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Decatur . Montgomery . Tuscaloosa ALABAMA  
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Nashville TENNESSEE

July 8, 2010

Mr. R. Russell Read  
Senior Project Manager  
Coskata, Inc.  
4575 Weaver Parkway, Suite 100  
Warrenville, IL 60555

Re: Threatened and Endangered Species Survey  
Coskata Flagship Project  
Crossroads of America Industrial Park  
Boligee, Greene County, AL  
TTL Project No. 600109-026

Dear Mr. Read:

TTL is submitting the findings of two site investigation reports regarding the potential presence of nine federally-listed species for Greene County, Alabama. Provided within these reports are a description of the current habitats located within the project boundary for the proposed Industrial Development in Greene County, Alabama. The Coskata Flagship Project is situated within the Crossroads of America Industrial Port and Park that is located in Sections 11, 12, 13, 14, 24, T. 21 N., R. 1 W., and Sections 18 and 19, T. 21 N., R. 1 E. as shown on the 1987 Boligee, Alabama, U.S.G.S., 7.5 minute topographic map (see Figure 1). The Industrial Park is located west and south of Exit 32, along an approximate one-mile stretch of I-20/59, in Greene County, Alabama. The irregularly shaped park area is comprised of approximately 1,390 acres. The Tombigbee River abuts the northwestern-most portion of the site. Brush Creek enters the park from the northeast and continues generally in a southwest direction through the site to empty into the Tombigbee River. Several unnamed intermittent tributaries flow south and west through the park area into Brush Creek. Alabama & Gulf Coast Railroad crosses the eastern portion of the site.

The property consists of various landscape types including: fallow agricultural fields, hardwood bottom and emergent wetlands, ponds resulting from former borrow and gravel pit operations, and upland areas covered with a mixture of hardwood and pine timber. A railroad spur from the Alabama & Gulf Coast Railroad runs through the central portion of the property. The majority of the project area located south of the railroad spur is flat fallow agricultural fields separated by

freshwater ponds and wetland areas. The majority of the northern portion of the park is covered with hardwood and pine timber and dirt roads and/or trails.

Along the Tennessee-Tombigbee Waterway at river mile 259.5, the park has an existing port. Also, adjacent to the park's western border is a TEPPCO fuel distribution facility that sources refined petroleum products from the neighboring Colonial Pipeline and barges them to local markets up river. This TEPPCO facility includes a truck blending rack for ethanol and barge loading capabilities for loading liquids on the port.

The Project Flagship cellulosic ethanol facility is planned to be built at the Crossroads of America Industrial Port and Park in Boligee, Alabama. The capacity of the facility will be 60 million gallons of cellulosic ethanol and the anticipated annual production will reach approximately 55 million gallons. The purpose of the project is to produce cellulosic ethanol that will contribute to meeting the requirements of the Renewable Fuel Standard established in the Energy Independence and Security Act of 2007. The Flagship project site will include the 150-acre parcel identified in Figure 1.

An assessment of the wastewater capacity at the industrial park performed in February 2009 showed that the sanitary sewer is only sufficient to handle employee sanitary sewer needs. This has required Coskata to seek a direct discharge permit for its treated process water to the Tombigbee River.

Coskata's process water treatment and discharge system is designed to be highly water efficient. Based on information supplied with the NPDES permit application in May 2010, slightly over 560,000 gpd will be drawn as non-potable water from new onsite wells and approximately 100,000 gpd comes into the process from the green wood (at 50% moisture content). Approximately 440,000 gpd will be returned to local waterways in the form of treated discharge and approximately 230,000 gpd will be lost to the atmosphere in the form of cooling tower evaporation.

An NPDES permit issued by the Alabama Department of Environmental Management (ADEM) will be required for discharge of treated process water. The permit application was submitted in mid-May 2010. The permit application includes the details of how process water is collected, treated

and discharged to the Tombigbee River. Concurrent with the process water NPDES application, Coskata has requested ADEM (EPA Form 455) provide a model of the mixing zone in the process water discharge area of the Tombigbee River. The model provides necessary data to solicit a Section 10, River Structure Permit from the Army Corp of Engineers (USACE).

Greene County Industrial Development Board contracted with TTL for the purpose of gathering information to indicate whether the project will either (1) affect a listed endangered or threatened species or critical habitat or (2) adversely affect a proposed critical habitat for an endangered or threatened species or jeopardize the continued existence of a proposed endangered or threatened species. A document review of federal-listed endangered species for the project area in Greene County, Alabama indicated the potential presence of nine species. The results of our coordination are included in the assessment along with the consultant's biological opinion.

The survey of the nine federally-listed species included the Wood Stork (*Mycteria Americana*), Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*), Orange-nacre mucket mussel (*Lampsilis perovalis*), Alabama moccasinshell mussel (*Medionidus acutissimus*), Southern clubshell mussel (*Pleurobema decisum*), Ovate clubshell mussel (*Pleurobema perovatum*), Heavy pigtoe mussel (*Pleurobema taitianum*), Inflated heelsplitter mussel (*Potamilus inflatus*), and Stirrup shell mussel (*Quadrula stapes*). TTL performed site investigations during April and May 2008, observing the site for favorable habitat for the listed species. TTL also observed stream beds and banks, where visible, for the presence of the seven listed mussel species for Greene County. AST Environmental performed an aquatic survey on a portion of the Tombigbee River and Brush Creek for the presence of protected mussels during May 2010. The attached reports describe specific site conditions and survey observations recorded during the site investigations.

In summary, these investigations did not locate suitable habitat within the project boundaries for either the Mitchell's satyr butterfly or the Wood Stork. No observations of protected mussel species were made during the Brush Creek investigated area of the aquatic survey. There were no observations of protected mussel species recorded in the transects located along the eastern side of the Tombigbee River where Flagship's treated process water will be discharged by means of a submerged multiport diffuser system. No protected species were present within the diffuser pipe

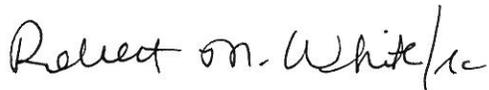
construction footprint or directly downstream. There will be no direct impacts to protected species associated with construction of the diffuser.

Inflated Heelsplitters are present in the Tombigbee River directly across from the proposed diffuser location. Inflated Heelsplitters are likely restricted to the inner bank and possibly other protected submerged slopes in the project vicinity. Based on the design of Coskata's process water treatment and discharge system that will operate in compliance with the Alabama Department of Environmental Management (ADEM) water quality standards, we do not expect indirect adverse effects to wildlife species including protected species associated with the proposed discharge.

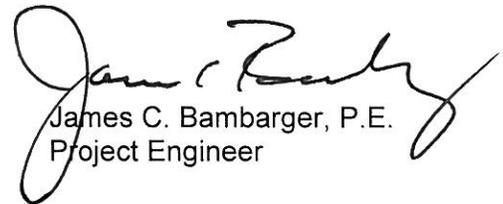
TTL has provided these findings for Coskata Flagship's project to be presented as part of the environmental section review process for a loan guarantee under the 9003 program. If you have any questions concerning our survey, please contact Bob White at 229-432-5805 or Jim Bambarger at 205-345-0816.

