized to help with drainage of farmlands. At the downstream end UT1 the channel moves into a more densely vegetated section which would be more likely support sheet flow conditions in the immediate area, however construction of the four-lane State Route 222 modified

drainage just upstream of this forested area and likely has further impacted the existing conditions of the channel by concentrating flow from the road surface. Additional impacts are likely with the forecasted development of the Memphis Regional Megasite, which would cause significant hydrology impacts if left unaddressed. Modification to both channels has also led to significant loss in geomorphology, physical chemistry and biology as adjacent agriculture provides sources of sediment and chemical loading on the natural system and, through extensive channel ditching, a reduction in available habitat. Restoration activities will reduce in-stream erosion and adjacent sediment loading by enhancing geomorphology and channel hydraulics, as well as improving physical chemistry and biology through the introduction of woody structures for habitat and natural profile in the channel.

14.3 ADJACENT LAND USES AND EXPECTED DEVELOPMENT

The project area is located within Haywood County along State Route 222 near the interchange with Interstate 40, at the midpoint between Memphis and Jackson. Adjacent land is used primarily for agriculture and small scale rural communities, and the population of Haywood County has decreased from 2010 to 2017. However, adjacent counties, including Fayette and Tipton, continue to experience growth that is likely to impact areas along the Interstate 40 corridor and areas adjacent to State Route 222. The project site is located within the greater site boundary of the Memphis Regional Megasite, a 4,100-acre industrial site in close proximity to Memphis and Jackson with significant potential to incite growth not only in manufacturing but also in rural and commercial development needed to support a projected 54,000 industry jobs. This growth will lead to significant development of local property, and would likely encroach on the tributaries to Muddy Creek without intervention from the Bank Sponsor.

15.0 PROPOSED MITIGATION APPROACH

15.1 MITIGATION APPROACH

The proposed mitigation project includes the restoration of 6,025 proposed linear feet of stream that has been severely impacted by past ditching/straightening and agricultural practices. The on-site stream reaches have historically been excavated down approximately 8 to 10 feet below their natural elevation. Both streams have minimal adjacent riparian buffers. The primary land use within the contributing watershed of both

on-site stream systems is agricultural. The land immediately upstream and adjacent to the mitigation site will be developed as part of the Memphis Regional Megasite. The adjacent changes in land use combined with the already altered channels and watershed characteristics make the restoration and protection of this existing stream system all the more important to prevent future degradation. This prospectus includes the general conceptual mitigation approach for the site, but proposed mitigation approaches will be further developed and presented in the Mitigation Plan phase of the project.

Restoration is proposed for all on-site stream reaches. They will be restored using a combination of Priority I and II natural channel design approaches. In general, the restoration of the two reaches will begin on the upstream end with Priority II restoration. During the preliminary design phase (Mitigation Plan phase) it will be decided if the channel can be raised enough in the lower downstream reaches to achieve Priority I restoration. Improvements to be implemented include the following:

Dimension –

- Excavate a floodplain/valley to the appropriate elevation as compared to the stream's bankfull depth in areas of Priority II restoration.
- Narrow up the low flow channel along UT2 where the system was ditched/dredged too wide. Utilize in-stream structures to help with maintaining the baseflow conditions to be narrow enough to provide pool and riffle habitat.

Pattern –

- Restore appropriate pattern dimensions to the channel utilizing proper belt width, radius of curvature, and pool-pool spacing.
- Propose stream alignments that generally follow the existing location of the stream centerline, but may be offset along either side of the channel to ensure that the new channel is not required to cross frequently over fill material placed along the existing ditched system.

Profile –

- Correct the overall slope of the system by decreasing the overall slope of the channel. This will be accomplished through raising the bed of the stream channel within the sections transitioning from Priority II to Priority I, and re-establishing pattern to the system.

- Install in-stream structures within the newly re-meandered system to improve bedform diversity. The existing system is acting as a continuous run and is lacking proper pool to pool spacing and riffles in the majority of the two reaches.

In-Stream Habitat –

- Install structures within the system that will provide immediate habitat for fish and aquatic insects (brush toe protection in pools, riffles with logs/brush in addition to rock, log cross vanes, etc.). The existing box culverts under Old Highway 222 will be removed and replaced with a bottomless Conspan type bridge/culvert which will provide for better fish/aquatic creature passage.

