

ECOLOGICAL STUDY

PROPOSED KIRBY PARKWAY EXTENSION MEMPHIS, SHELBY COUNTY, TENNESSEE

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1.0 INTRODUCTION

Development & Environmental Planning Associates, Inc conducted an ecological assessment of the proposed Kirby Parkway improvements in Memphis, Shelby County, Tennessee, during mid October 2000. The assessment was conducted pursuant to the guidelines established by the Federal Highway Administration and the Tennessee Department of Transportation to update previous studies conducted in the area.

The purpose of the assessment was to determine the presence or absence of wetlands, threatened and/or endangered species or the critical habitat for same, significant elements of natural diversity, significant natural resources, or other sensitive areas that may be environmentally impacted by the proposed project. The field review consisted of intensive pedestrian survey of the approximately 21.18 km (13.16 miles) along the five proposed alternatives for the Kirby Parkway project. The proposed project will involve the improvement of Whitten Road, from Macon Road to Mullins Station Road; a section of Walnut Grove Road, from just west of I-240 to an area just north of the Shelby Farms Agri-Center; and a section of Humphreys Boulevard that intersects Walnut Grove Road. Two new roadways, Sycamore View Road and Kirby Parkway, will be constructed through a portion of Shelby Farms. The alternatives are described in Section 2.0 of this report. The approximate project location is depicted in Figure 1.

The study area extends from the south side of Macon Road to Walnut Grove Road in the eastern portion of the project area; from just west of I-240 to just north of the Shelby Farms Agri-Center along Walnut Grove Road in the southern most portion of the project area; from just south of Walnut Grove Road on Humphreys Boulevard to just south of the CSX Railroad in the western portion of the project area; from just east of a TVA power line easement to the intersection of Mullins Station Road and Whitten Road in the northern portion of the project, with the exception of a short section of Sycamore View road and a portion of Whitten Road, which are both located north of Mullins Station Road.

The study corridor is 91.44m (300') wide for the five proposed alternatives, with the

exception of the two proposed Wolf River Bridge crossings on Alternatives D and E, and the improvements to the Wolf River Bridge on Alternatives A, B and C, where the study corridor extends to 304.8m (1,000'). No detailed information related to the proposed bridge crossings was available at the time of this report. The alternatives are fully described in Section 2.0 of this report. The approximate project location is depicted in Figure 1.

The methods utilized in conducting the project consisted of an initial contact with the Tennessee Division of Natural Heritage to determine the known locations in the general area of rare plant and animal species, the habitat of each such species, and the likelihood of these species being present within or near the proposed project area. Subsequently, the U.S. Fish and Wildlife Service was contacted and requested to provide comments on the project area concerning threatened or endangered species, critical habitats for such species, the possible presence of regulatory wetlands, or other potential environmental impact concerns.

Previous studies conducted in the area were reviewed. Topographic maps, geologic maps, aerial photographs and the National Wetlands Inventory maps of the project area were reviewed for significant features to be field checked. Following the assimilation and review of these data, an extensive field review of the proposed project was conducted.

2.0 PROJECT DESCRIPTION

The project consists of the proposed construction of two new roads, Kirby Parkway and Sycamore View Road, through a portion of Shelby Farms and the improvements to three existing roadways, Whitten Road, Walnut Grove Road, and Humphreys Boulevard. The proposed project consists of five alternatives, which are described as follows.

2.1 Alternative A

Alternative A would have a six-lane typical section. Alternative A would consist of widening Walnut Grove Road from the Humphreys Boulevard intersection to a new interchange west of the existing Farm Road/Walnut Grove Road intersection; constructing a new road north across Shelby Farms to the intersection of Mullins Station Road and Whitten Road; widening Whitten Road from Walnut Grove Road to Macon Road. The proposed Kirby Parkway between Humphreys Boulevard and Macon Road would be approximately 4.8km (3 miles). Alternative A would also include an extension of Sycamore View Road from Mullins Station Road to the new Kirby Parkway within Shelby Farms, a distance of about 2.1km (1.3 miles).

The typical section for Kirby Parkway and Sycamore View Road extensions under Alternative A would be built with a 34.8m (114') right-of-way, with six 3.7m (12') traffic lanes, curbs and gutters and a raised median. From Mullins Station Road to Macon Road, the right-of-way for Kirby Parkway would be 32.9m (108'), consisting of six 3.7m (12') traffic lanes with curbs and gutters and a center turn lane.

Alternative A would include a new grade-separated interchange at the Walnut Grove Road/Humphreys Boulevard intersection. The alternative would cross the Wolf River at the existing Walnut Grove Road Bridge, which would be widened to accommodate six traffic lanes. From the east side of the Wolf River, Walnut Grove Road would be widened north of the existing road. Approximately 274.3m (900') west of the existing Farm Road/Walnut Grove Road signalized intersection, Alternative A

would turn north, bisecting a portion of Shelby Farms. The project would curve to the east to intersect Mullins Station Road at a 90° angle at Whitten Road. Whitten Road would be widened northward to Macon Road. An extension of Sycamore View Road would be built on new location in Shelby Farms.

Grade-separated interchanges would be built at the existing Walnut Grove Road/Humphreys Boulevard intersection, the planned Walnut Grove Road/Kirby Parkway intersection and the planned Sycamore View Road/Kirby Parkway intersection. The existing Wolf River Bridge also would be widened as a part of the Walnut Grove Road/Humphreys Boulevard interchange.

2.2 Alternative B

Alternative B would revise the typical section of the proposed Kirby Parkway through Shelby Farm from six lanes with a median to four lanes with a landscaped median. The location of the new alignment through Shelby Farms would also be shifted to the west in order to increase the distance from Patriot's Lake, Plough Park and Chickasaw Lake.

Under Alternative B, the grade-separated interchange of Walnut Grove Road and Kirby Parkway would be moved approximately 426.7m (1,400') to the west of the existing Farm Road intersection and approximately 152.4m (500') west of Alternative A's proposed grade-separated interchange. The new at-grade signalized intersection at Sycamore View Road and Kirby Parkway would be approximately 365.8m (1,200') west of Alternative A's location of that intersection. The proposed Kirby Parkway would have an at-grade, signaled intersection with Mullins Station Road, approximately 213.4m (700') west of the current Mullins Station/Whitten Road T-intersection. Kirby Parkway would then proceed on new location to the northeast to joint the existing Whitten Road approximately 274.3m (900') north of the existing Mullins Station/Whitten Road intersection.

The typical section for the proposed Kirby Parkway would be two 3.7m (12') travel lanes in each direction with a 24.4m (80') raised median. Sycamore View Road would have two 3.7m (12') travel lanes in each direction and a 9.1m (30') raised median. Total right-of-way through Shelby Farms would be approximately 45.7m (150'). For Sycamore View Road, the total right-of-way would be 30.5m (100'). The section of Walnut Grove Road between Humphreys Boulevard and the new Kirby Parkway/Walnut Grove Road interchange would be five 3.7m (12') lanes in each direction with a 9.1m (30') raised median, for an approximately 52.4m (172') right-of-way.

2.3 Alternative C

This alternative has the same alignment as Alternative B at the intersections of Kirby Parkway with Mullins Station Road and with Walnut Grove. In the middle of Shelby Farms, Alternative C would be approximately 182.9m (600') west of Alternative B at the new intersection of Kirby Parkway and Sycamore View Road. The typical section and right-of-way width for this alternative would be the same as for Alternative B above.

2.4 Alternative D

Alternative D was suggested to avoid a major interchange at Walnut Grove and a new roadway through the middle of Shelby Farms. From the proposed Humphreys Boulevard/Walnut Grove interchange, Alternative D would continue north along North Humphreys Boulevard rather than turning east to follow the existing Walnut Grove Road and the existing Wolf River bridge, as does Alternatives A, B and C. Alternative D would continue north on North Humphreys Boulevard, through the office park behind Christian Brothers High School. South of the TVA easement, Alternative D would curve to the northeast and cross the Wolf River on a new bridge, and continue through the Wolf River floodway and the Lucius Burch Jr. State Natural Area. It would then intersect with Sycamore View Road approximately 609.6m (2,000') west of Alternative B's proposed

intersection of Kirby Parkway and Sycamore View Road, and would join the alignment of Alternatives B and C at the southeast corner of the Shelby County Road Department complex south of Mullins Station Road. The typical section and right-of-way width for this alternative would be the same as for Alternative B above.

2.5 Alternative E

Alternative E would extend north from the Humphreys Boulevard/Walnut Grove Road interchange along North Humphreys Boulevard. At the TVA utility easement east of I-240, Alternative E would follow the eastern boundary of the TVA easement to reach the CSX railroad tracks in the vicinity of the State Prison Complex and the State Tech campus. Alternative E would continue east along the railroad line to the Whitten Road/Kirby Parkway intersection (or the suggested alignment of Alternatives B, C and D at Mullins Station Road). The typical section and right-of-way width for this alternative would be the same as for Alternative B above.

3.0 PROJECT SETTING

3.1 Terrain, Geology, and Soils

The proposed Kirby Parkway project in Memphis, Shelby County, Tennessee, lies within the physiographic Gulf Coastal Plain Province, which is characterized by relatively low elevations and relief, with sediments of the same characteristics as the coastal regions in other southeastern states. The topography of the extreme east and northeast portions of the project consists of low, rolling hills, while the remaining portions of the project are relatively flat.

The soils within the project area consist of the Grenada-Calloway-Henry Association. These soils are moderately to poorly drained, silty soils. These soils are located in level to rolling areas (0-5% grade). The project crosses one area, the flood plain of the Wolf River, which has soils of the Falaya-Waverly-Collins Association. These soils are associated with flood plains.

The geology along the proposed Kirby Parkway project is comprised of loess, a clayey, silty gray to dark brown wind-deposited soil. The underlying strata consist of sand and clay deposited along the coastal plain that existed during the Cretaceous Period.

3.2 Land Use

A mixture of agricultural, commercial, riparian, recreational, rural and wooded/forest land use characterizes the length of the Kirby Parkway project, with moderate commercial development in a former rural/agricultural setting. The five proposed alternatives for the project contain approximately 574.73 hectares (1,420.19 acres). It is approximately 51.98km (32.3 miles) in length and generally 91.44 m (300 feet) in width. Table I shows the land use categories within the project area for each of the five alternatives.