Sincerely,

**TTL, Inc.**



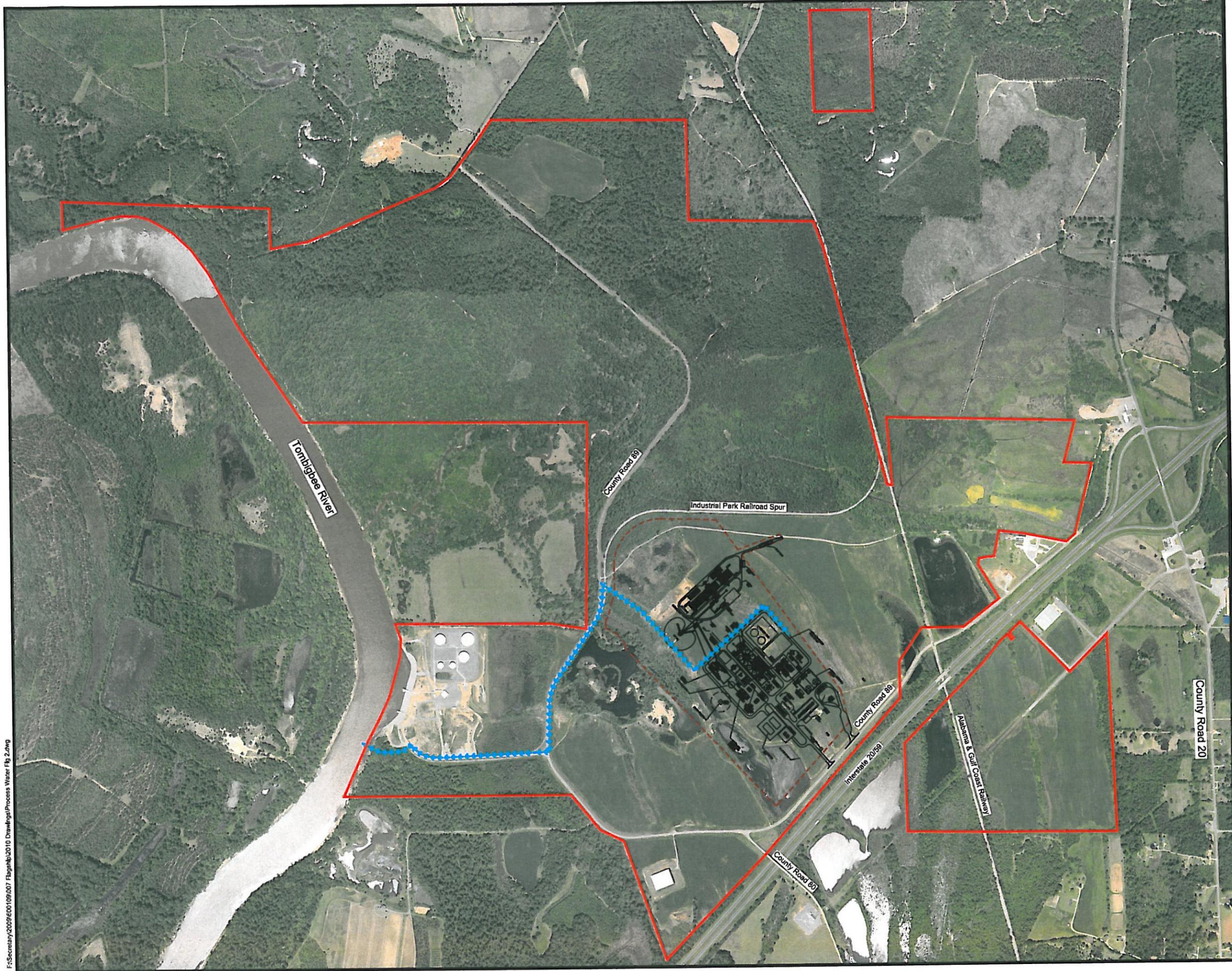
Robert M. White  
Project Manager



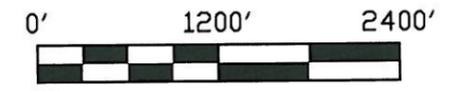
James C. Bambarger, P.E.  
Project Engineer

Enclosures





- Draft Industrial Park Boundary
- - - Draft Flagship Property Boundary
- - - - Proposed Process Water Discharge Route (Surface Trenching)



3516 Greensboro Avenue ■ Tuscaloosa, Alabama 35401  
 205.345.0816 ■ Fax 205.343.0619

TTL PROJECT NO: 600109007  
 PROJECT DATE: June 28, 2010

**Figure 2. Site Map**

Proposed Flagship Site  
 Crossroads of America Industrial Park  
 Boligee, Greene County, Alabama.

Approximate Scale: 1" = 1200'

# **Threatened & Endangered Species Surveys**

**June 16, 2008 Site Investigation  
and  
June 2010 Aquatic Survey Report**



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Decatur . Montgomery . Tuscaloosa ALABAMA  
Albany . Valdosta GEORGIA  
Nashville TENNESSEE

June 16, 2008

Mr. Bill Pearson, Field Supervisor  
U. S. Fish and Wildlife Service  
Daphne ES Field Office  
1208-B Main Street  
Daphne, AL 36526

RE: Informal Consultation Request  
Proposed Industrial Development  
Boligee, Greene County, AL  
Latitude N 32° 47' 10"; Longitude W 88° 3' 2"  
TTL Project No. 100108040

Dear Mr. Pearson:

TTL is requesting an informal consultation based on a site investigation regarding the nine federally-listed species for Greene County, Alabama. Provided within is a description of the current habitats mostly located within the project boundary for the proposed Industrial Development along the Tombigbee River in Greene County, Alabama. The site is located in Sections 11, 12, 13, 14, 24, T. 21 N, R. 1 W, and S. 18 and 19, T. 21 N, R. 1 E. as shown on the 1987 Boligee, Alabama, U. S. G. S., 7.5 minute topographic map (see Figures 1 and 2).

The nine federally-listed species include the Wood Stork (*Mycteria Americana*), Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*), Orange-nacre mucket mussel (*Lampsilis perovalis*), Alabama moccasinshell mussel (*Medionidus acutissimus*), Southern clubshell mussel (*Pleurobema decisum*), Ovate clubshell mussel (*Pleurobema perovatum*), Heavy pigtoe mussel (*Pleurobema taitianum*), Inflated heelsplitter mussel (*Potamilus inflatus*), and Stirrup shell mussel (*Quadrula stapes*). TTL performed site investigations on April 14 through April 17, and May 14, 2008, observing the site for favorable habitat for the listed species. TTL also observed stream beds and banks, where visible, for the presence of the seven listed mussel species for Greene County. TTL did not perform an underwater survey of the Tombigbee River or Brush Creek for the listed mussels. The following section describes general site conditions and survey observations recorded during the site investigations. Attached are site photographs illustrating general site conditions.

TTL surveyed the site and up to 1.5 miles from the property boundaries as defined by the project map provided by Burk-Kleinpeter. TTL traversed the project area and adjacent property using a vehicle or on foot during the survey. Outside the property boundaries, TTL performed a "windshield survey" along public roads and observed the Tombigbee River, Brush Creek, and Trussells Creek shoreline from a boat.

- **TTL** did not locate suitable habitat (prairie fens) within the project boundaries for the Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*).
- **TTL** did not observe freshwater mussels (living or relic) within the project boundaries or adjacent to the project boundaries.
- **TTL** did not locate suitable habitat within the project boundaries or within a one-mile radius of the project boundaries for the Wood Stork (*Mycteria Americana*).

### **Site Description**

The project area is located west and south of Exit 32, along an approximate one-mile stretch of I-20/59, in Greene County, Alabama. The property is accessed from Greene County Road 89 (Industrial Park Road). The irregularly shaped project site is comprised of approximately 1,390 acres. The Tombigbee River abuts the northwestern-most portion of the site. Brush Creek enters the site from the northeast and continues generally in a southwest direction through the site to empty into the Tombigbee River. Several unnamed intermittent tributaries flow south and west through the project area to flow into Brush Creek. Alabama & Gulf Coast Railroad crosses the eastern portion of the site.

The property consists of various landscape types including: fallow agricultural fields, hardwood bottom and emergent wetlands, ponds resulting from former borrow and gravel pit operations, and upland areas covered with a mixture of hardwood and pine timber. A railroad spur from the Alabama & Gulf Railroad runs through the central portion of the property. The majority of the project area located south of the railroad spur is flat fallow agricultural fields separated by freshwater ponds and wetland areas. The majority of the northern portion of the project site is covered with hardwood and pine timber and dirt roads and/or trails.

Two headwater tributaries enter the property at the northeastern boundary and continue mostly south to converge into one stream known as Brush Creek which flows to the Tombigbee River. Brush Creek has mostly a silty stream bed with average stream banks about 20 to 40 feet in height and are about 50 to 80 feet wide. The stream has been impacted by the depositing of household garbage from the Greene County Road 89 Bridge. Water quality may also be affected by a leaking sewer line that spans the creek at the bridge location. Brush Creek and its tributaries have large vegetative buffers adjacent to them of mixed hardwood forests with a mixed understory of small trees and shrubs.

### **Habitat Evaluation**

The following lists each listed species and its associated habitat.

#### **Wood Stork (*Mycteria Americana*)**

The habitat for the Wood stork is brackish or freshwater wetlands with mature, undisturbed forested wetlands for nesting.