Streamside and Riparian Habitat –

- Improve streamside wildlife habitat by reconnecting the stream to the designed valley in Priority II reaches, or reconnecting the stream to the historic valley in Priority I reaches. Instead of a vertical 8-foot-tall stream bank that drops directly down into the channel, a more gradual approach will be provided along the reaches. This will make access to the stream possible along the whole reach instead of a few select locations.
- Re-establish Riparian buffers. As shown in the proposed mitigation figure, the total conservation easement width is proposed to be 700 feet wide. Subtracting out approximately 14 feet for the channel widths, this will provide for a 343-foot-wide riparian buffer along both sides of the stream channels, greatly improving the condition of streamside habitat within all on-site reaches.

Riparian stormwater wetlands/swales –

- Provide streamside riparian stormwater wetlands/swales to capture runoff from adjacent agricultural land and runoff from future development. These proposed riparian features will protect the banks of the proposed channel by reducing the peak flow rates/velocity of the adjacent runoff, and will provide nutrient reduction functions by filtering the stormwater runoff prior to the water entering the stream.

West Tennessee Umbrella Stream Mitigation Bank

BIG MUDDY CREEK TRIBUTARIES SITE

The table below contains the proposed credits associated with the two stream reaches. These proposed credits account for the 700-foot-wide conservation easement proposed along the reaches, the removal of the existing box culverts under Old Highway 222, and replacement with a bottomless Conspan type bridge/culvert. The proposed lengths shown in this table are based on conceptual design approaches and may be modified as the project progresses.

15.2 FUNCTIONAL LIFT

The proposed mitigation approach will provide significant functional lift regarding hydrology, hydraulics, channel geomorphology, and aquatic habitat.

Hydrology – Several concentrated flow points are located throughout the existing stream reaches where adjacent agricultural runoff enters the channel through deep ditches. This concentrated flow results in erosion along the stream banks and causes most of the stream reaches to classify as “Functioning-At-Risk”. Proposed improvements to the site include the placement of bio-swales or stormwater wetlands along these drainage features to slow the flow before it reaches the stream, provide flood flow storage, reduce peak runoff volumes/ velocities, provide nutrient reduction for phosphorous and nitrogen, and provide for stabilized flow access into the stream rather than the existing eroding banks. Additionally, as shown in the proposed mitigation figure, a 700-foot-wide corridor is proposed along the stream system. This wide corridor will be graded to stabilize any existing gullies and areas of erosion, and will be permanently stabilized by re-establishing vegetation in the entire corridor.

Hydraulics – Due to the incised condition of the existing stream channels, flood flows are confined within the channel and contribute to further degradation of the streams. Most of the existing channel reaches classify as Rosgen G channels that are eroding and transitioning to F channels. In a few reaches along the upstream end of UT1 the channel has progressed from Rosgen G, to F, and is beginning to form an E channel down within its incised valley. Functional lift will be achieved

for channel hydraulics by excavating a valley/floodplain for the stream system and constructing an appropriately sized (bankfull width and depth) channel that will meander through the floodplain. This will allow flood flows to spread out over the valley and therefore allow in-stream habitat and channel features to be maintained. The existing state of the system confines these flood flows to the incised channel, resulting in flows 8 feet deep that scour the bottom of the channel, ripping away in-stream habitat features and substrate. The restored stream systems will have a bank height ratio of approximately 1.0 and entrenchment ratios 2.2 or greater.

Geomorphology – As previously mentioned, the existing stream systems on-site are disconnected from their floodplain, lack sufficient riparian/stream bank vegetation, and lack any natural pattern. This is resulting in significant erosion along UT2 and the lower half of UT1. Reconnecting the stream to a floodplain through Priority II restoration will allow flood flows to spread out over the floodplain and will allow channel forming flows to remain within the channel banks. The existing vertical and incised banks of UT2 and lower UT1 prevent stream bank vegetation from establishing. Once the bank heights are reduced and the channel is connected with its floodplain, these lower banks can be stabilized through the establishment of vegetation. It is proposed that live stakes will be installed for immediate stabilization, but trees will also be established that will provide root mass along the banks for long term stability. Pattern will be re-established along the stream channel within the excavated floodplain and will allow for the establishment of in-stream habitat features and appropriate riffle-pool sequencing. The existing channel lacks in-stream habitat because it is incised and contains flood flows which scour the bottom of the channel. The shear stress along the channel bed from these flood flows will be reduced by reconnecting the stream to a floodplain and allowing the flood flows to spread out. In addition to the vegetation established immediately adjacent to the channel, the proposed mitigation plan includes planting and re-establishment of a 300+ foot wide riparian buffer along each side of the restored stream channel.