Table I. Land Use in the Proposed Kirby Parkway Project Area Along the Five Proposed Alternatives

Category	Alternative A Approximate Hectares-Acres Percent of Project Area	Alternative B Approximate Hectares-Acres Percent of Project Area	Alternative C Approximate Hectares-Acres Percent of Project Area	Alternative D Approximate Hectares-Acres Percent of Project Area	Alternative E Approximate Hectares-Acres Percent of Project Area
Agricultural	17.08 – 42.20 50.64%	13.66 – 33.75 36.54%	16.21 – 40.05 41.63%	13.90 – 34.35 36.22%	6.48 – 16.01 14.22%
Riparian	0.85 – 2.10 2.52%	1.13 – 2.79 3.03%	0.62 – 1.53 1.59%	0.61 – 1.51 1.58%	0.64 – 1.58 1.40%
State Natural Area (Lucius Burch Jr., State Natural Area)	1.85 – 4.57 5.48%	4.14 – 10.23 11.08%	4.14 – 10.23 10.63%	7.18 – 17.74 18.71%	6.94 – 17.15 15.23%
Commercial/Industrial	3.86 – 9.54 11.44%	4.37 – 10.80 11.69%	4.37 – 10.80 11.22%	10.23 – 25.28 26.65%	10.91 – 26.96 23.94%
Recreational	1.06 – 2.62 3.14%	-----	-----	-----	-----
Residential	4.11 – 10.16 12.18%	4.27 – 10.55 11.42%	4.27 – 10.55 10.97%	4.27 – 10.55 11.13%	5.18 – 12.80 11.37%
Railroad	0.18 – 0.45 0.53%	0.36 – 0.89 0.96%	0.36 – 0.89 0.92%	0.19 – 0.47 0.5%	4.74 – 11.71 10.40%
Roadway	4.74 – 11.71 14.07%	9.45 – 23.35 25.28%	8.97 – 22.17 23.04%	2.00 – 4.94 5.21%	6.88 – 17.00 15.10%
TVA Power Line Easement	-----	-----	-----	-----	3.80 – 9.39 8.34%
Totals	33.73 – 83.35 100%	37.38 – 92.37 100%	38.94 – 96.22 100%	38.38 – 94.84 100%	45.57 – 112.60 100%

4.0 AFFECTED ENVIRONMENT

4.1 Terrestrial Habitat

Human activity has extensively modified the terrestrial habitat within the study corridor. The entirety of the project area has been disturbed to some extent, with the exception of the Lucius Burch Jr. State Natural Area. Many exotics have become established in the disturbed areas and along roadsides such as Nodding Thistle (*Carduus nutans*), Japanese Honeysuckle (*Lonicera japonica*), Sericea Lespedeza (*Lespedeza cuneata*), and Privet (*Ligustrum* spp.).

The habitat types within the northern and southern most portions of the study corridor have been fragmented and modified by rural, residential and commercial development and the related infrastructure, such as utilities, roads, etc. Vegetative habitat types were determined during the site survey and reviewed on the functional aerial photographs. Habitat types and estimated area for each were calculated in the following categories:

1. developed/disturbed
2. mixed hardwood forest
3. agricultural (crop/pasture/grassland)
4. riparian

Table II identifies each of the above categories and provides the area of coverage and the percentage of the project area for each habitat type.

Table II. Habitat Types, Calculated Area and Percentage of Project Area by Alternative

Habitat Type	Alternative A Approximate Hectares-Acres Percent of Project Area	Alternative B Approximate Hectares-Acres Percent of Project Area	Alternative C Approximate Hectares-Acres Percent of Project Area	Alternative D Approximate Hectares-Acres Percent of Project Area	Alternative E Approximate Hectares-Acres Percent of Project Area
Developed/Disturbed	13.95 - 34.48 41.36%	18.45 - 45.59 49.35%	17.97 - 44.41 46.15%	16.69 - 41.24 43.49%	31.51 - 77.86 69.15%
Mixed Hardwood	1.85 - 4.57 5.48%	4.14 - 10.23 11.08%	4.14 - 10.23 10.63%	7.18 - 17.74 18.71%	6.94 - 17.15 15.23%
Agricultural (Crop/Pasture/Grassland)	17.08 - 42.20 50.64%	13.66 - 33.75 36.54%	16.21 - 40.05 41.63%	13.90 - 34.35 36.22%	6.48 - 16.01 14.22%
Riparian	0.85 - 2.10 2.52%	1.13 - 2.79 3.03%	0.62 - 1.53 1.59%	0.61 - 1.51 1.58%	0.64 - 1.58 1.40%

4.1.1 Developed/Disturbed Land

This habitat type consists of areas altered by human activities that eliminate all or nearly all natural habitat potential. Within the study corridor, developed or disturbed land areas include businesses, residences, highways, secondary roads, utility right of ways, railroads, and recreational areas. This habitat type would offer food and shelter to such animal species as the Eastern Cottontail Rabbit (*Sylvilagus floridanus*), Raccoon (*Procyon lotor*), House Mouse (*Mus musculus*), Eastern Gray Squirrel (*Sciurus carolinensis*), Eastern Chipmunk (*Tamias striatus*), Groundhog (*Marmota monax*), Common Mole (*Scalopus aquaticus*), and Opossum (*Didelphis marsupialis*). It would also afford nesting sites for a variety of birds associated with residential areas such as the Robin (*Turdus migratorius*), Cardinal (*Richmondena cardinalis*), and the Mocking Bird (*Mimus polyglottos*). The average of developed or disturbed land along all five proposed alternatives is approximately 49.9% of the project area (19.71 hectares/48.71 acres).

4.1.2 Mixed Hardwood Forest

Forest areas are dominated by tree species, are contiguous, and have greater than 50% canopy coverage. The forest areas within the study area are found primarily in the Lucius Burch Jr. State Natural Area, with a few scattered and disjunct forest pockets located along Whitten Road. The forest areas are dominated by Oak (*Quercus* spp.), Hickory (*Carya* spp.), Tulip Poplar (*Liriodendron tulipifera*), and Red Maple (*Acer rubrum*).

Species found in the perimeter areas of the mixed hardwood forests, including fence rows and other grown-over areas, include Hackberry (*Celtis* spp.), Black Locust (*Robinia pseudoacacia*), and Box Elder (*Acer negundo*). Additional understory species are Dogwood (*Cornus florida*) and Sassafras (*Sassafras albidum*). The shrub layer in the forest areas and much of the fence rows contain

Japanese Honeysuckle (*Lonicera japonica*), Poison Ivy (*Toxicodendron radicans*), Blackberry (*Rubus* spp.), Privet (*Ligustrum* spp.), and Multiflora and Wild Rose (*Rosa* spp.). This habitat type would offer food, cover and nesting sites to such animal species as the Eastern Cottontail Rabbit (*Sylvilagus floridanus*), Spotted Skunk (*Spilogale putorius*), Striped Skunk (*Mephitis mephitis*), Short-tailed Shrew (*Blarina brevicauda*), Raccoon (*Procyon lotor*), House Mouse (*Mus musculus*), Eastern Gray Squirrel (*Sciurus carolinensis*), Eastern Chipmunk (*Tamias striatus*), Groundhog (*Marmota monax*), Common Mole (*Scalopus aquaticus*), White-tailed Deer (*Odocoileus virginianus*), Wild Turkey (*Meleagris gallopavo*) and Opossum (*Didelphis marsupialis*). Nesting sites for a variety of bird species, both resident and transient, would be provided in this habitat type. Suitable habitat for native reptiles and amphibians would be found in the forest areas as well. The average of mixed hardwood forest habitat along all five proposed alternatives is approximately 12.2% of the project area (4.85 hectares/11.98 acres).

4.1.3 Agricultural (Crop/Pasture/Grassland)

This habitat type occurs throughout the central portion of the project area, through Shelby Farms. This habitat type contains mostly crop and pasture land. The dominant grass species in this section is Fescue (*Festuca* spp.) with some legumes (*Trifolium* spp.). Several weed species and small trees have invaded the fence rows. This habitat type would offer food, shelter, and/or nesting sites to such animal species as the Eastern Cottontail Rabbit (*Sylvilagus floridanus*), Spotted Skunk (*Spilogale putorius*), Striped Skunk (*Mephitis mephitis*), Short-tailed Shrew (*Blarina brevicauda*), Raccoon (*Procyon lotor*), House Mouse (*Mus musculus*), Eastern Gray Squirrel (*Sciurus carolinensis*), Eastern Chipmunk (*Tamias striatus*), Groundhog (*Marmota monax*), Common Mole (*Scalopus aquaticus*), and Opossum (*Didelphis marsupialis*).

The open fields would likely provide habitat and/or nesting sites for many

Alternative B will impact three areas within the 100 year floodplain. The first impact to the floodplain will involve approximately 381m (1,250') along the proposed Kirby Parkway, just north of the Walnut Grove Road and Kirby Parkway intersection. The second impact to the floodplain will involve approximately 228.6m (750') along Walnut Grove Road, just northeast of the proposed intersection of Walnut Grove Road and Humphreys Boulevard. The third impact to the floodplain will involve approximately 70m (200') along Walnut Grove Road, south-southwest of the proposed intersection of Walnut Grove Road and Humphreys Boulevard.

Alternative C will impact three areas within the 100 year floodplain. The first impact to the floodplain will involve approximately 381m (1,250') along the proposed Kirby Parkway, just north of the Walnut Grove Road and Kirby Parkway intersection. The second impact to the floodplain will involve approximately 228.6m (750') along Walnut Grove Road, just northeast of the proposed intersection of Walnut Grove Road and Humphreys Boulevard. The third impact to the floodplain will involve approximately 70m (200') along Walnut Grove Road, south-southwest of the proposed intersection of Walnut Grove Road and Humphreys Boulevard.

Alternative D will impact three areas within the 100 year floodplain. The first impact to the floodplain will involve approximately 70m (200') along Walnut Grove Road, south southwest of the proposed intersection of Walnut Grove Road and Humphreys Boulevard. The second impact to the floodplain will involve approximately 91.4m (300') along the proposed Humphreys Boulevard, just northwest of the Walnut Grove Road and Humphreys Boulevard intersection. The third impact to the floodplain will involve approximately 1,097.3m (3,600') through the Lucius Burch Jr. State Natural Area.