#### **Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*)**

Mitchell's satyr butterfly requires a rare type of wetland called prairie fens. Prairie fens are fragile wetlands fed by carbonate rich groundwater springs or seeps.

**Orange-nacre mucket mussel (*Lampsilis perovalis*)**

The habitat for the Orange-nacre mucket mussel is small headwater streams and larger streams with a gravel bed or cobble bed covered with silt with little or no current.

**Alabama moccasinshell mussel (*Medionidus acueissimus*)**

The Alabama moccasinshell mussel requires slow to moderately flowing small creeks or headwaters of large streams with gravel bottoms covered with silt or sand.

**Southern clubshell mussel (*Pleurobema decisum*)**

The habitat for the Southern clubshell mussel is moderate to fast flowing creeks and small rivers with sand or gravel bottoms.

**Ovate clubshell mussel (*Pleurobema perovatum*)**

The habitat for the Ovate clubshell mussel is fast flowing creeks and small rivers with sand or gravel bottoms.

**Heavy pigtoe mussel (*Pleurobema taitianum*)**

The Heavy pigtoe mussel prefers slow to moderately flowing streams or rivers with sandy gravel or gravel-cobble bottoms.

**Inflated heelsplitter mussel (*Potamilus inflatus*)**

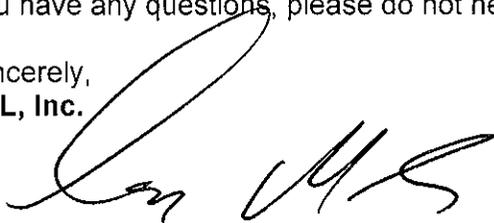
The Inflated heelsplitter mussel prefers slow to moderately flowing streams or rivers with soft bottoms such as silt, sand, or silty sand.

**Stirrup shell mussel (*Quadrula stapes*)**

The Stirrup shell mussel prefers slow to moderately flowing streams or rivers with sandy gravel or gravel-cobble bottoms.

**TTL did not locate suitable habitat within the project boundaries for the listed species.** TTL requests the U. S. Fish and Wildlife Service comment on possible presence of threatened or endangered species that may be located on this property. If you have any questions, please do not hesitate to call us at (334)244-0766.

Sincerely,  
TTL, Inc.

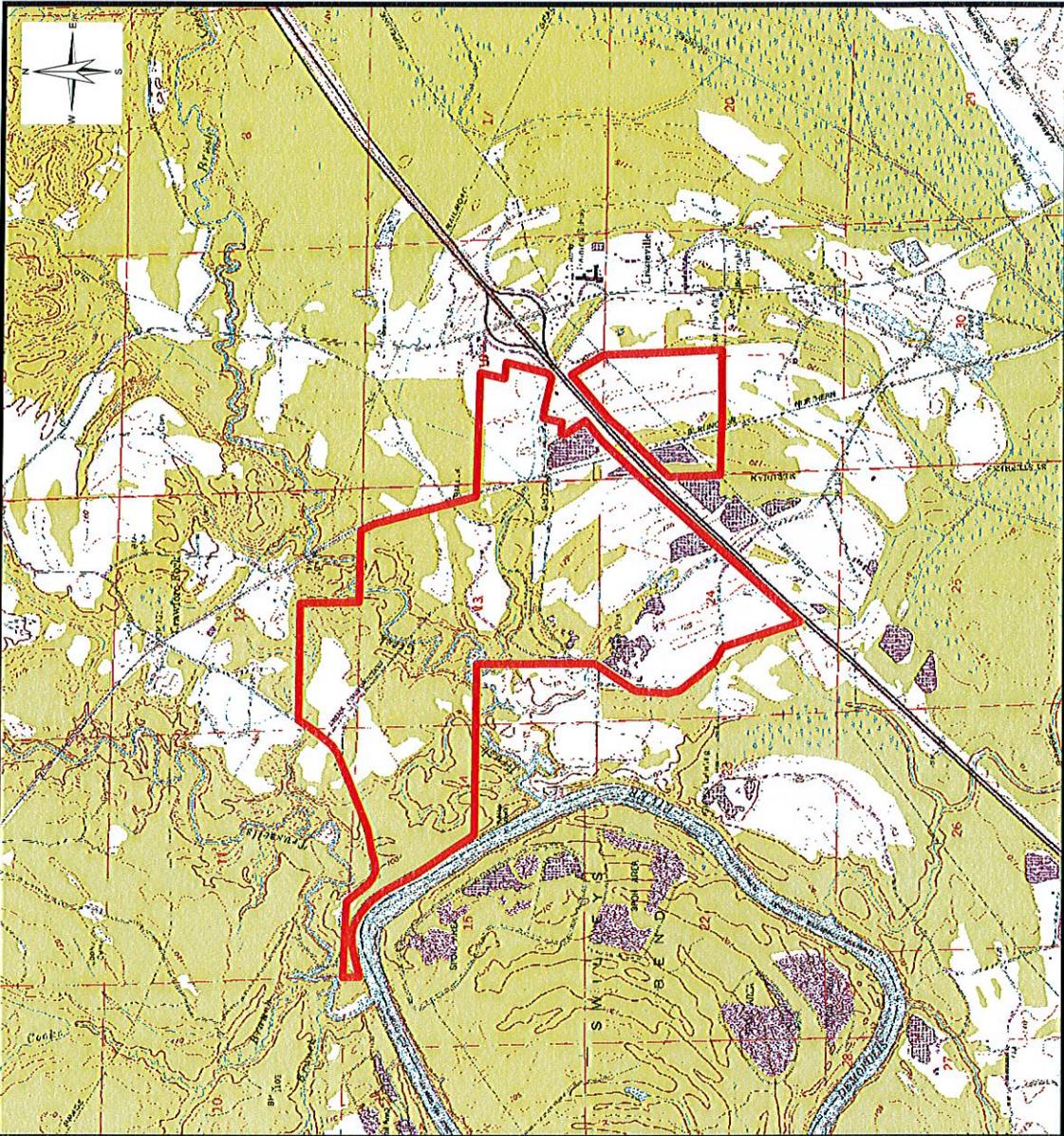


Greg Meeks  
Environmental Biologist



Sheryle G. Reeves, P. E.

Attachments: Figure 1. Topographic map  
Figure 2. General Site Map  
Photographs 1 through 8



0 2,000 4,000 8,000 Feet

Section, Township, and Range: S. 11, 12, 13, 14, 24, T. 21 N, R. 1 W and S. 18 and 19, T. 21 N, R. 1 E

Latitude: 32° 47' 10" N

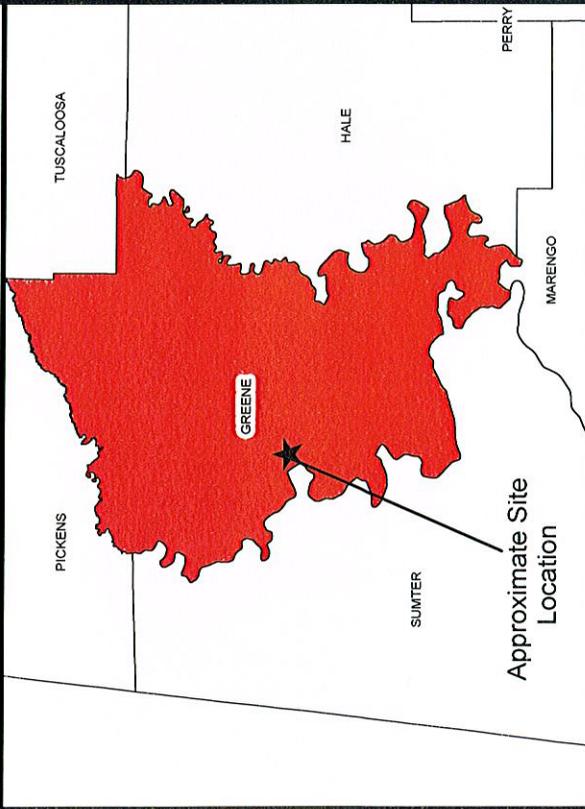
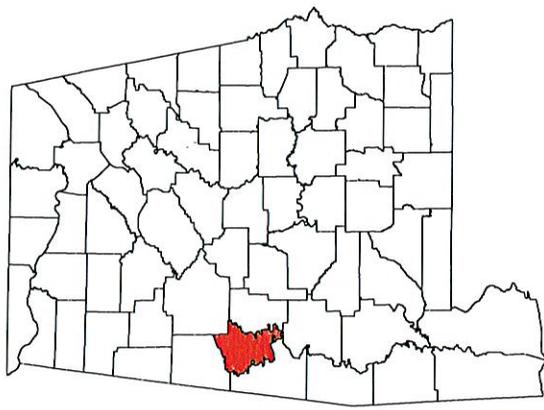
Longitude: 88° 3' 2" W