Table 6. Proposed Mitigation Credits

Reach Name	Mitigation Type	Proposed Stream Length	Ratio	Potential Credits
UT1	Replacement and Restoration	3,438	1:1	3,438
UT2	Replacement and Restoration	2,587	1:1	2,587
Total Stream Length		6,025	Total Credits	6,025

Physicochemical and Biology – Placement of bio-swailes within the riparian corridor to capture and treat stormwater from adjacent agricultural lands, establishment of a 300+ foot wide riparian buffer, and stabilization of the eroding banks to prevent excess sediment are all proposed for this project and should improve water quality within the reach, but no specific improvements to Physicochemical functional parameters are being proposed. In-stream habitat will be improved by the installation of both woody and rock structures, but no biological functional parameters are being measured as part of this proposed restoration.

16.0 SITE PROTECTION

16.1 OVERALL

All Sites included in the Umbrella Bank will be protected in perpetuity by a legal instrument, which may include deed restrictions or a conservation easement, to be developed in coordination with the USACE and IRT. The Site protection instrument will ensure that the mitigation area is protected from encroachment for the protection and preservation of the aquatic resources contained therein.

16.2 SITE SPECIFIC

The Unnamed Tributaries to Muddy Creek Site is currently owned by the State of Tennessee. Prior to the first credit release from the Site, a Conservation Easement will be recorded for the Site. It is anticipated that the West Tennessee River Basin Authority or other suitable conservation organization will be the holder of the Conservation Easement.