Alternative E will impact three areas within the 100 year floodplain. The first impact to the floodplain will involve approximately 70m (200') along Walnut Grove

Road, south southwest of the proposed intersection of Walnut Grove Road and Humphreys Boulevard. The second impact to the floodplain will involve approximately 91.4m (300') along the proposed Humphreys Boulevard, just northwest of the Walnut Grove Road and Humphreys Boulevard intersection. The third impact to the floodplain will involve approximately 1,585m (5,200') through the Lucius Burch Jr. State Natural Area.

Thirty-six (36) water quality-monitoring stations were reviewed during the assessment (See Figure 2). The 36 water quality-monitoring stations were established and utilized to obtain water quality data such as approximate water flow, temperature, pH, conductivity, and dissolved oxygen. Aquatic plant-life and stream fauna were noted at each site. The data are presented in Table A-1 (Appendix A). The water quality monitoring stations and stream crossings are described as follows starting at the project beginning on Whitten Road.

4.2.1 Unnamed Blueline-Upstream(WQ-1)

A blueline stream is located approximately 609.6m (2,000') south of the intersection of Whitten Road and Macon Road, on Whitten Road. It trends from southeast to northwest. The substrate consists of silty clay. The stream is estimated to be approximately 3.7-4.6m (12-15') wide, 0.31-0.61m (1-2') deep and had a flow of approximately 1 CFS. The banks are steep and lined with various herbaceous plants and shrubs. The canopy at this site is mostly open. No aquatic plants or animals were observed at this site. This stream will be impacted by all five of the proposed alternatives.

4.2.2 Unnamed Blueline Stream-Downstream (WQ-2)

A blueline stream is located approximately 609.6m (2,000') south of the intersection of Whitten Road and Macon Road, on Whitten Road. It trends from southeast to northwest. The substrate consists of small to medium boulders on

silty clay for approximately 31m (100') from the west side of the road before it enters a concrete spillway as it enters a residential area. The stream is estimated to be approximately 3.7-4.6m (12-15') wide, less than 0.31m (1') deep and had a flow of approximately 1 CFS. The banks are moderately sloped and lined with rip-rap and various herbaceous plants and shrubs. The canopy at this site is mostly open. Snails with a left-handed operculum were observed at this site. This stream will be impacted by all five of the proposed alternatives.

4.2.3 Wetland (WQ-3)

A wetland area is located approximately 167.6m (550') south southwest of the intersection of Whitten Road and Mullins Station Road, in an undeveloped field south of Mullins Station Road. The wetland is approximately 18.3x24.4m (60x80') in size, 0.31-0.61m (1-2') deep, with a silty clay substrate. A few small pools were observed in the basin of this wetland area. The depth was determined by the watermarks observed on the trees surrounding this area. The banks are moderately sloped and lined with Black Willow (*Salix nigra*), Honey Locust (*Gleditsia tricanthos*) and Privet (*Ligustrum spp.*). *Juncus spp.* and *Cyperus spp.* were observed throughout the basin of this wetland area. The canopy at this site is open. No aquatic animals were observed at this site. This stream will be impacted by proposed Alternative A.

4.2.4 Intermittent "Blueline" Stream (WQ-4)

An intermittent "blueline" stream is located approximately 167.6m (550') south southwest of the intersection of Whitten Road and Mullins Station Road, in an undeveloped field south of Mullins Station Road. It trends from east to southwest. The substrate consists of silty soil. The stream is estimated to be approximately 1.5-3.1m (5-10') wide, 0.91m (3') deep, and was dry at the time of observation. The banks are level and eroded, with various herbaceous plants and shrubs. The canopy at this site is mostly open. No aquatic plants or animals were

This wet weather conveyance will be impacted by proposed Alternative A.

4.2.8 Channelized Wet Weather Conveyance (WQ-8)

This wet weather conveyance is located approximately 213.4m (700') north of Walnut Grove Road. This wet weather conveyance trends from east to west. The substrate consists of silty soil. This wet weather conveyance flows from east to west. The banks are essentially non-existent and level. The canopy is open. No aquatic plants or animals were observed at this site. This wet weather conveyance appears to be nothing more than a depression in the middle of a cultivated field. This wet weather conveyance will be impacted by proposed Alternative A.

4.2.9 Channelized Wet Weather Conveyance (WQ-9)

This wet weather conveyance is located approximately 1,753m (5,750') east northeast of the Wolf River on Walnut Grove Road. This wet weather conveyance appears to originate from a large pond/lake and trends from north northeast to south southwest. This wet weather conveyance is estimated to be approximately 0.91-1.2m (3-4') wide and 0.31-0.91m (1-3') deep, and was dry at the time of observation. The substrate consists of grass and the banks are moderately sloped. The canopy is open. No aquatic plants or animals were observed at this site. This wet weather conveyance will be impacted by proposed Alternatives A, B and C.

4.2.10 Channelized Wet Weather Conveyance (WQ-10)

This wet weather conveyance is located approximately 1,753m (5,750') east northeast of the Wolf River on Walnut Grove Road. This wet weather conveyance was not flowing at the time of observation but did have a few small pools of water along its course. This wet weather conveyance trends from north northeast to south southwest. The wet weather conveyance is estimated to be approximately 0.91-1.2m (3-4') wide and 0.31m (1') deep, and was dry at the

time of observation. The substrate consists of silty soil with small cobble. The banks at this site are moderately sloped. The canopy at this site is open and consists of a few small Black Willow (*Salix nigra*). Watercress (*Barbarea vulgaris*), Sedge (*Cyperus* spp.) and Rush (*Juncus* spp.) were all observed in the stream. Snails and minnows were also observed at this location. An oil sheen was noticed floating on pools of water at this location. This wet weather conveyance will be impacted by proposed Alternatives A, B and C.

4.2.11 Channelized Wet Weather Conveyance (WQ-11)

This wet weather conveyance is located approximately 1,036m (3,400') southwest of the intersection of Whitten Road and Mullins Station Road, on an unnamed road just west of Farm Road. It trends from northeast to west southwest. The substrate consists of silty soil. This wet weather conveyance is estimated to be approximately 1.2m (4') wide, 0.61-0.91m (2-3') deep, and was dry at the time of observation. The banks are level and lined with various herbaceous plants and shrubs. The canopy at this site was open. No aquatic plants or animals were observed at this site. Proposed Alternative B will impact this wet weather conveyance.

4.2.12 Channelized Wet Weather Conveyance (WQ-12)

This wet weather conveyance forms a confluence with WQ-11 and is located approximately 304.8m (1,000') west of Farm Road on an unnamed road located in Shelby Farms. It trends from north to south and was dry at the time of observation. The substrate consists of silty soil. This wet weather conveyance is estimated to be approximately 0.91-1.2m (3-4') wide and 0.91-1.2m (3-4') deep. The banks are level and the canopy is open. Small shrubs and grasses line the banks. No aquatic plants or animals were observed at this site. Proposed Alternative B will impact this wet weather conveyance.

4.2.13 Channelized Wet Weather Conveyance (WQ-13)

This wet weather conveyance is located approximately 487.7m (1,600') north of Walnut Grove Road, just southeast of an unnamed road in Shelby Farms. This wet weather conveyance extends along an access road through a large field in Shelby Farms. Although the conveyance was dry at the time of observation, it is estimated to be approximately 0.61m (2') wide and approximately 0.31m (1') deep. This conveyance trends from east to west. The substrate consists of silty soil. The banks of this conveyance are steep to level and they are lined with various grasses and honeysuckle. The canopy at this site is open. No aquatic plants or animals were observed at this site. Proposed Alternatives B and C will impact this wet weather conveyance.

4.2.14 Channelized Wet Weather Conveyance (WQ-14)

This wet weather conveyance is located approximately 487.7m (1,600') north of Walnut Grove Road, just southeast of an unnamed road in Shelby Farms. The wet weather conveyance is estimated to be approximately 1.2-1.5m (4-5') wide and approximately 0.31m (1') deep. It trends from east to west and was dry at the time of observation. The substrate consists of silty soil. The banks of the conveyance are steep, extremely eroded and lined with grasses and shrubs. The canopy at this site was mostly open and consisted of Red Maple (*Acer rubrum*) and Privet (*Ligustrum* spp.). No aquatic plants or animals were observed at this site. Proposed Alternatives B and C will impact this wet weather conveyance.

4.2.15 Channelized Wet Weather Conveyance (WQ-15)

This wet weather conveyance is located approximately 335.3m (1,100') north of Walnut Grove Road. This wet weather conveyance trends from east to west. The substrate consists of silty soil. It is approximately 0.61m (2') wide and 0.91-1.2m (3-4') deep and was dry at the time of observation. The banks are level and the canopy is open. No aquatic plants or animals were observed at this site.

Proposed Alternatives B and C will impact this wet weather conveyance.

4.2.16 Channelized Wet Weather Conveyance (WQ-16)

This wet weather conveyance is located approximately 213.4m (700') north of Walnut Grove Road. This wet weather conveyance trends from east to west. The substrate consists of silty soil. It is approximately 2.4m (8') wide and 0.31m (1') deep and was dry at the time of observation. The banks are level and the canopy is open. No aquatic plants or animals were observed at this site. Proposed Alternatives B and C will impact this wet weather conveyance.

4.2.17 Channelized Wet Weather Conveyance (WQ-17)

This wet weather conveyance is located approximately 533.4 (1,750') west of WQ-12, in a field southeast of the Memphis Correctional Institute. This wet weather conveyance flows from north to south and enters the Wolf River. The substrate consists of a concrete ditch. It is estimated to be approximately 0.61-0.91m (2-3') wide, 0.31m (1') deep, and the flow was estimated to be less than 1 CFS. The banks are level and lined with white clover and various grass species. No aquatic plants or animals were observed at this site. Proposed Alternatives A, B, C, and D will impact this wet weather conveyance.