**Figure 1**  
**Topographic Map**

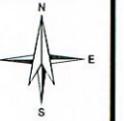
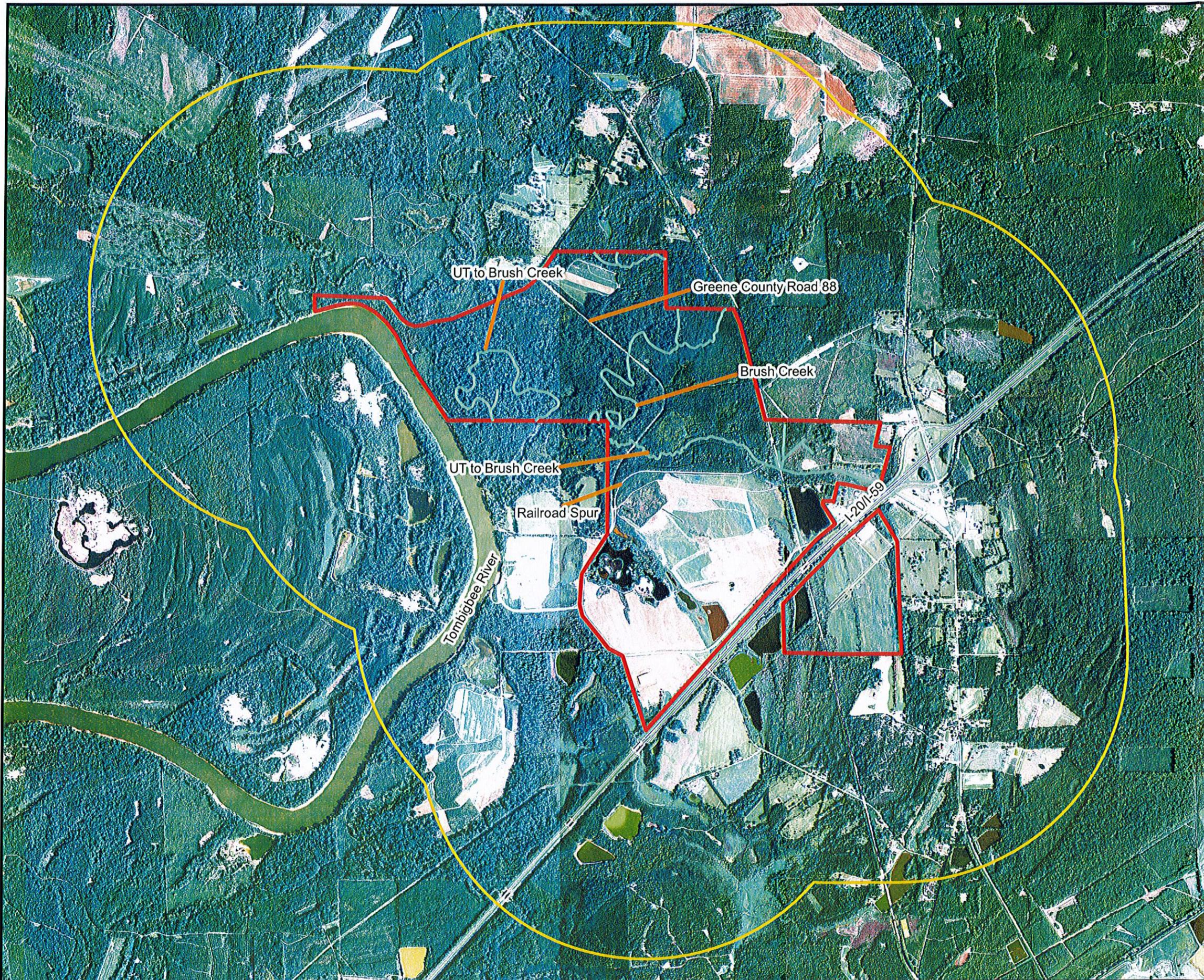
1987 Boligee, Alabama 7.5-Minute USGS Quadrangle Obtained From The Alabama Cooperative Extension Service



2743-B Sumter Park Drive W. ■ Montgomery, Alabama 36109  
 334.244.0766 ■ Fax 334.244.6668

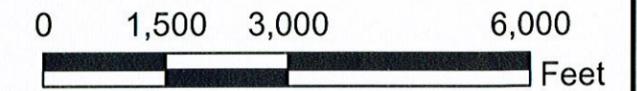


Crossroads of America  
 Threatened and Endangered Species Survey  
 Boligee, Greene County, Alabama  
 TTL Project Number: 100108040



**Legend**

- Approximate Property Boundary
- Approximate Location of Streams
- One Mile Radius



Section, Township, and Range:  
S. 11, 12, 13, 14, 24, T. 21 N, R. 1 W and S. 18 and 19, T. 21 N, R 1 E

Latitude: 32° 47' 10" N

Longitude: 88° 3' 2" W

Crossroads of America  
Threatened and Endangered Species Survey  
Boligee, Greene County, Alabama

**Figure 2**

**General Site Map**



2743-B Gunter Park Drive W ■ Montgomery, Alabama 36109  
334.244.0766 ■ Fax 334.244.6668

TTL Project Number: 100108040



Photograph 1 - View of Crossroads of America Industrial Park from the Tombigbee River. Viewed southwest to northeast.  
Date: May 14, 2008.



Photograph 2 - View of Crossroads of America Industrial Park. Viewed east to west.  
Date: April 14, 2008



Photograph 3 - View of the typical grassland and mixed hardwood/pine forest throughout the project area.  
Date: April 14, 2008



Photograph 4 - View of the typical wetland with surrounding grassland within the project area.  
Date: April 15, 2008



Photograph 5 - View of the river bank and typical mixed hardwood/pine forest along the river within a 1 mile radius of the project area. Note the high chalk bluff which is approximately 60 feet high.

Date: May 14, 2008



Photograph 6 - Additional view of the river bank and typical mixed hardwood/pine forest along the river within a 1 mile radius of the project area

Date: May 14, 2008



Photograph 7 - View of Brush Creek and trash. Viewed from Green County Road 89 Bridge.  
Date: April 17, 2008



Photograph 8 - View of leaking sanitary sewer line spanning Brush Creek. Viewed from  
Greene County Road 89 Bridge. Note trash in the Creek.  
Date: April 17, 2008

# **AQUATIC SURVEY REPORT**

## **TOMBIGBEE RIVER (proposed diffuser location) and BRUSH CREEK**

GREENE COUNTY, ALABAMA

Prepared for

**TTL**

P.O. Drawer 1128 (35403)  
3516 Greensboro Avenue  
Tuscaloosa, Alabama 35401

Prepared by

**AST** Environmental  
98 Mark Selby Pvt. Dr.  
Decatur, Alabama 35603  
Phone (256) 476-7355

Project Number JS10-108  
June 2010

## **INTRODUCTION**

As part of the proposed Crossroads of America (Crossroads) Project, AST Environmental (AST) was contracted to examine a reach of the Tombigbee River and a reach of Brush Creek located near RM 260 for the presence of protected mussels. The river site is a proposed effluent located along the eastern (outer) bank of the Tombigbee near the downstream extent of the Crossroads project boundary. The stream portion of the survey included examination of the first two miles of Brush Creek beginning at the Tombigbee confluence. See figures 1-3.

## **BACKGROUND**

The Tombigbee River is the major western tributary of the Mobile Basin. It is typically divided into Upper Tombigbee and Lower Tombigbee sections at Demopolis, Alabama and its confluence with the Black Warrior. The Tennessee-Tombigbee, completed in 1984, connected the Upper Tombigbee with the Tennessee River for navigation purposes. This action along with an accompanying series of locks and dams drastically changed the Upper Tombigbee from a free-flowing riverine ecosystem to a largely impounded one.