17.0 LONG-TERM MANAGEMENT

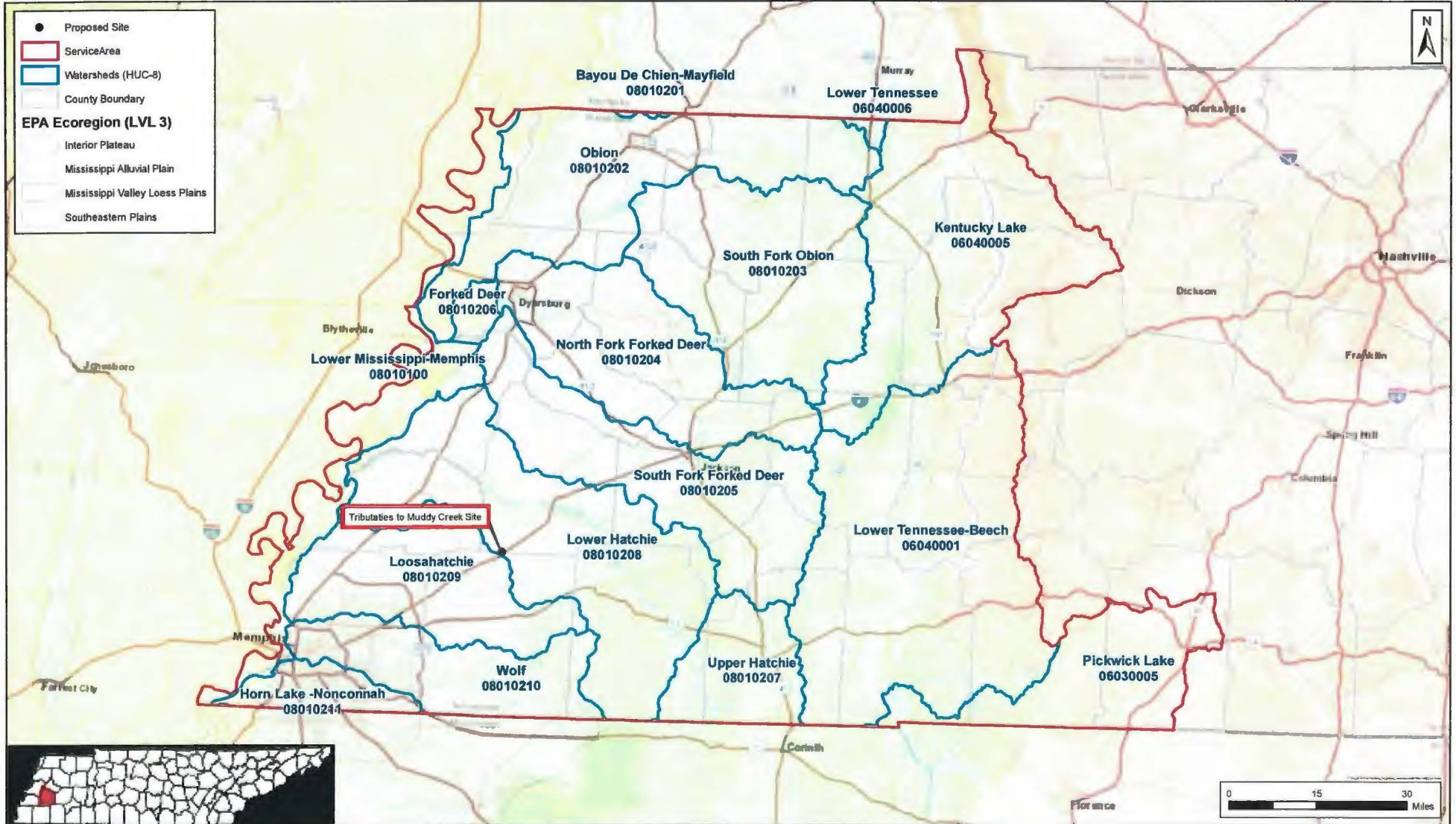
After the required monitoring period is complete, performance standards are met, and the project is formally closed out, the long term stewardship of this project will be the responsibility of the West Tennessee River Basin Authority. The long-term steward will focus on ensuring easement integrity is maintained and that the landowner is observing the established restrictions for the easement. Long-term management consists of annual inspection of projects to assure that conservation easements or other site protection management agreements are not being violated. Sufficient funds have been retained to cover the costs of the annual site inspections, and for enforcing land use restrictions through litigation if necessary.

18.0 HISTORIC PROPERTIES

According to the National Register of Historic Places, there are no properties listed within or near the mitigation site. A search of the Tennessee Historical Commission database did not identify any records for historic properties on the mitigation site. Due to the type of work being done and the location of the streams (open agricultural fields), impacts to potential historic properties not identified by these organizations are unlikely to occur.

19.0 THREATENED AND ENDANGERED SPECIES

A review of the U.S. Fish and Wildlife Service's (USFWS) IPaC tool was utilized to identify any listed species, critical habitat, migratory birds, or other natural resources that may be present on or within the vicinity of the Site. Two endangered or threatened species were identified: Indiana Bat (*Myotis sodalis*), and Northern Long-eared Bat (*Myotis septentrionalis*). Although there are forested areas present, no known roosting sites or hibernacula are documented within the Site. In addition, no critical habitats are documented.