4.2.18 Channelized Wet Weather Conveyance (WQ-18)

This wet weather conveyance is located approximately 533.4 (1,750') west of WQ-12, in a field southeast of the Memphis Correctional Institute. This wet weather conveyance flows from north to south and enters the Wolf River. The substrate consists of silty soil. It is estimated to be approximately 0.61m (2') wide, less than 0.31m (1') deep, with an estimated flow of less than 1 CFS. The banks are level and lined with Virginia Creeper (*Parthenocissius quinquefolia*), Cattails (*Typha* spp.), Asiatic Dayflower (*Commelina communis*), Lady's Thumb (*Polygonum* spp.) and Black Willow (*S. nigra*) shrubs. No aquatic animals were

observed at this site. Proposed Alternatives A, B, C, and D will impact this wet weather conveyance.

4.2.19 Wolf River-Upstream (WQ-19)

This site is located on the upstream side of the Wolf River from the project. The Wolf River is estimated to be approximately 38.1m (125') wide, 0.91-1.5m (3-5') deep, with an estimated flow of 3 CFS. The substrate consists of silty soil with small to medium boulders. The Wolf River flows from southeast to northwest. The banks at this location are steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), and Sycamore (*Platanus occidentalis*). Fish, snails with a right-handed operculum, and water striders were observed at this site. No aquatic plants were observed at this site. Proposed Alternatives A, B, and C will impact this stream.

4.2.20 Wolf River-Downstream (WQ-20)

This site is located on the downstream side of the Wolf River from the project. The Wolf River is estimated to be approximately 38.1m (125') wide, 0.91-1.5m (3-5') deep, with an estimated flow of 3 CFS. The substrate consists of silty soil with small to medium boulders. The Wolf River flows from southeast to northwest. The banks at this location are steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), and Sycamore (*Platanus occidentalis*). Fish, snails with a right-handed operculum, and water striders were observed at this site. No aquatic plants were observed at this site. Proposed Alternatives A, B, and C will impact this stream.

4.2.21 Unnamed Pond (WQ-21)

This pond is located approximately 45.7m (150') east of Humphreys Boulevard and 305m (1,000') southeast of Walnut Grove Road, west of the Wolf River. The pond is estimated to be approximately 106.7m (350') wide by 487.7m (1600')

long. The substrate consists of sandy soil and the banks are moderately sloped. The canopy is open and consists primarily of Sycamore (*Platanus occidentalis*). Rush (*Juncus* spp.) were observed along the banks. No aquatic animals were observed at this site. All five of the proposed alternatives will impact this pond.

4.2.22 Unnamed Pond (WQ-22)

This pond is located approximately 152.4m (500') north of Walnut Grove Road and 45.7m (150') northeast of Humphreys Boulevard. The pond is estimated to be approximately 45.7m (150') wide by 83.8m (275') long. The substrate consists of sandy clay and the banks are steep. The canopy is open and consists primarily of Sycamore (*Platanus occidentalis*). Sedge (*Cyperus* spp.) were observed along the banks. Minnows and freshwater mussels (clams) were observed at this site. All five of the proposed alternatives will impact this pond.

4.2.23 Blueline Stream (WQ-23)

This stream is located on the south side of Humphreys Boulevard, upgradient to WQ-22. The stream is estimated to be approximately 6.1-7.6m (20-25') wide, 1.2-1.5m (4-5') deep, with an estimated flow of 3 CFS. The substrate consists of silty soil with small boulders. This stream flows from south to north. The banks at this location are steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), Hackberry (*Celtis* spp.), Green Ash (*Fraxinus pennsylvanica*), Honey Locust (*Gleditsia triacanthos*) and Sycamore (*Platanus occidentalis*). Minnows were observed at this site. Aquatic plants observed at this site included Lady's Thumb (*Polygonum coccineum*) and Sedge (*Cyperus* spp.). Proposed Alternatives D and E will impact this stream.

4.2.24 Blueline Stream (WQ-24)

This site is located approximately 30.5m (100') north of Walnut Grove Road. The stream is estimated to be approximately 6.1-15.2m (20-50') wide (varies

along its course), <0.31-1.5m (1-5') deep, with an estimated flow of 2-3 CFS. The stream begins as a riffle area as it passes under Walnut Grove Road and gets wider and deeper as it flows to the north. The substrate consists of small to medium boulders on silty clay. The canopy is mostly open and the banks are extremely steep and eroded. The canopy consists of Mimosa (*Albizia julibrissin*), Cottonwood (*Populus* spp.), Red Oak (*Quercus rubra*), Red Maple (*A. rubrum*) and Hackberry (*Celtis* spp.). No aquatic plants or animals were observed at this site. All five of the proposed alternatives will impact this stream.

4.2.25 Intermittent "Blueline" Stream (WQ-25)

This site is located approximately 76.2m (250') east of I-240, just outside of the Lucius Burch Jr. State Natural Area. The stream is estimated to be approximately 1.2-1.8m (4-6') wide, 0.31-0.61m (1-2') deep, with an estimated flow of less than 1 CFS. The substrate consists of silty soil and detritus. The banks at this site are moderately sloped and were lined with rip-rap. The canopy at this site is open to the west and closed to the east. The canopy consists of Black Willow (*S. nigra*), Red Maple (*A. rubrum*), Hackberry (*Celtis* spp.), Red Oak (*Quercus rubra*) and Sycamore (*Platanus occidentalis*). Minnows were also observed at this location. An oil sheen was noticed on the surface of the stream at this location. Proposed Alternatives D and E will impact this stream.

4.2.26 Borrow Pit (WQ-26)

This borrow pit is located approximately 121.9m (400') east of I-240, just outside of the Lucius Burch Jr. State Natural Area. It most likely originates from construction activities related to I-240. The substrate consists of silty sand. The borrow pit is estimated to be approximately 70m (200') long by 22.9m (75') wide, 0.61-0.91m (2-3') deep, and was full of tree stumps. The banks are extremely steep. The canopy at this site is open and consisted mainly of Sycamore (*Platanus occidentalis*). Aquatic plants and animals observed at this site included minnows, fish and Sedge (*Cyperus*

spp.). Proposed Alternatives D and E will impact this area.

4.2.27 Borrow Pit (WQ-27)

This borrow pit is located approximately 121.9m (400') east of I-240, just outside of the Lucius Burch Jr. State Natural Area, adjacent to WQ-26. It most likely originates from construction activities related to I-240. The substrate consists of silty sand. The borrow pit is estimated to be approximately 106.7m (350') long by 22.9m (75') wide and 0.61-0.91m (2-3') deep. The banks are extremely steep. The canopy at this site is open and consisted mainly of Sycamore (*Platanus occidentalis*). Aquatic plants and animals observed at this site included minnows, fish and Sedge (*Cyperus* spp.). Proposed Alternatives D and E will impact this area.

4.2.28 Wolf River-Upstream (WQ-28)

This site is located in the Lucius Burch Jr. State Natural Area, approximately 350.2m (1,150') east of the TVA power line easement, on the upstream side of the Wolf River from the project. The Wolf River is estimated to be approximately 45.7m (150') wide, 0.91-1.8m (3-6') deep, with an estimated flow of 3 CFS. The substrate consists of sandy soil. The Wolf River flows from southeast to northwest. The banks at this location are extremely steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), Hackberry (*Celtis* spp.) and Sycamore (*Platanus occidentalis*). Fish and water striders were observed at this site. No aquatic plants were observed at this site. Proposed Alternative D will impact this stream.

4.2.29 Wolf River-Downstream (WQ-29)

This site is located in the Lucius Burch Jr. State Natural Area, approximately 289.6m (950') east of the TVA power line easement, on the downstream side of the Wolf River from the project. The Wolf River is estimated to be approximately 45.7m (150') wide, 0.91-1.8m (3-6') deep, with an estimated flow of 3 CFS. The substrate consists of sandy soil. The Wolf River flows from southeast to northwest. The banks at this location are extremely steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), Hackberry (*Celtis* spp.) and Sycamore (*Platanus occidentalis*). Fish and water striders were observed at this site. No aquatic plants were observed at this site. Proposed Alternative D will impact this stream.

4.2.30 Wolf River-Upstream (WQ-30)

This site is located in the Lucius Burch Jr. State Natural Area, approximately 83.8m (275') east of the TVA power line easement, on the upstream side of the Wolf River from the project. The Wolf River is estimated to be approximately 45.7m (150') wide, 0.91-1.8m (3-6') deep, with an estimated flow of 3 CFS. The substrate consists of sandy soil. The Wolf River flows from southeast to northwest. The banks at this location are extremely steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), Hackberry (*Celtis* spp.) and Sycamore (*Platanus occidentalis*). Fish and water striders were observed at this site. No aquatic plants or animals were observed at this site. Proposed Alternative E will impact this stream.

4.2.31 Wolf River-Downstream (WQ-31)

This site is located in the Lucius Burch Jr. State Natural Area, approximately

30.5m (100') east of the TVA power line easement, on the upstream side of the Wolf River from the project. The Wolf River is estimated to be approximately 45.7m (150') wide, 0.91-1.8m (3-6') deep, with an estimated flow of 3 CFS. The substrate consists of sandy soil. The Wolf River flows from southeast to northwest. The banks at this location are extremely steep and the canopy is open. The canopy consists mainly of Red Maple (*A. rubrum*), Cottonwood (*Populus* spp.), Hackberry (*Celtis* spp.) and Sycamore (*Platanus occidentalis*). No aquatic plants or animals were observed at this site. Proposed Alternative E will impact this stream.

4.2.32 Intermittent "Blueline" Stream (WQ-32)

This site is located approximately 518.2m (1,700') north of the Wolf River in the Lucius Birch Junior Natuarl Area, just east of the TVA power line easement. The stream is estimated to be approximately 1.2-1.8m (4-6') wide and 0.31m (1') deep. The substrate consists of silty soil and detritus. The banks at this site are level to moderately sloped. The canopy at this site is mostly closed. The canopy consists of Red Maple (*A. rubrum*), Hackberry (*Celtis* spp.), Red Oak (*Quercus rubra*) and Sycamore (*Platanus occidentalis*). No aquatic plants or animals were observed at this site. Proposed Alternative E will impact this stream.

4.2.33 Intermittent "Blueline" Stream (WQ-33)

This site is located approximately 487.7m (1,600') north of WQ-32, east of the TVA power line easement in the Lucius Burch Jr. State Natural Area. The stream is estimated to be approximately 0.91-1.2m (3-4') wide and 0.31-0.61m (1-2') deep. The substrate consists of silty soil and detritus. The banks at this site are level to moderately sloped. The canopy at this site is partially open. The canopy consists of Black Willow (*S. nigra*), Red Maple (*A. rubrum*), Hackberry (*Celtis* spp.), Red Oak (*Quercus rubra*) and Sycamore (*Platanus occidentalis*). No

aquatic plants or animals were observed at this site. Proposed Alternative E will impact this stream.