The US Fish and Wildlife Service (USFWS) lists the following freshwater mussel species for Greene County:

- T - Orange-nacre mucket mussel *Hamiota (= Lampsilis) perovalis*
- T - Alabama moccasinshell mussel *Medionidus acutissimus*
- E - Southern clubshell mussel *Pleurobema decisum*
- E - Ovate clubshell mussel *Pleurobema perovatum*
- E - Heavy pigtoe mussel *Pleurobema taitianum*
- T - Inflated heelsplitter mussel *Potamilus inflatus*
- E - Stirrup shell mussel *Quadrula stapes*

### **Critical Habitat:**

- Species—ovate clubshell, southern clubshell, Alabama moccasinshell, orange-nacre mucket
- Location—Sipsey River, Trussel's Creek

### **Orangenacre Mucket – Federally Threatened**

The Orangenacre Mucket [*Hamiota (=Lampsilis) perovalis*] attains a size of 50 - 90 mm (2 -3.6 in.) in length. Its shell is oval in shape, moderately thick and inflated. The outer shell is yellow to dark reddish brown, with or without fine to moderate green rays.

This species prefers stable sand, gravel, and cobble substrates with moderate to swift current in large streams and small rivers. It is most common in depositional areas along margins or flowing pools.

The Orangenacre Mucket is endemic to the Tombigbee and lower Alabama River systems. It is currently known only from tributaries of the Tombigbee River. Critical habitat has been designated for the Orangenacre Mucket and includes Trussel's Creek, Greene County, AL.

**Alabama Moccasinshell – Federally Threatened**

*Medionidus acutissimus*, the Alabama Moccasinshell, is a small freshwater mussel that reaches an average length of 30 mm (1.2 in). The shell is narrowly elliptical and thin with a well-developed acute posterior ridge that terminates in an acute point on the posterior ventral margin. The posterior slope is finely corrugated. The outer shell is yellow to brownish-yellow or tan with faint, fine green rays that may be broken or zigzag across the entire surface of the shell.

This mussel is found in a variety of streams, but is usually found in sand on the margins of streams with a stable sand and gravel substrate in clear water of moderate flow in small upland streams to large Coastal Plain rivers.

Historically, the Alabama Moccasinshell was known from the Alabama, Tombigbee, Black Warrior, Cahaba, and Coosa Rivers and their tributaries in Alabama, Mississippi, Georgia, and Tennessee. The confirmed current range of the species includes the Luxapalila Creek, Buttahatchie and Sipsey Rivers in the Tombigbee River drainage. Critical habitat has been designated for the Alabama Moccasinshell and includes Trussel's Creek, Greene County, AL.

**Southern Clubshell – Federally Endangered**

The Southern Clubshell, *Pleurobema decisum*, attains an average adult size of 70 mm (2.8 in.) in length. The outer shell is yellow to yellowish-brown with occasional green rays or spots on the umbo of young specimens. This species has a thick shell, and heavy hinge plate and teeth. Shell outline is roughly rectangular, produced posteriorly with the umbos terminal with the anterior margin, or nearly so. The posterior ridge is moderately inflated and ends abruptly with little development of the posterior slope at the dorsum of the shell.

Southern Clubshell is usually found in highly oxygenated streams with sand and gravel substrate in shoals of large rivers to small streams; may be found in sand and gravel in the center of the stream or in sand along the margins of the stream.

It was formerly widespread throughout the Mobile River basin, known historically from the Alabama River, Tombigbee River and tributaries, Black Warrior River; Cahaba and Little Cahaba Rivers, two Tallapoosa River tributaries, and the Coosa River and tributaries in Mississippi, Alabama, Georgia, and Tennessee. Large populations remain only in the Tombigbee River system with smaller, scattered populations found in the Alabama, Coosa, and Tallapoosa rivers. Critical habitat has been designated for the Southern Clubshell and includes Trussel's Creek, Greene County, AL.

### **Ovate Clubshell – Federally Endangered**

Ovate Clubshell, *Pleurobema perovatum*, is a small freshwater mussel attaining a maximum size of 50 mm (2.0 in.) shell length. The shell is oval to elliptical in shape with nearly terminal, inflated umbos. The posterior ridge is well-developed, broadly rounded, and often concave. The posterior slope is produced well beyond the posterior ridge. The periostracum color varies from yellow to dark brown, and occasionally has broad green rays that may cover most of the umbo and posterior ridge.

This species occupies sand and fine gravel substrate in stretches of river with moderate current and typically at a depth of less than three feet.

Historically, the Ovate Clubshell was distributed in the Tombigbee, Black Warrior, Alabama, Cahaba, and Coosa Rivers and their tributaries in Mississippi, Alabama, Georgia, and Tennessee; and in tributaries in several Tombigbee River tributaries in Alabama and Mississippi. Critical habitat has been designated for the Oval Pigtoe and includes Trussel's Creek, Greene County, AL.

### **Heavy Pigtoe Mussel – Federally Endangered**

The Heavy Pigtoe, *Pleurobema taitianum*, averages about 55 mm (2.2 in) in length. The shell is solid, heavy, thick, and inflated. The shell is basically triangular in outline with broadly to obliquely truncate posterior margin. Ventral margins are straight and dorsal margin is slightly convex. Umbos and furrow are less prominent than in other congeners and the umbonal cavity is relatively very shallow. The periostracum is yellowish, greenish-yellow, or tawny, usually darkening with age.

The Heavy Pigtoe is found in riffles and shoals of small to large rivers on sandy gravel to gravel-cobble substrates and with moderate to fast currents.

A Mobile basin endemic, historically this species occurred in the Tombigbee River between Columbus, Mississippi and Demopolis, Alabama; the lower Cahaba River, Alabama; and possibly the Coosa River, Alabama; the East Fork Tombigbee River above Amory, Mississippi and the Buttahatchie River in Mississippi. It is currently known only from the Tombigbee and Alabama rivers.

### **Inflated Heelsplitter – Federally Threatened**

The shell of the Inflated Heelsplitter, *Potamilus inflatus*, is brown to black and may have green rays in young individuals. Adults attain a maximum shell length of about 140 mm (5 ½ in.). The shell outline is roughly trapezoidal with an obliquely truncate posterior margin and a bluntly pointed anterior margin. A dorsal wing is just posterior to the umbo and ventral margin is somewhat convex.

The preferred habitat is soft, stable substrates in slow to moderate currents, but it may be found in sand, mud, silt, and sandy-gravel substrates in slow to moderate currents. It is typically found on sloping banks of inside bends and the protected side of bars, in water as deep as 20 feet.

This species is known historically from the Amite and Tangipahoa rivers, Louisiana; the Pearl River, Mississippi; and the Tombigbee, Black Warrior, Alabama, and Coosa Rivers, Alabama. The current distribution is limited to the Amite River, Louisiana and the Alabama, Tombigbee, and Black Warrior rivers, Alabama. The Alabama River population's viability is in question.

### **Stirrupshell – Federally Endangered**

The Stirrupshell, *Quadrula stapes*, is a relatively small freshwater mussel reaching an average adult shell length of about 55 mm (2.2 in.). The shell is yellowish-green in color, with green zigzag markings of young individuals which become dark with age. Some young individuals lack the zigzag marking. The shell is irregularly quadrate with a sharp posterior ridge. Posterior margin is truncate to bluntly pointed, tubercled, and posterior slope extends from umbo to posterior margin. Anterior and ventral margins are broadly rounded.

This species is found in riffles and shoals on sandy gravel to gravel-cobble substrates and with moderate to fast current in medium to large rivers.

Historically, this species was endemic to the Mobile basin and found in the Tombigbee River from Columbus, Mississippi, downstream to Epes, Alabama; the Black Warrior River, Alabama; and in the Alabama River as prehistoric shells. It has not been found in the most recent surveys and is considered extinct by some.

## **METHODOLOGY**

### **River**

A surface-supplied diving rig equipped with a surface-to-diver audio communication system was used in order to complete the Tombigbee River surveys. River surveys were conducted using transect search methods. Divers completed tactile / visual searches of all representative habitat types along each survey transect. Transects covered a five to six feet wide swath and varied in length. Efforts were intensified in those areas exhibiting potentially suitable habitat for the listed mussels of Greene County. All diving operations were conducted following the AST Dive Standards and Safety Manual protocol following the American Academy of Underwater Scientists.