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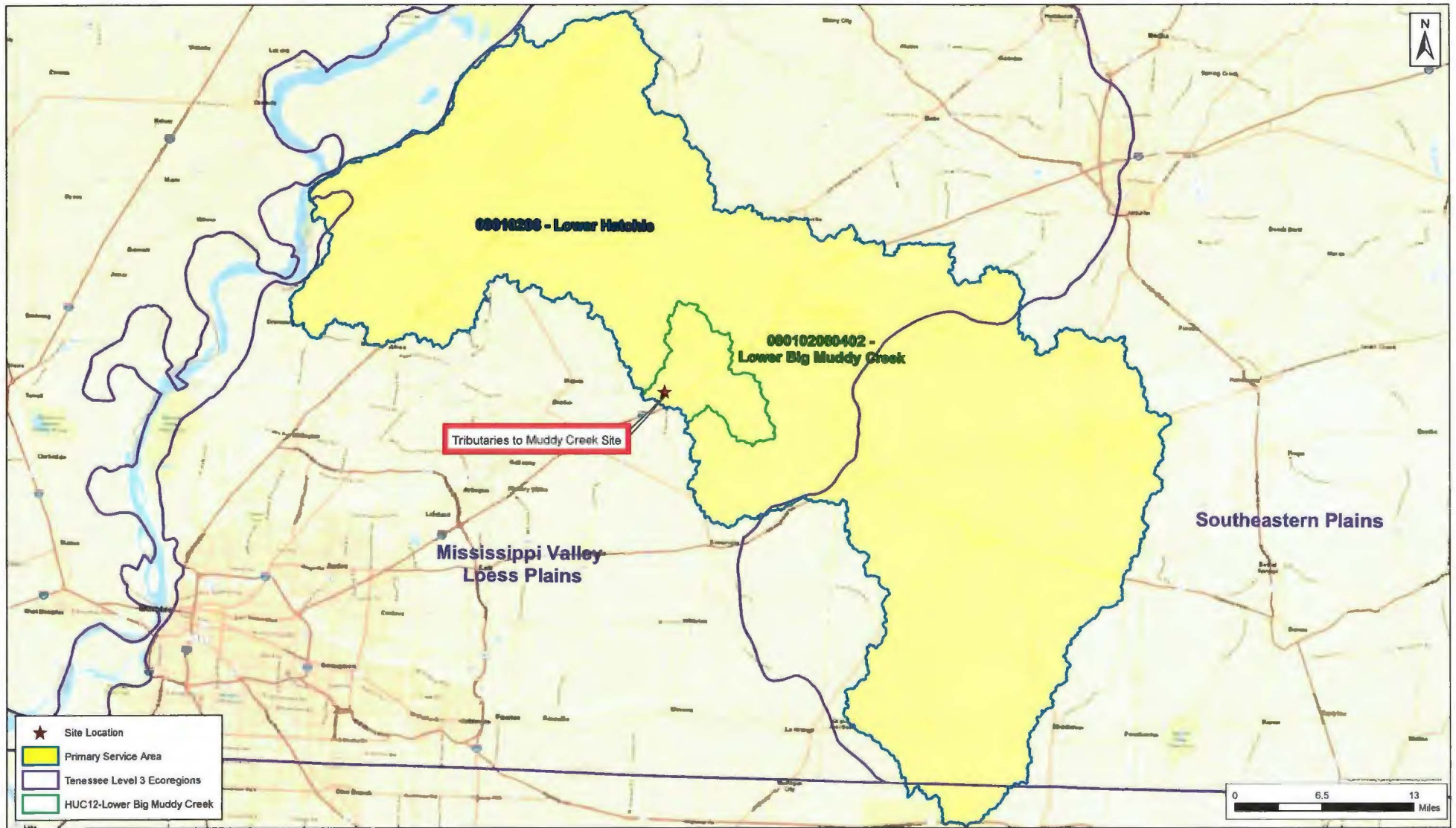


WTRBA Umbrella Stream Mitigation Bank

Proposed Umbrella Mitigation Bank Service Areas

Service Areas

Figure A
Western Tennessee



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WTRBA Umbrella Stream Mitigation Bank

Tributaries to Muddy Creek Site

Service Area

Figure B
Haywood County, TN



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Kimley»Horn

Prepared For:
WTRBA
WATER TREATMENT RESOURCES
BAYNE BASIN AUTHORITY

WTRBA Umbrella Stream Mitigation Bank

Tributaries to Muddy Creek Site

Historic Aerials

Figure 4
Haywood County, TN



— Existing Streams - 5,737 LF
 □ Mitigation Area
From NWI
 ■ Freshwater Forested/Shrub Wetland
 ■ Freshwater Pond
 ■ Riverine