4.2.34 Intermittent “Blueline” Stream (WQ-34)

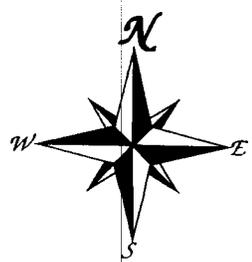
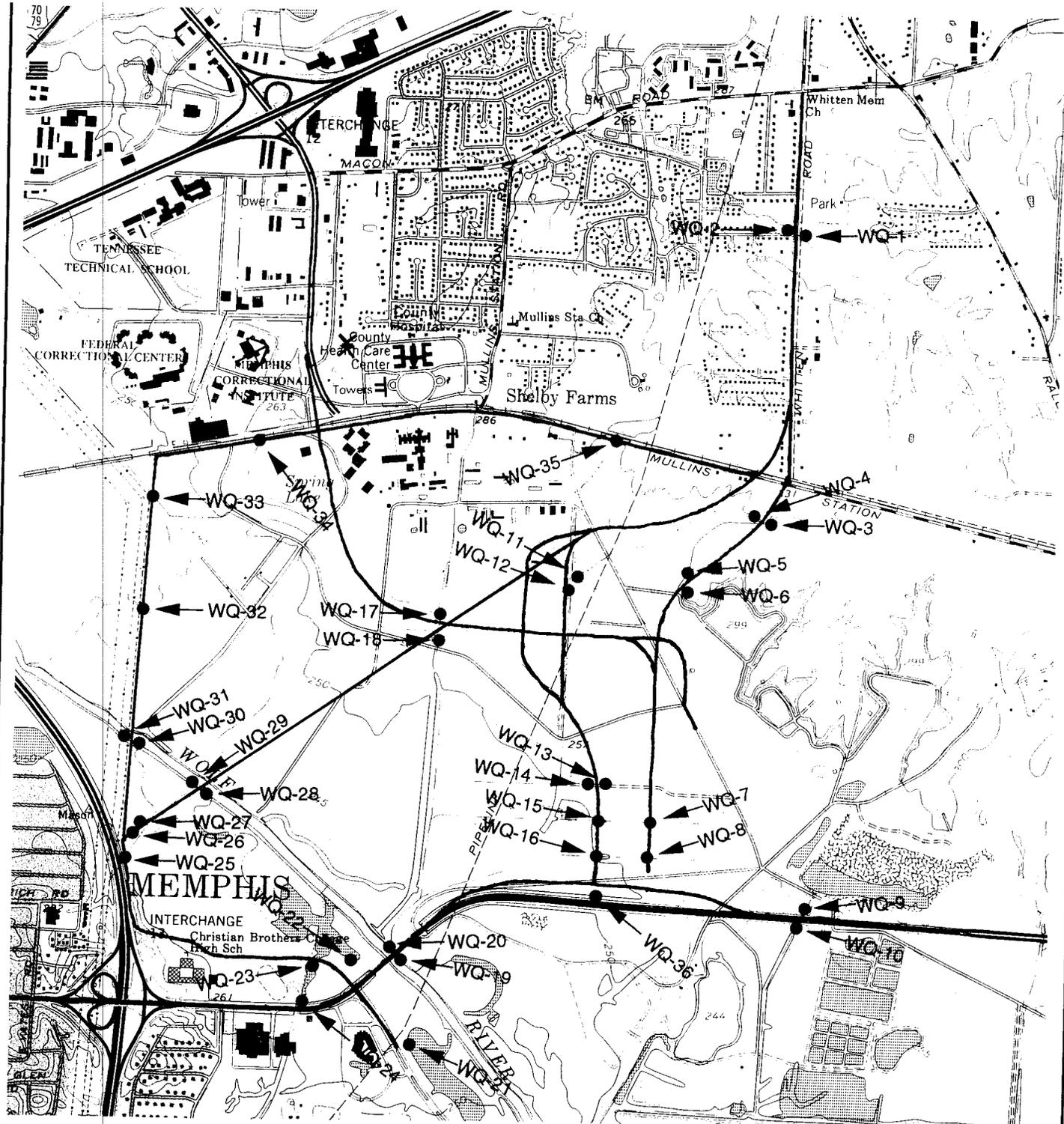
This site is located approximately 487.7m (1,600’) northeast of WQ-33, just south of the CSX railroad tracks. The stream is estimated to be approximately 1.2-1.8m (4-6’) wide and 0.31m (1’) deep. The substrate consists of silty soil and cobble. The banks at this site are level to moderately sloped. The canopy at this site is open. The canopy consists of Red Maple (*A. rubrum*), Hackberry (*Celtis* spp.), and Red Oak (*Quercus rubra*). No aquatic plants or animals were observed at this site. Proposed Alternative E will impact this stream.

4.2.35 Channelized Wet Weather Conveyance (WQ-35)

This wet weather conveyance is located approximately 1524m (5,000’) east of WQ-34, just south of the CSX railroad tracks. It is estimated to be approximately 1.2-1.8m (4-6’) wide and 0.31-0.61m (1-2’) deep. The substrate consists of silty soil and detritus. The banks at this site are level to moderately sloped. The canopy at this site is open. The canopy consists of Red Maple (*A. rubrum*), Hackberry (*Celtis* spp.) and Red Oak (*Quercus rubra*). No aquatic plants or animals were observed at this site. Proposed Alternative E will impact this wet weather conveyance.

4.2.36 Wet Weather Conveyance (WQ-36)

This wet weather conveyance parallels the north side of Walnut Grove Road. This conveyance is approximately 1.5-3.1m (5-10’) wide and 0.31m (1’) deep. The substrate consists of silty clay. The north bank is moderately sloped and the south bank from the road is steep. The canopy at this site is open. No aquatic plants or animals were observed at this location. Proposed Alternatives A, B, and C will impact this stream.



ENVIRONMENTAL CONSTRAINTS MAP

ELLEDALE, TENNESSEE
(1965-Photorevised 1993)

USGS Topographic Map
7.5 Minute Series

KIRBY PARKWAY PROJECT
MEMPHIS, TENNESSEE

WQ = Water Quality Station

SCALE: 1" = 2,000'

Contour Interval = 10'

FIGURE 2

4.3 Wetlands

Wetlands are defined in 33 CFR Part 328.3 and are protected by Section 404 of the Clean Water Act (33 USC 1344), which is administered and enforced by the U.S. Army Corps of Engineers (USACE).

Upon review of the subject property, one site was reviewed in which the three criteria (hydric soils, hydrophytic vegetation and hydrology) for wetland conditions existed. A single wetland area was identified during the field review just south of the intersection of Mullins Station Road and Whitten Road, on the proposed Alternative A. Even though this wetland was not delineated, it was identified as a jurisdictional wetland. This wetland area is approximately 18.3x24.4m (60x80') in size and was approximately 0.31-0.61m (1-2') deep. This wetland area is associated with an intermittent blueline stream which trends from east to west, just south of Mullins Station Road. This wetland area is identified as WQ-3 on the Environmental Constraints Map (See Figure 2).

4.4 Federally Listed Proposed, Endangered and Threatened Species

The U.S. Fish & Wildlife Service indicated that no records regarding proposed, threatened and/or endangered species of plants and animals exist within the proposed project corridor. Additionally, the records of the Tennessee Division of Natural Heritage were reviewed to determine the known locations in the general area for rare plant and animal species, the habitat of each such species, and the likelihood of these species being present within or near the proposed project area. After reviewing the records of the Division of Natural Heritage, it was determined that no state-listed threatened, endangered or sensitive species will be impacted by the proposed project.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Terrestrial Habitat Impacts

Construction and earth-moving activities will disturb soils, and possibly some of the underlying sand and clay sediments where the soil is thin. Some fair to good productivity soils will be converted to non-agricultural uses, particularly in the central portion of the proposed project area through Shelby Farms. Long-term minimal and insignificant impacts to the topography are expected.

Short- and long-term impacts will occur to existing land use within the study corridor as a result of the project. Short-term impacts will consist of noise, dust, and traffic movement inconveniences arising from the construction activities associated with the project implementation. Long-term impacts include the permanent loss of open space, wooded areas, riparian areas and agricultural land as a result of the right-of-way expansion. Limited residential displacement may occur as a result of the project, particularly along Whitten Road And Mullins Station Road.

The proposed improvements created by the project may encourage future development within the study corridor. Direct long-term impacts will occur when right-of-way expansion encroaches on agricultural and forest lands. Additional development activities may occur along the new roadway on private lands, which may further encroach on terrestrial habitat. Construction and earth-moving activities will create additional disturbed soil areas that will become susceptible to exotic plant species invasion, further depleting suitable habitat for more desirable native species.

5.2 Stream Impacts

There are potential impacts to the Wolf River and all of the intermittent “blueline” streams from the proposed project. The linear stream impact calculations were determined by measuring the linear distances of the streams within the project study corridor. The total number was then divided into stream crossings and side stream impacts. The stream impacts for each alternative are as follows: The project could potentially impact 59.5 linear meters (195') of streams along Alternative A; 53.3 linear meters (175') of streams along Alternative B; 53.3 linear meters (175') of streams along Alternative C; 70.4 linear meters (231') of streams along Alternative D; 75.3 linear meters (247') of streams along Alternative E.

Indirect, short-term impacts to aquatic habitats will occur during clearing, site preparation and construction. Sedimentation within the streams will likely increase due to significant soil disturbances. There will likely be short-term impacts to stream fisheries along the Wolf River due to reduced water quality from physical disturbances, such as rechanneling, bridge pier placement, or other in-stream construction operations. Such disturbances often displace larger fish while increasing mortality and impairing reproduction in smaller fish. Larval and the youngest fish would be the most adversely affected because of their lessened mobility and narrow range of tolerance to disturbance and pollution.

Project impacts to fisheries will be lessened during the months of September through March, and would greatly increase between April and August due to spawning activities and larval fish growth. A long-term impact on the fishery streams will be the loss of habitat from rechanneling, bank clearing and stream filling, if required for project completion.