The river survey focused on the diffuser construction footprint and a downstream buffer. Most transects included those areas from mid-river to the eastern bank.

### **Stream**

Qualitative surveys for mussels consisted of tactile (hand grubbing) and visual searches of all representative habitat types within the survey area. Additionally, visual searches for dead shells were conducted along stream shorelines. In survey areas less than 3 ft deep, techniques included hand grubbing and visual searches using view boxes and/or while skin diving (i.e. mask and snorkel) as water clarity permitted. In survey areas greater than 3 ft depth searches were conducted using

SCUBA diving. All diving operations were conducted following the AST Dive Standards and Safety Manual protocol following the American Academy of Underwater Scientists.

Stream search areas ranged from 200 ft to 1,200 ft in length depending on presence and quality of suitable habitat. Due to the presence of potentially suitable habitat in the upper reach of Brush Creek, AST thoroughly examined the entire stream reach between areas A-8 and A-11. Area A-7 was not examined due to the excessive presence of trash and debris in the stream.

Habitat information and photographs for each of the stream survey areas was collected in the field. Habitat characteristics were visually estimated based on experience and including: stream width (top of bank), water depth, water flow, and substrata composition.

## **RESULTS**

Field surveys were conducted from May 12 – 19, 2010. Habitat details and species composition are listed in Tables 1 and 2.

### **River – Effluent**

Five transects were run in the direct vicinity of the proposed effluent (four parallel with the proposed effluent location and one perpendicular to the proposed location near mid channel). Three transects were run parallel and downstream from the proposed effluent. A total of eight transects were run between mid-channel and the eastern (outer) bank, and a single transect was run along the western (inner) bank directly across the river from the proposed effluent (see figure 2).

Much of the eastern shoreline in the vicinity of the survey included highly eroded banks (see photograph 8). The submerged banks along the eastern side of the river were steep and mostly comprised of hard-pack clay. The clay bottom persisted along the submerged shoreline and extended toward mid-channel. Pockets of stable gravel / sandy gravel were interspersed among a predominantly hard-pack clay bottom. The gravelly pockets provided limited suitable habitat for common mussel species (see Table 1).

The western shoreline was comprised of more sloping stable sandy banks (see photograph 9). The submerged shoreline was also comprised of gentle slopes and firm substrate. One Federally Threatened Inflated Heelsplitter mussel was collected from the firm sandy / muddy slope across the river from the proposed effluent.

### **Stream**

Eleven sample areas were selected within Brush Creek (see figure 3). The six areas nearest the Tombigbee confluence exhibited characteristics of constant scour and deposition. Shifty sand, deeply packed detritus and scoured clay substrates dominated the lower reach of Brush Creek. A sizeable illicit trash dump is located along Brush Creek on the project property (see photographs 11 and 12). Mussel

habitat improves significantly upstream from the illicit dump site. No live freshwater mussels were collected from Brush Creek below the dump site. Two live mussels were collected from a riffle at search area A-10 (see Table 2). In general, suitable mussel habitat is not present within Brush creek below the dump site and habitat substantially improves upstream.

## **CONCLUSIONS**

The stable gravelly portions of the Tombigbee River Could potentially provide suitable habitat for the Alabama moccasinshell, Southern clubshell, Ovate clubshell, Heavy pigtoe and the Stirrup shell mussel; however given the scarcity of common mussel species observed during the survey, inhabitation by these rare species is possible but unlikely in the stable gravelly patches present on site. No observations of protected species were made while running transects located on the eastern side of the Tombigbee River.

No protected species were present within the diffuser pipe construction footprint or directly downstream. There will be no direct impacts to protected species associated with construction of the diffuser.

Inflated Heelsplitters are present in the Tombigbee River directly across from the proposed diffuser location. Inflated Heelsplitters are likely restricted to the inner bank and possibly other protected submerged slopes in the project vicinity. if diffuser discharge is in compliance with Alabama Department of Environmental Management (ADEM) water quality standards, we do not expect indirect adverse effects to wildlife species including protected species associated with the proposed discharge.

Potentially suitable habitat for the Orangenacre Mucket, Alabama moccasinshell, Southern clubshell and Ovate clubshell is present in the upper reach of Brush Creek; however the entire stream was examined for mussels between area A-8 and area A-11 and only two common species were collected. No observations of protected species were made during the Brush Creek portion of the aquatic survey.

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Alabama Department of Conservation and Natural Resources. 2004. Alabama Wildlife. Volume 1 and 2. Division of Wildlife and Freshwater Fishes. The University of Alabama Press. Tuscaloosa, AL.

Brim Box, J. and J.D. Williams. 2000. Unionid mollusks of the Apalachicola Basin in Alabama, Florida, and Georgia. Alabama Museum of Natural History Bulletin 21. University of Alabama Press, Tuscaloosa, AL.

Carlson, S., A. Palmer, H. Blalock-Herod, K. McCafferty, and S. Abbott. 2003. Freshwater mussel survey protocol for the southeastern Atlantic slope and northeastern Gulf drainages in Florida and Georgia (DRAFT). United States Fish and Wildlife Service, Ecological Services and Fisheries Resources Offices and the

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## **TABLES**

TABLE 1. Mussel Species and Substrate Composition										
Tombigbee River - Proposed Effluent Site										
Common Name	Scientific Name	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8	T-9
Three Ridge	<i>Amblema plicata</i>									
Butterfly	<i>Ellipsaria lineolata</i>									
Ebony Shell	<i>Fusconaia ebona</i>									
Washboard	<i>Megaloniaias nervosa</i>									
Three Horn	<i>Obliquaria reflexa</i>							1L, 1R		
Bank Climber	<i>Plectomerus dombeyanus</i>									
Inflated Heelsplitter	<i>Potamilus inflatus</i> *									1L
Southern Mapleleaf	<i>Quadrula apiculata</i>									
Gulf Mapleleaf	<i>Quadrula nobilis</i>	1R								
Ridged Mapleleaf	<i>Quadrula rumphiana</i>									
Habitat / Substrate		estimated percentages								
	<i>Cobble / Gravel</i>									
	<i>Gravel</i>						25	15	25	
	<i>Gravelly Sand</i>	10						75	25	
	<i>Sandy Mud</i>						25	10		85
	<i>Silt</i>									15
	<i>Hard Packed Clay</i>	90	100	100	100	100	50		50	