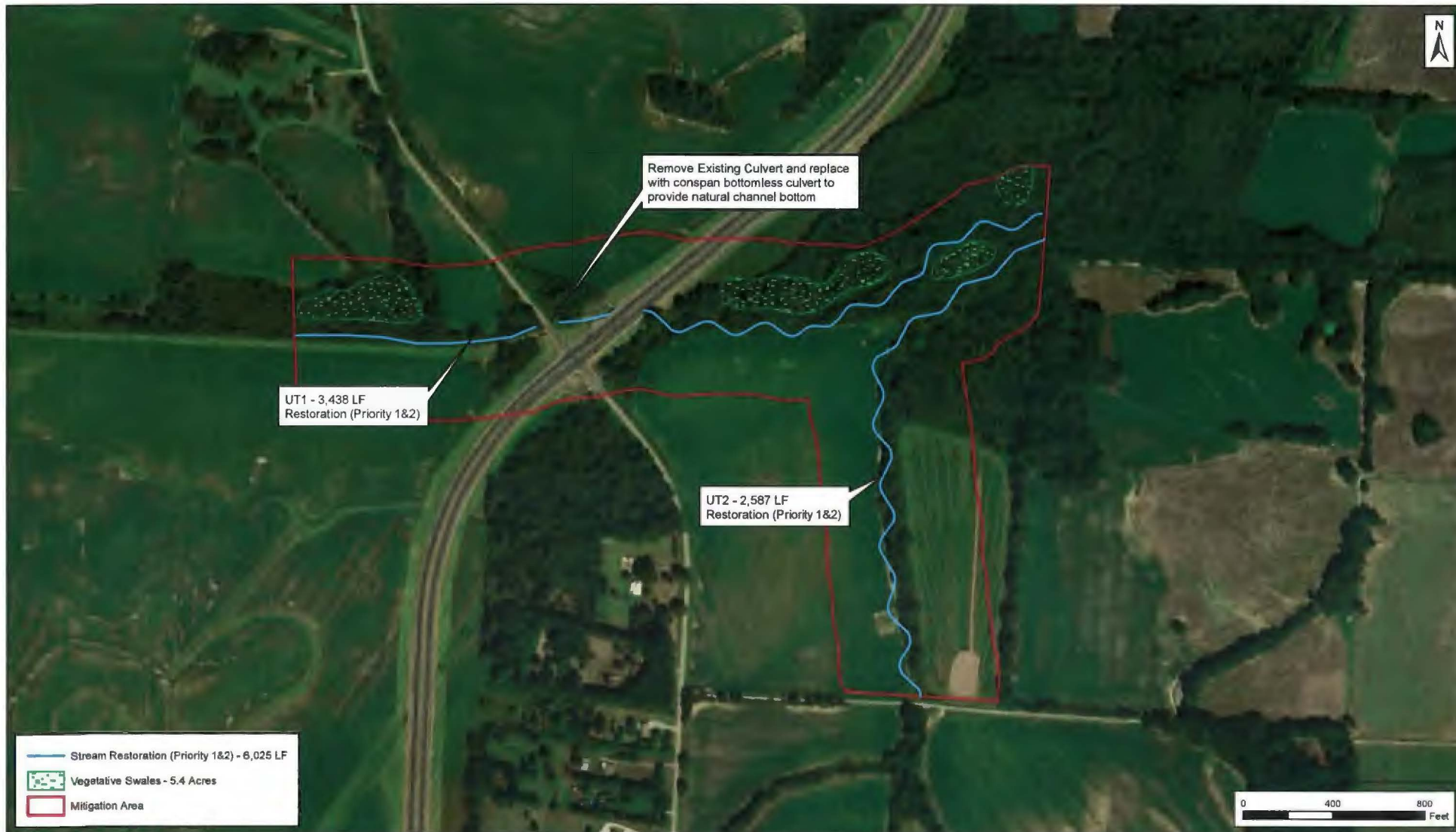


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WTRBA Umbrella Stream Mitigation Bank
Tributaries to Muddy Creek Site

Existing Conditions
 Figure 6
 Haywood County, TN



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WTRBA
 Water Treatment & Resource Bank of Appalachia