Direct floodplain impacts (short- and long-term) may be greatly reduced by drainage structure and bridge design to avoid pier placement within the floodplain, when possible. Minimizing impacts to the Wolf River floodplain will be of particular importance to protect the natural area and the aquatic fauna. Minimal clearing of trees and vegetative cover within the floodplains and zero bank clearing at streams will reduce floodplain and water quality impacts. Floodplain impact avoidance will be very important for this project, since the new roadway location may increase the storm event run-off (creating impervious surfaces and loss of forested areas). Increased flow during storm events must be partially stored on the floodplains to prevent excessive damage to downstream areas that may be caused by erosion, substrate scouring and aquatic habitat alterations.

5.3 Wetlands Impacts

A single wetland area was identified during the field review just south of the intersection of Mullins Station Road and Whitten Road, on the proposed Alternative A. Even though this wetland was not delineated, it was identified as a jurisdictional wetland. This wetland area is approximately 18.3x24.4m (60x80') in size. This wetland area is associated with an intermittent blue-line stream which trends from east to west, just south of Mullins Station Road.

Indirect, short-term impacts to this wetland area are avoidable if the proper measures are taken during clearing and construction activities.

5.4 Impacts to Threatened and Endangered Species

No impacts to any federally- or state-listed species are expected as a result of the proposed project.

5.5 Wildlife Impacts

The proposed project may result in minor impacts to wildlife, particularly along the Wolf River. Short-term, direct effects include displacement and loss of habitat.

Long-term, cumulative effects could include loss of habitat, permanent roadways causing animal movement barriers, and loss of individual animals to traffic.

5.6 Invasive Species Impacts

Executive Order 13112 (E.O.) of 1999, calls for the prevention and control of invasive species (non-native exotics). The E.O. directs federal agencies to expand and coordinate their efforts to combat the introduction and spread of plants and animals not native to the United States. The purpose of the E.O. is to avert the spread of non-native species and prevent them from encroaching upon and altering plant and animal habitat; prevent further loss of our native species; avoid the loss of agricultural and recreational lands; and avoid other detrimental effects caused by these species.

Highways provide opportunities for the unimpeded movement of invasive species. Non-native plant species are of a great concern along roadways. These invasive species can be spread along roadways by automobile and animal traffic; mowing and spraying operations; the importing of dirt, gravel or sod; being planted for erosion control, landscape or wildflower projects; or by the inadvertent spread of their seeds. While some of these factors are beyond human control, some measures can be taken to prevent the spread of these invasive species. Some of the most common non-native species observed in the proposed project corridor were Nodding Thistle (*Carduus nutans*), Japanese Honeysuckle (*Lonicera japonica*), Sericea Lespedeza (*Lespedeza cuneata*), and Privet (*Ligustrum* spp.).

Each of the above-listed species is listed by Tennessee Exotic Pest Plant Council as a Rank 1 (Severe Threat: exotic plant species which possess characteristics of invasive species and spread easily into native plant communities and displace native vegetation; includes species which are or could become widespread in Tennessee). Also found in the project area are Crown Vetch (*Coronilla varia*) and Mimosa (*Albizia julibrissin*), listed by Tennessee Exotic Pest Plant Council as a Rank 2 (Significant Threat: exotic plant species which possess some invasive characteristics, but have less impact on native plant communities; may have the capacity to invade natural communities along disturbance corridors, or to spread from stands in disturbed sites into undisturbed areas, but have fewer characteristics of invasive species than Rank 1).

Other species found within the project corridor include White Poplar (*Populus alba*) and Wild Carrot (*Daucus carota*), and are listed by Tennessee Exotic Pest Plant Council as a Rank 3 (Lesser Threat: exotic plant species which seem to principally spread and remain in disturbed areas, but not readily invade natural areas). The effect that these and other non-native species may have on the proposed project area could be detrimental to native plant populations, if allowed to spread. Exotic pest plants can alter ecosystems by displacing native plant species, which may in turn impact native fauna survival.

The following recommendations may help prevent the introduction and spread of invasive species:

1. Grasses, shrubs and trees planted for beautification purposes or to prevent erosion should be native species, and, if possible, naturally occurring at the project locale. Salvaging native plants and/or harvesting native plant seeds in the way of construction will aid in the re-establishment of the natural ecosystem. These native species are adapted to the regional conditions, promote biodiversity, provide food and shelter to native wildlife and, once fully established, will help prevent the

introduction and spread of exotics. Other non-invasive species may be used in plantings in the absence of native species.

2. Fresh disturbances to soil are areas in which exotics tend to invade and establish rapidly. Whenever possible, all disturbed soil should be seeded with non-invasive or temporary annual species (wheat, oats, rye, etc.) to reduce the ability of exotics to become established and reduce erosion potential during rain events.
3. Careful consideration should be given to the types and quality of plants at borrow sites where soils will be removed for use in the project area. Borrow material often contains viable plant parts and seeds of exotics that could thrive at new locations once introduced.

5.7 Impacts to Other Significant Natural Resources

Potential impacts to the Lucius Burch Jr. State Natural Area may occur as a result of the proposed project. Indirect, short-term impacts will occur during clearing, site preparation and construction. There will likely be short-term impacts to stream fisheries along the Wolf River, within the natural area, due to reduced water quality from physical disturbances, such as rechanneling, bridge pier placement, or other in-stream construction operations. Another long- and short-term impact to the natural area will be the temporary loss of habitat by clearing activities and construction. The proposed roadways that will cross the natural area on Alternatives D and E could restrict animal movement, open the natural area to invasive species, and diminish the overall quality of this public resource.

Table III. Project Area Impacts by Alternative

Type of Impact	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Land Use	Hectares 33.73 Acres 83.35	Hectares 37.38 Acres 92.37	Hectares 38.94 Acres 96.22	Hectares 38.38 Acres 94.84	Hectares 45.57 Acres 112.60
Habitat Types	Hectares 13.95 Acres 34.48	Hectares 18.45 Acres 45.59	Hectares 17.97 Acres 44.41	Hectares 16.69 Acres 41.24	Hectares 31.51 Acres 77.86
Mixed Hardwood	Hectares 1.85 Acres 4.57	Hectares 4.14 Acres 10.23	Hectares 4.14 Acres 10.23	Hectares 7.18 Acres 17.74	Hectares 6.94 Acres 17.15
Agricultural	Hectares 17.08 Acres 42.20	Hectares 13.66 Acres 33.75	Hectares 16.21 Acres 40.05	Hectares 13.90 Acres 34.35	Hectares 6.48 Acres 16.01
Riparian	Hectares 0.85 Acres 2.10	Hectares 1.13 Acres 2.79	Hectares 0.62 Acres 1.53	Hectares 0.61 Acres 1.51	Hectares 0.64 Acres 1.58
Floodplain	441 linear meters 1,450 linear feet	670.6 linear meters 2,200 linear feet	670.6 linear meters 2,200 linear feet	1,249.7 linear meters 4,100 linear feet	1,737.4 linear meters 5,700 linear feet
Proposed, Threatened and/or Endangered Species	None	None	None	None	None
Wetlands	A 18.3X24.4m (60X80') wetland area is located just south of the Mullins Station Road and Whitten Road Intersection	None	None	None	None
Stream Impacts	59.5 linear meters 195 linear feet	53.3 linear meters 175 linear feet	53.3 linear meters 175 linear feet	70.4 linear meters 231 linear feet	75.3 linear meters 247 linear feet
Invasive Species Impacts	Minor-due to prior disturbances, numerous exotics have already been established throughout this alternative	Minor-due to prior disturbances, numerous exotics have already been established throughout this alternative	Minor-due to prior disturbances, numerous exotics have already been established throughout this alternative	Severe-construction of this proposed alternative through the Lucius Birch Junior Natural Area is likely to introduce numerous exotics	Severe-construction of this proposed alternative through the Lucius Burch Jr. State Natural Area is likely to introduce numerous exotics

Lucius Birch Junior Natural Area	Minor-along Wolf River Bridge	Minor-along Wolf River Bridge	Minor-along Wolf River Bridge	Severe-new construction through this area will destroy wildlife habitat, impact the floodplain, and enable exotic species to become established within this area.	Severe-new construction through this area will destroy wildlife habitat, impact the floodplain, and enable exotic species to become established within this area.
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Land Use - Refers to the total amount of land, in hectares and acres, that will be used to construct the proposed alternatives.

Habitat Types - Refers to the different types of habitat available to wildlife within the proposed project area on each alternative. The amount of each habitat type is calculated into total hectares and acres.

Floodplain - Floodplain impacts are based upon the amount of linear feet that each proposed alternative will impact within the 100 year floodplain.

Proposed, Threatened and/or Endangered Species - The U.S. Fish & Wildlife Service did not identify any listed or proposed for listing species.

Wetlands - One wetland area along Alternative A may be impacted.

Stream Impacts - Stream impacts are based upon the amount of linear feet that each proposed alternative will impact.

Invasive Species Impacts - These impacts are based upon the amount of previously disturbed and undisturbed areas along each of the proposed alternatives. Disturbed areas enable exotic species to establish themselves due to the lack of competition from native species.

Lucius Burch Jr. State Natural Area - wildlife habitats, floodplains and invasive species were all considered when assessing these areas.

6.0 CONCLUSIONS

The construction of the proposed Kirby Parkway road improvements is not likely to adversely impact any federally-listed species. However, review and concurrence by the U.S. Department of Interior Fish and Wildlife Service may be required.

The project may impact a wetland area, some floodplains and the water quality of the Wolf River and several small intermittent blueline streams. The greatest potential for effect would be from sedimentation from activities related to roadway construction. This could result in water quality degradation and the limited loss aquatic life in the streams and impact terrestrial animal species that depend on the streams for food and water.

There will be direct, long-term impacts when agricultural lands and forests are converted to roadways and right-of-way ditch lines. Long-term impacts will occur in aquatic habitats due to stream channelization, bridge pier placement or box culvert construction, bank clearing, and stream filling or covering.

There will be direct and indirect short-term impacts to soils, water quality, and aquatic habitat due to construction activities, earth moving, drainage structures, and bridge construction that create soil disturbances, soil erosion, and stream sedimentation. Properly installed and maintained erosion control structures, as well as designed and implemented engineering controls, should reduce the overall impact to the environment in the project area.