\* = Federally Listed as *Threatened* by the US Fish and Wildlife Service

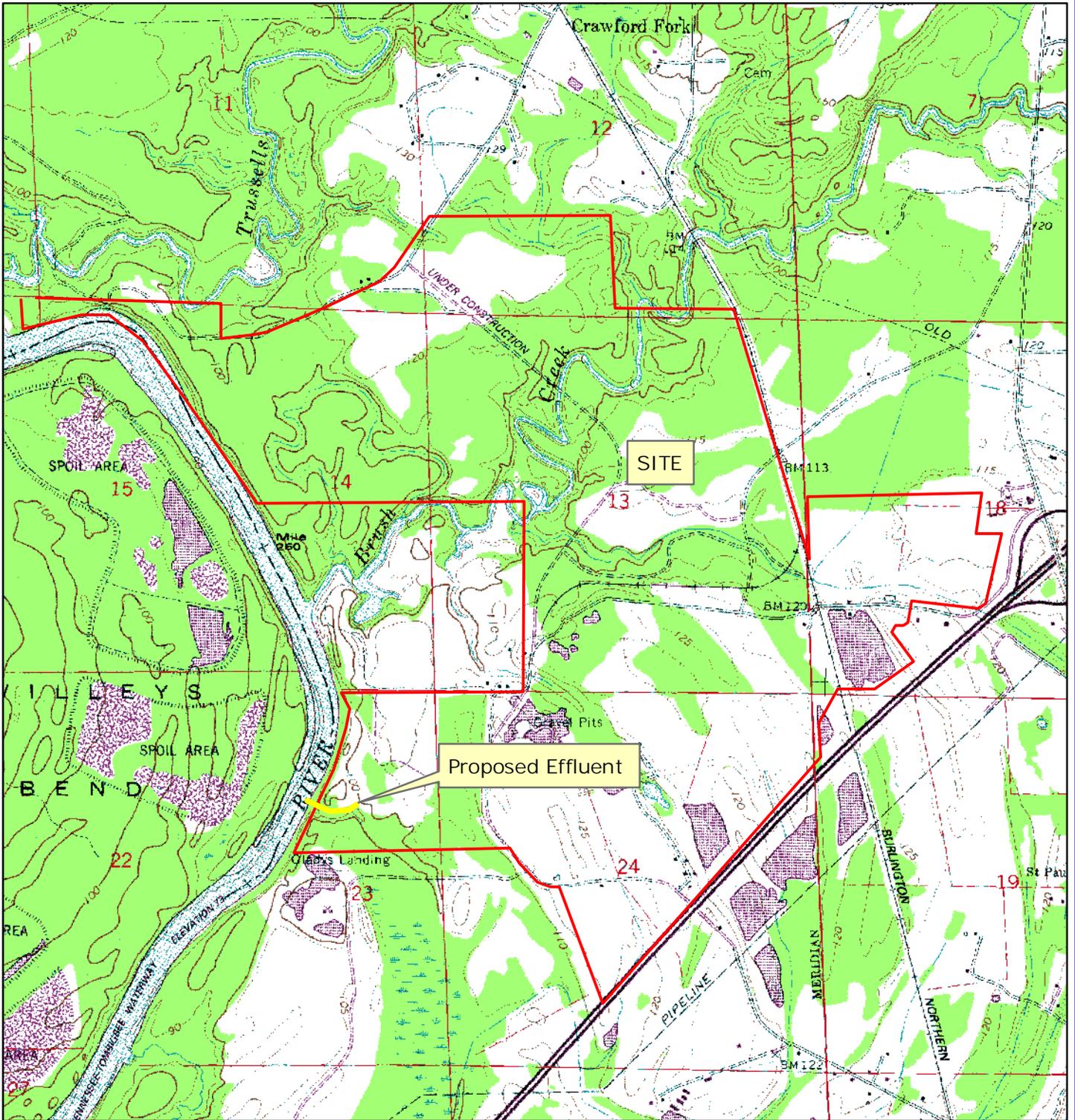
L = Live, R = Relict Shell

NOTE: Species List includes all river species observations for the entire project

TABLE 2. Mussel Species and Substrate Composition												
Brush Creek												
Common Name	Scientific Name	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11
Three Ridge	<i>Amblema plicata</i>						1R					
Gulf Pigtoe	<i>Fusconaia cerina</i>								1R			
Southern Pocketbook	<i>Lampsilis ornata</i>								1R	1R		
Southern Fatmucket	<i>Lampsilis straminea</i>					1R			1R	1R	1L, 4R	1R
Yellow Sandshell	<i>Lampsilis teres</i>										2R	
Fragile Papershell	<i>Leptodea fragilis</i>								1R			1R
	<i>Pleurobema sp.</i>						3R					
Little Spectaclecase	<i>Villosa lienosa</i>					1R	4R		1R		1L, 3R	1R
Asian Clam	<i>Corbicila fluminea</i>					R	L		L	L	L	L
Habitat / Substrate		estimated percentages										
	<i>Gravel</i>									10	20	10
	<i>Gravelly Sand</i>					10	15		20	20	30	20
	<i>Sand</i>	10	60	10	10		20		50	50	10	30
	<i>Sandy Mud / Leaf Pack</i>	10	30	80	80	90	60		35	10		10
	<i>Silt</i>	30	10	10	10				5			
	<i>Hard Packed Clay</i>	50					5			10	40	30

L = Live, R = Relict Shell

**MAPS**



0 0.5 1 Miles

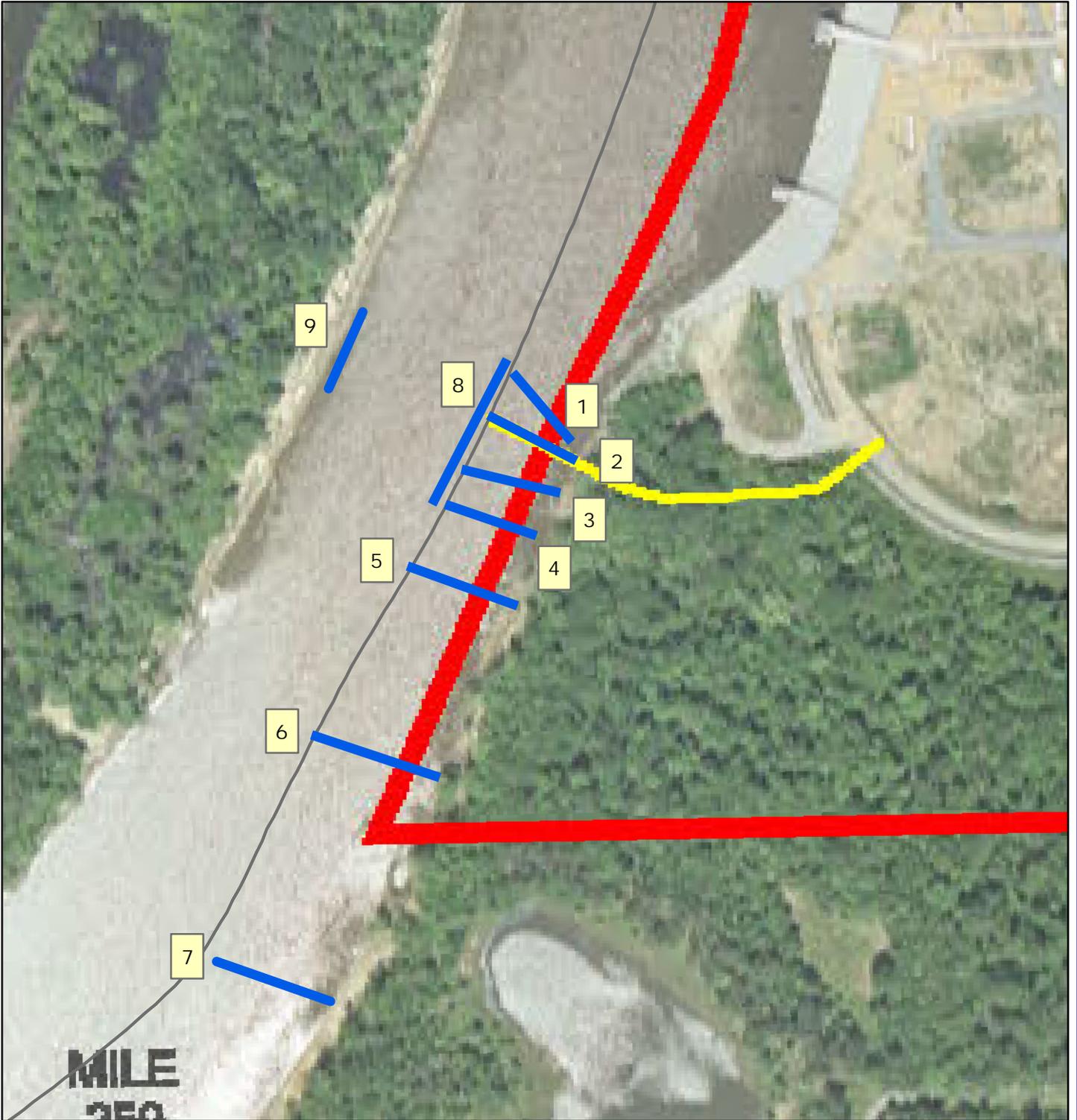
SCALE = 1 : 24,000

FIGURE 1. SITE MAP  
 TTL - Crossroads of America JS10-108  
 Greene County, Alabama