WTRBA Umbrella Stream Mitigation Bank

Tributaries to Muddy Creek Site

Proposed Mitigation

Figure 8
 Haywood County, TN

Appendix A

The "C" Stream Type

The "C" stream types are located in narrow to wide valleys, constructed from alluvial deposition. The "C" type channels have a well-developed floodplain (slightly entrenched), are relatively sinuous with a channel slope of 2% or less and a bedform morphology indicative of a riffle/pool configuration. The shape and form of the "C" stream types are indicated by cross-sectional width/depth ratios generally greater than 12, and sinuosities exceeding 1.2. The "C" stream type exhibits a sequencing of steeps (riffles) and flats (pools), that are linked to the meander geometry of the river where the riffle/pool sequence or spacing is on the average one-half a meander wavelength or approximately 5-7 bankfull channel widths. The primary morphological features of the "C" stream type are the sinuous, low relief channel, the well-developed floodplains built by the river, and characteristic "point bars" within the active channel. The channel aggradation/degradation and lateral extension processes, notably active in "C" stream types, are inherently dependent on the natural stability of stream banks, the existing upstream watershed conditions and flow and sediment regime. Channels of the "C" stream type can be significantly altered and rapidly de-stabilized when the effects of imposed changes in bank stability, watershed condition, or flow regime are combined to cause an exceedance of a channel stability threshold. "C" stream types may be observed in valley types IV, V, VI, VIII, IX and X. They can also be found on the lower slope positions of the very low gradient valley type III.

The "E" Stream Type

The "E" type stream channels are conceptually designated as evolutionary in terms of fluvial process and morphology. The "E" stream type represents the developmental "end-point" of channel stability and fluvial process efficiency for certain alluvial streams undergoing a natural dynamic sequence of system evolution. The "E" type system often develops inside of the wide, entrenched and meandering channels of the "F" stream types, following floodplain development on and vegetation recovery of the former "F" channel beds. The "E" stream types are slightly entrenched, exhibit very low channel width/depth ratios, and display very high channel sinuosities which result in the highest meander width ratio values of all the other stream types. The bedform features of the "E" stream type are predominantly a consistent series of riffle/pool reaches, generating the highest number of pools per unit distance of channel, when compared to other riffle/pool stream types (C, DA, and F). "E" type stream systems generally occur in alluvial valleys that exhibit low elevational relief characteristics and physiographically range from the high elevations of alpine meadows to the low elevations of coastal plains. While the "E" stream types are considered as highly stable systems, provided the floodplain and the low channel width/depth characteristics are maintained, they are very sensitive to disturbance and can be rapidly adjusted and converted to other stream types in relatively short time periods. The "E" stream type typically develops within valley types VIII, X, and XI.

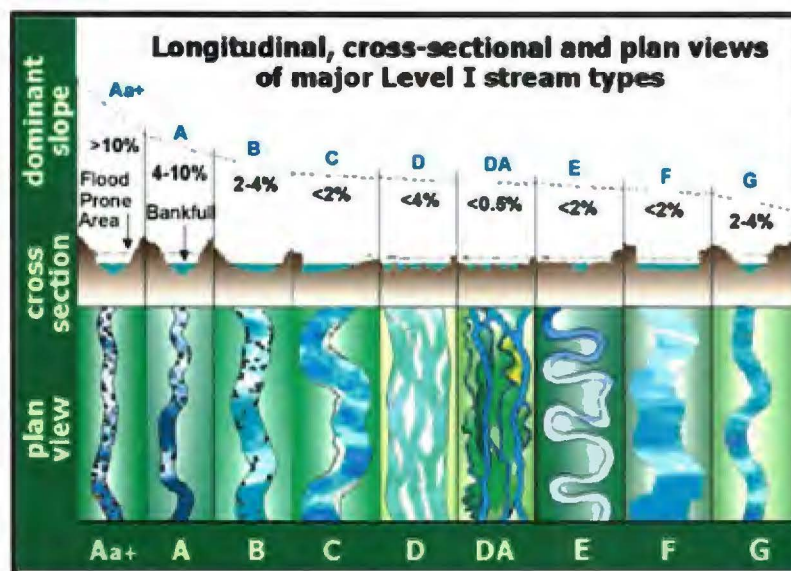


Figure 1. This diagram compares the longitudinal (as seen from the side), cross-sectional (bank to bank), and plan (as seen from above) views of each of the nine major stream types in the Level I classification. Image, caption, and channel descriptions from U.S. Environmental Protection Agency, Watershed Academy Web, Fundamentals of Rosgen Classification System. (https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=1189). Accessed 08 February 2019.