Public lands will be impacted by the project, since construction activities may transect portions of Shelby Farms and the Lucius Burch Jr. State Natural Area.

General and overall mitigation measures and project safeguards should include during and post-construction sediment control and roadside and slope plantings suitable to the area and the species that may be impacted.

Construction mitigation should include careful planning, implementation, and monitoring during all construction activities, in coordination with the U.S. Fish & Wildlife Service, the Tennessee Division of Water Pollution Control, the Tennessee Wildlife Resources Agency, and the Tennessee Division of Natural Heritage, to minimize the overall impact to wildlife, streams, and the Lucius Birch Junior Natural Area in the project area.

Further mitigation should include the post-construction roadside plantings of annual and perennial, non-invasive grasses with a mixture of native species without ground covering and invasive species such as Tall Fescue, Sericea and Crown Vetch. Such plantings will provide an opportunity for destroyed or removed species to become re-established.

Careful planning and project monitoring may be required to avoid impacting the wetland located just south of the intersection of Mullins Station Road and Whitten Road, on the proposed Alternative A.

Respectfully submitted,

Development & Environmental Planning Associates, Inc.


James R. Powers, Project Manager


Rhett W. Delaney, C.W.D.

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APPENDIX A

**WATER QUALITY MONITORING DATA
AND
WATER QUALITY MONITORING STATION DESCRIPTIONS**

TABLE A-I

WATER QUALITY STATION DESCRIPTIONS

Water Quality Station	Substrate & Stream Conditions	Canopy & Bank Descriptions	Aquatic Plants Observed	Aquatic Animals Observed
WQ-1 Unnamed Blueline Stream (Upstream)	Substrate- silty clay Stream- 3.7-4.6m (12-15') wide, 0.31-0.61m (1-2') deep, 1CFS	Canopy- mostly open Banks- steep, lined w/ herbaceous plants & shrubs	None observed	None observed
WQ-2 Unnamed Blueline Stream (Downstream)	Substrate- silty clay w/ sm. To med. boulders- enters a concrete spillway Stream- 3.7-4.6m (12-15') wide, <0.31m (1') deep, 1CFS	Canopy- mostly open Banks- moderately sloped & lined w/ rip-rap, herbaceous plants & shrubs	None observed	Snails-left handed operculum
WQ-3 Wetland	Substrate- silty clay Size--18.3x24.4m (60x80'), 0.31-0.61m (1-2') deep	Canopy- open Banks- moderately sloped	None observed	None observed
WQ-4 Intermittent Blueline Stream	Substrate- silty soil Stream-1.5-3.1m (5-10') wide, 0.91m (3') deep, dry	Canopy- mostly open Banks- level	None observed	None observed
WQ-5 Intermittent Blueline Stream (Upstream)	Substrate- silty clay Stream-1.5-3.1m (5-10') wide, dry	Canopy- open Banks- level to moderately sloped	None observed	None observed
WQ-6 Intermittent Blueline Stream (Downstream)	Substrate- silty clay Stream-1.5-3.1m (5-10') wide, dry	Canopy- open Banks- level to moderately sloped	None observed	None observed
WQ-7 Channelized Wet Weather Conveyance	Substrate- silty soil Drain- essentially non-existent	Canopy- open Banks- level	None observed	None observed
WQ-8 Channelized Wet Weather Conveyance	Substrate- silty soil Drain- essentially non-existent	Canopy- open Banks- level	None observed	None observed
WQ-9 Channelized Wet Weather Conveyance	Substrate- grass Drain-0.91-1.2m (3-4') wide, 0.31-0.91m (1-3') deep, dry	Canopy- open Banks- moderately sloped	None observed	None observed

WQ-10 Channelized Wet Weather Conveyance	Substrate- silty soil w/ sm. cobble Drain-0.91-1.2m (3-4') wide, 0.31m (1') deep, dry	Canopy- open Banks- moderately sloped	<i>Juncus</i> spp. & <i>Cyperus</i> spp.	Snails & minnows
WQ-11 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-1.2m (4') wide, 0.61-0.91m (2-3') deep, dry	Canopy- open Banks- level	None observed	None observed
WQ-12 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-0.91-1.2m (3-4') wide, 0.91- 1.2m (3-4') deep, dry	Canopy- open Banks- level	None observed	None observed
WQ-13 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-0.61m (2') wide, 0.31m (1') deep, dry	Canopy- open Banks- level	None observed	None observed
WQ-14 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-1.2-1.5m (4- 5') wide, 0.31m (1') deep, dry	Canopy- mostly open Banks- steep & extremely eroded	None observed	None observed
WQ-15 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-0.61m (2') wide, 0.91-1.2m (3-4') deep, dry	Canopy- open Banks- level	None observed	None observed
WQ-16 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-2.4m (8') wide, 0.31m (1') deep, dry	Canopy- open Banks- level	None observed	None observed
WQ-17 Channelized Wet Weather Conveyance	Substrate- concrete ditch Drain-0.61-0.91m (2-3') wide, 0.31m (1') deep, <1CFS	Canopy- open Banks- level	None observed	None observed
WQ-18 Channelized Wet Weather Conveyance	Substrate- silty soil Drain-0.61m (2') wide, <0.31m (1') deep, <1CFS	Canopy- open Banks- level	<i>Typha</i> spp.	None observed
WQ-19 Wolf River (Upstream)	Substrate- silty soil w/ sm. To med. boulders Stream-38.1m (125') wide, 0.91- 1.5m (3-5') deep, ~3CFS	Canopy- open Banks- steep	None observed	Snails w/ right handed operculum & water striders
WQ-20 Wolf River (Downstream)	Substrate- silty soil w/ sm. To med. boulders Stream-38.1m (125') wide, 0.91- 1.5m (3-5') deep, ~3CFS	Canopy- open Banks- steep	None observed	Fish, snails w/ right handed operculum & water striders

WQ-21 Unnamed Pond	Substrate- sandy clay Size- 106.7x487.7m (350x1600'), unknown depth	Canopy- open Banks- moderately sloped	<i>Juncus</i> spp.	None observed
WQ-22 Unnamed Pond	Substrate- sandy clay Size-45.7x83.8m (150x275'), unknown depth	Canopy- open Banks- steep	<i>Cyperus</i> spp.	Minnows & freshwater mussels
WQ-23 Blueline Stream	Substrate- silty soil w/ sm. boulders Stream-6.1-7.6m (20-25') wide, 1.2-1.5m (4-5') deep, ~3CFS	Canopy- open Banks- steep	<i>Cyperus</i> spp. & <i>Polygonum coccineum</i>	Minnows
WQ-24 Blueline Stream	Substrate- silty clay w/ sm. To med. boulders Stream-6.1-15.2m (20-50') wide, <0.31-1.5m (1-5') deep, ~2-3CFS	Canopy- mostly open Banks- extremely steep & eroded	None observed	None observed
WQ-25 Intermittent Blueline Stream	Substrate- silty soil & detritus Stream-1.2-1.8m (4-6') wide, 0.31-0.61m (1-2') deep, <1CFS	Canopy- open to the west & closed to the east Banks- moderately sloped & lined w/ rip-rap	None observed	Minnows
WQ-26 Borrow Pit	Substrate- silty sand Size-22.9x70m (75x200') wide, 0.61-0.91m (2-3') deep	Canopy- open Banks- extremely steep	<i>Cyperus</i> spp.	Fish & minnows
WQ-27 Borrow Pit	Substrate- silty sand Size-22.9x106.7m (75x350') wide, 0.61-0.91m (2-3') deep	Canopy- open Banks- extremely steep	<i>Cyperus</i> spp.	Fish & minnows
WQ-28 Wolf River (Upstream)	Substrate- sandy soil Stream-45.7m (150') wide, 0.91-1.8m (3-6') deep, ~3CFS	Canopy- open Banks- extremely steep	None observed	Fish & water striders
WQ-29 Wolf River (Downstream)	Substrate- sandy soil Stream-45.7m (150') wide, 0.91-1.8m (3-6') deep, ~3CFS	Canopy- open Banks- extremely steep	None observed	Fish & water striders

WQ-30 Wolf River (Upstream)	Substrate- sandy soil Stream-45.7m (150') wide, 0.91-1.8m (3-6') deep, ~3CFS	Canopy- open Banks- extremely steep	None observed	None observed
WQ-31 Wolf River (Downstream)	Substrate- sandy soil Stream-45.7m (150') wide, 0.91-1.8m (3-6') deep, ~3CFS	Canopy- open Banks- extremely steep	None observed	None observed
WQ-32 Intermittent Blueline Stream	Substrate- silty soil & detritus Stream-1.2-1.8m (4-6') wide, 0.31m (1') deep, dry	Canopy- mostly closed Banks- moderately sloped	None observed	None observed
WQ-33 Intermittent Blueline Stream	Substrate- silty soil & detritus Stream-0.91-1.2m (3-4') wide, 0.31-0.61m (1-2') deep, dry	Canopy- partially open Banks- level to moderately sloped	None observed	None observed
WQ-34 Intermittent Blueline Stream	Substrate- silty soil & cobble Stream-1.2-1.8m (4-6') wide, 0.31m (1') deep, dry	Canopy- open Banks- level to moderately sloped	None observed	None observed
WQ-35 Channelized Wet Weather Conveyance	Substrate- silty soil & detritus Stream-1.2-1.8m (4-6') wide, 0.31-0.61m (1-2') deep, dry	Canopy- open Banks- level to moderately sloped	None observed	None observed
WQ-36 Channelized Wet Weather Conveyance	Substrate- silty soil & detritus Stream-0.91-1.2m (3-4') wide, 0.31-0.61m (1-2') deep, dry	Canopy- partially open Banks- level to moderately sloped	None observed	None observed