SOURCE: USGS Topographic  
 Quadrangle Boligee, Alabama

**AST** Environmental



0 250 500 Feet

SCALE = 1 : 3,000

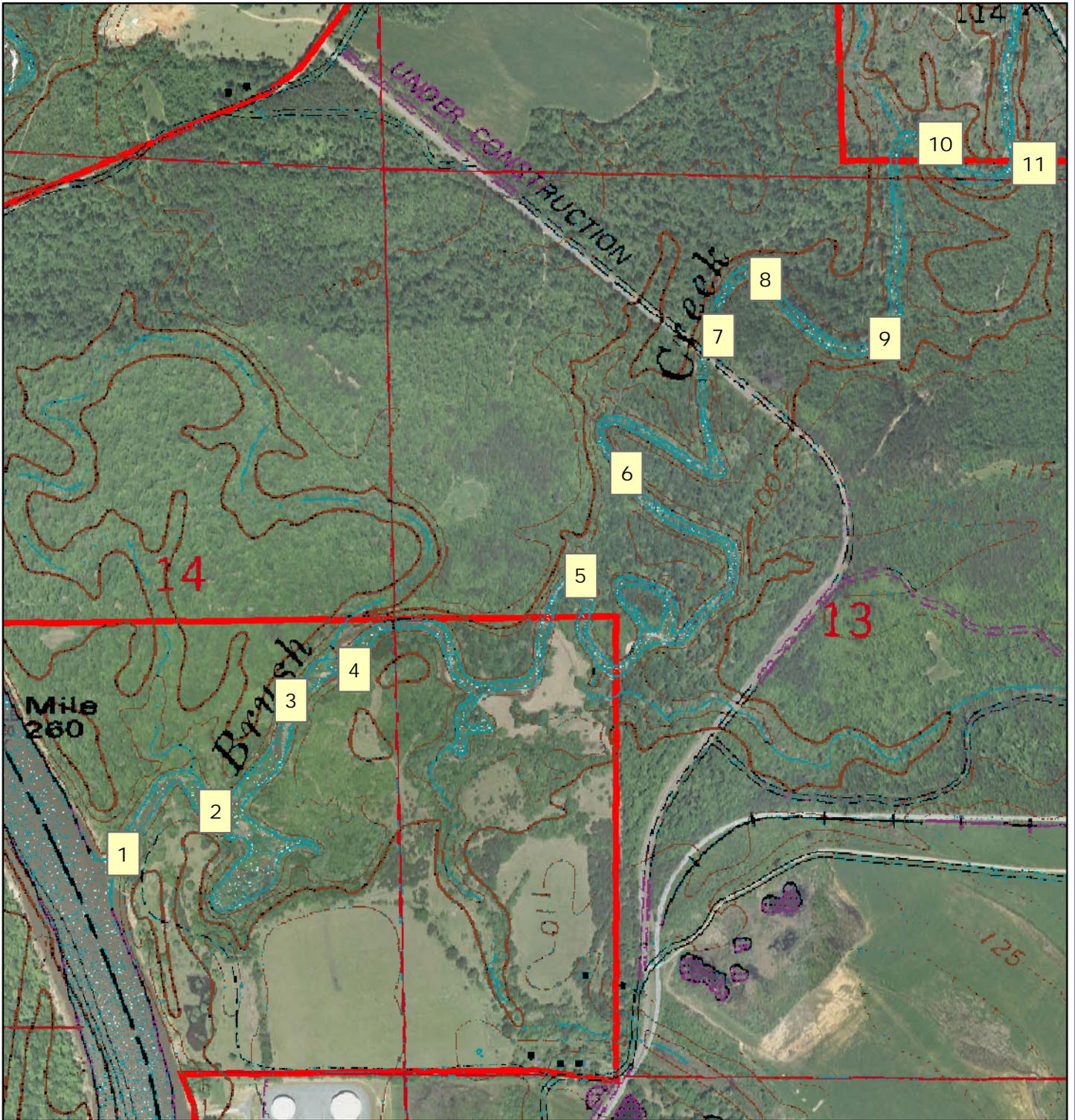
NOTE: Transect 2 follows the proposed effluent pipe location

AERIAL SOURCE: Southern Resource Mapping April 24, 2009



FIGURE 2. TOMBIGBEE SURVEY MAP  
 Proposed Effluent Location  
 TTL - Crossroads of America JS10-108  
 Greene County, Alabama

**AST** Environmental



0 500 1,000 Feet

SCALE = 1 : 10,000

SOURCE: Aerial - Southern Resource Mapping April 24, 2009

USGS Topographic Quadrangle Boligee, Alabama



FIGURE 3. BRUSH CREEK SURVEY MAP  
TTL - Crossroads of America JS10-108  
Greene County, Alabama

**AST** Environmental

## **PHOTOGRAPHS**

**PHOTOGRAPH 1**



Relict shell collected during survey at transect T-1. Taken by Jeff Selby, 5-13-10.

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**PHOTOGRAPH 2**



Outer / eastern bank of Tombigbee River. Approximately 400 yards downstream of proposed effluent at transect T-7. Taken on 5-13-10.

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**PHOTOGRAPH 3**



Inner / western bank of Tombigbee River at transect T-9. Facing upstream. Taken by Michael McConnell, 5-14-10.

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**PHOTOGRAPH 4**



Live *Potamilus inflatus* collected from survey at transect T-9. Photo taken on 5-14-10.

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**PHOTOGRAPH 5**



Survey area A-1. Brush Creek at confluence with Tombigbee River. Facing upstream. Taken by Jeff Selby, 5-18-10.

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**PHOTOGRAPH 6**



Brush Creek. Survey area A-2. Facing downstream. Taken on 5-18-10.

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**PHOTOGRAPH 7**



Brush Creek survey area A-3. Facing upstream. Taken by Michael McConnell, 5-18-10.

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**PHOTOGRAPH 8**



Brush Creek survey area A-4. Facing upstream. Taken by Terry Richardson on 5-14-10.

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**PHOTOGRAPH 9**



Brush Creek survey area A-5. Facing upstream. Taken on 5-17-10.

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**PHOTOGRAPH 10**



Brush Creek survey area A-6. Facing downstream. Taken on 5-14-10.

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**PHOTOGRAPH 11**



Survey area A-7. Illicit dump site along Brush Creek flood plain.  
Taken on 5-18-10 by Terry Richardson.

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**PHOTOGRAPH 12**



Illicit dump site along Brush Creek flood plain at survey area A-7.  
Taken on 5-14-10.

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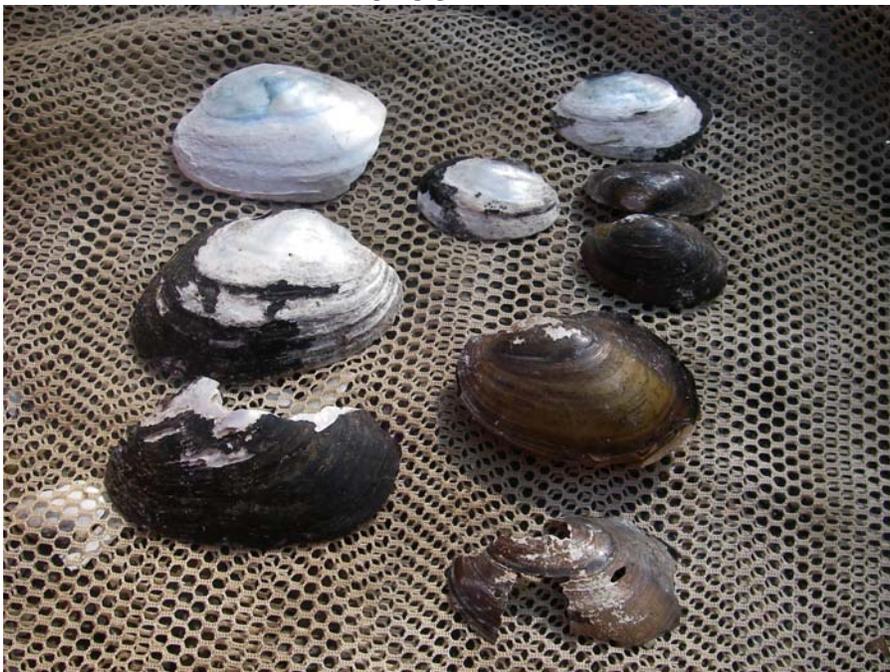
**PHOTOGRAPH 13**



Area A-8. Brush Creek. Facing upstream.  
Taken on 5-17-10.

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**PHOTOGRAPH 14**



Relict mussel shells present in survey area A-8. Taken on  
5-17-10.

**PHOTOGRAPH 15**



Area A-9. Brush Creek. Facing upstream.  
Taken on 5-17-10.

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**PHOTOGRAPH 16**



Survey Area A-10. Brush Creek. Facing upstream. Taken on  
5-18-10.

**PHOTOGRAPH 17**



Live *Lampsilis straminea* collected from survey area A-10.  
Taken on 5-18-10.

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**PHOTOGRAPH 18**



Live *Villosa lienosa* collected from survey area A-10. Taken on  
5-18-10.

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**PHOTOGRAPH 19**



Northern property boundary at search area A-11. Facing upstream.  
Taken on 5-18-10.

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