TABLE A-II
WATER QUALITY MONITORING DATA

Water Quality Station Number	Water Flow	Temperature	pH Level	Conductivity	Dissolved Oxygen
WQ-1		9.2	7.3	87.4	3.80
WQ-2		10.6	8.4	50.2	6.16
WQ-3	Dry				
WQ-4	Dry				
WQ-5	Dry				
WQ-6	Dry				
WQ-7	Dry				
WQ-8	Dry				
WQ-9	Dry				
WQ-10	Dry				
WQ-11	Dry				
WQ-12	Dry				
WQ-13	Dry				
WQ-14	Dry				
WQ-15	Dry				
WQ-16	Dry				
WQ-17		26.5	9.3	116.5	6.20
WQ-18		24.3	8.8	29.2	9.64
WQ-19		21.3	7.4	47.7	7.07
WQ-20		21.5	7.5	49.3	7.65
WQ-21		15.3	7.2	139.4	5.82
WQ-22		15.2	6.9	92.7	5.24
WQ-23		10.0	7.2	114.0	7.44
WQ-24		10.8	8.7	168.7	8.76
WQ-25		11.0	7.0	113.9	3.76
WQ-26		12.1	6.9	71.2	8.64
WQ-27		12.9	7.3	89.5	7.57
WQ-28		12.4	7.1	41.2	5.59
WQ-29		12.6	7.3	42.3	5.98
WQ-30		12.2	6.9	46.8	6.46
WQ-31		12.5	7.3	47.3	5.99
WQ-32	Dry				
WQ-33	Dry				
WQ-34	Dry				
WQ-35	Dry				
WQ-36	Dry				

APPENDIX B

AGENCY COORDINATION



United States Department of the Interior

FISH AND WILDLIFE SERVICE

446 Neal Street
Cookeville, TN 38501

April 12, 2000

Mr. James R. Powers
Senior Biologist
Development & Environmental Planning
Associates, Inc.
484 Highway 70 East
Crossville, Tennessee 38555

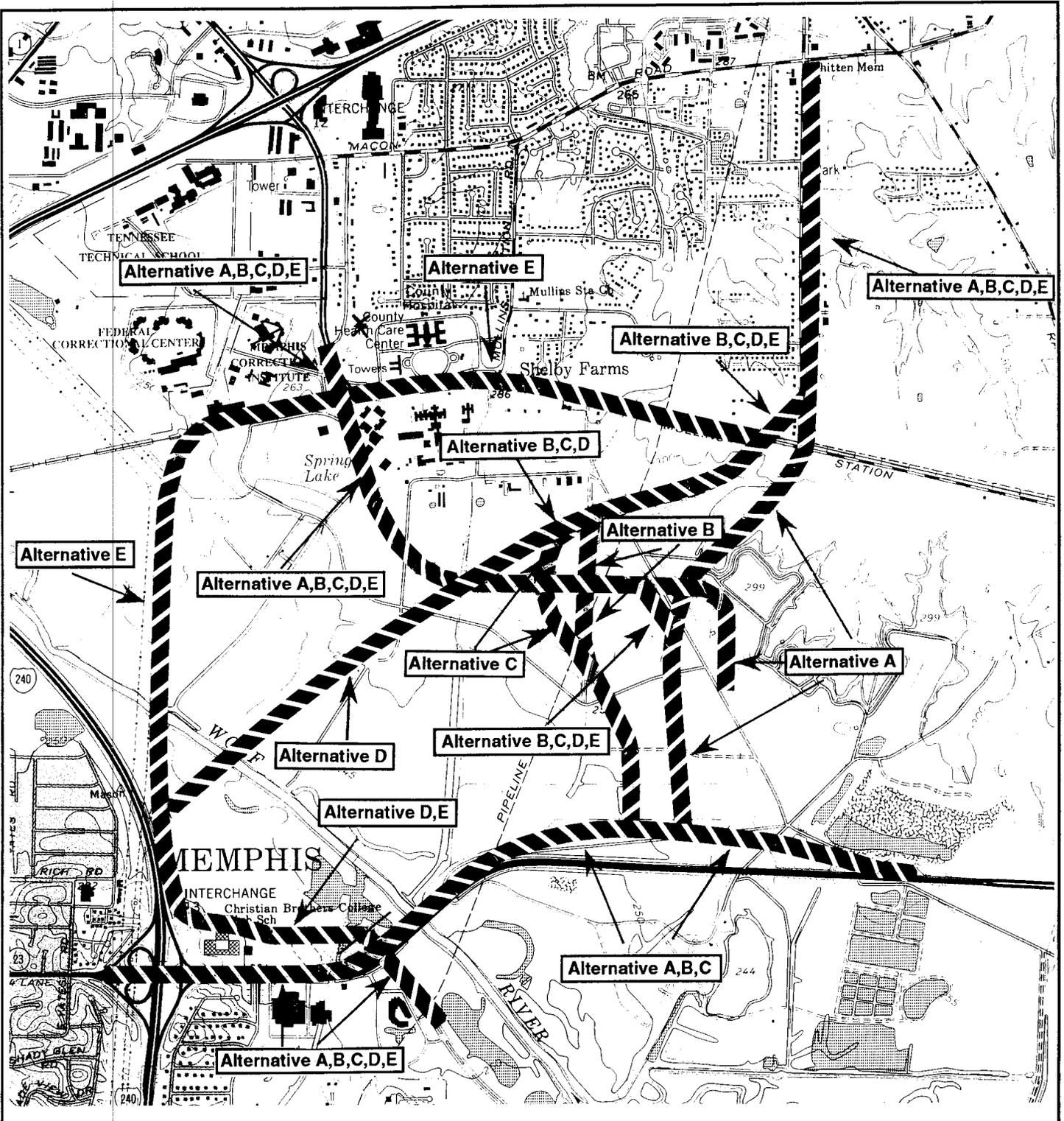
Dear Mr. Powers:

Thank you for your letter and enclosures of March 24, 2000, regarding the proposed extension of Kirby Parkway through the Shelby Farms Complex in Shelby County, Tennessee. The Fish and Wildlife Service (Service) has reviewed the information submitted and offers the following comments.

Information available to the Service indicates that wetlands exist in the vicinity of the proposed project. Attached is a copy of a portion of the National Wetlands Inventory's Ellendale quadrangle with the referenced wetlands highlighted. This information is provided for your convenience. Our wetlands determination has been made in the absence of a field inspection and does not constitute a wetlands delineation for the purposes of Section 404 of the Clean Water Act. The Corps of Engineers should be contacted regarding the presence of regulatory wetlands and the requirements of wetlands protection statutes.

From the information provided, we note that the proposed work entails stream crossings. We recommend that silt barriers be put in place when working adjacent to all streams to prevent runoff of sediment. If a stream crossing is necessary, it should be accomplished during low flow periods and the streambanks reseeded with native vegetation beneficial to wildlife immediately following completion of the stream crossing.

Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened species occur within the impact area of the project. We note, however, that collection records available to the Service may not be all-inclusive. Our data base is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. However, based on the best information available at this time, we believe that the



	<p>PROJECT LOCATION MAP</p>	<p>KIRBY PARKWAY PROJECT MEMPHIS, TENNESSEE</p>
	<p>ELLENDALE, TENNESSEE (1965-Photorevised 1993)</p>	<p>Project Route = </p>
	<p>USGS Topographic Map 7.5 Minute Series</p>	<p>SCALE: 1" = 2,000'</p>
		<p>Contour Interval = 10'</p>
		<p>FIGURE 1</p>

APPENDIX C

PHOTOGRAPHIC PLATES



Plate 1. View to the southeast of WQ-1 (upstream), located east of Whitten Road on proposed Alternatives A, B, C, D, and E.



Plate 2. View to the northwest of WQ-1 (downstream), located east of Whitten Road on proposed Alternatives A, B, C, D, and E.



Plate 3. View to the southeast of WQ-2 (upstream), located west of Whitten Road on proposed Alternatives A, B, C, D, and E.



Plate 4. View to the northwest of WQ-2 (downstream), located west of Whitten Road on proposed Alternatives A, B, C, D, and E.



Plate 5. View of WQ-3, a small wetland area, located south of the Mullins Station Road and Whitten Road intersection and east of the proposed Alternative A.



Plate 6. View to the east of WQ-4 (upstream), located south of the Mullins Station Road and Whitten Road intersection and east of the proposed Alternative A.



Plate 7. View to the west of WQ-4 (downstream), located south of the Mullins Station Road and Whitten Road intersection and east of the proposed Alternative A.



Plate 8. View to the north of WQ-5 (upstream), located south of the Mullins Station Road and Whitten Road intersection and north of the proposed Alternative A.



Plate 9. View to the south of WQ-5 (downstream), located south of the Mullins Station Road and Whitten Road intersection and north of the proposed Alternative A.



Plate 10. View to the north of WQ-6 (upstream), located south of the Mullins Station Road and Whitten Road intersection and south of the proposed Alternative A.



Plate 11. View to the south of WQ-6 (downstream), located south of the Mullins Station Road and Whitten Road intersection and south of the proposed Alternative A.



Plate 12. View to the east of WQ-7 (upstream), located in the central portion of the project area and east of the proposed Alternative A.



Plate 13. View of a lake north of WQ-9. This lake should not be impacted by project.



Plate 14. View downstream of WQ-9, located north of Walnut Grove Road and the proposed Alternatives A, B, and C.



Plate 15. View to the north of WQ-10 (upstream), located south of Walnut Grove Road and the proposed Alternatives A, B, and C.



Plate 16. View to the southeast of WQ-10 (downstream), located south of Walnut Grove Road and the proposed Alternatives A, B, and C.



Plate 17. View to the northeast of WQ-11, an intermittent stream that forms a confluence with WQ-12 adjacent to an unnamed road through Shelby Farms on the proposed Alternative B.



Plate 18. View to the north of WQ-12 (upstream), an intermittent stream that parallels an unnamed road through Shelby Farms on the proposed Alternative B.



Plate 19. View to the south of WQ-12 (downstream), an intermittent stream that parallels an unnamed road through Shelby Farms on the proposed Alternative B.



Plate 20. View to the east of WQ-13 (upstream), an intermittent stream located on the east side of the proposed Kirby Parkway on Alternatives B and C.



Plate 21. View to the west of WQ-14 (downstream), located on the west side of the proposed Kirby Parkway for Alternatives B and C.



Plate 22. View to the west of WQ-15 (downstream), located on the proposed Kirby Parkway on Alternatives B and C.



Plate 23. View to the east of WQ-16 (upstream), an intermittent stream located just west of the proposed Kirby Parkway on Alternatives B and C.



Plate 24. View to the west of WQ-16 (downstream), an intermittent stream located just west of the proposed Kirby Parkway on Alternatives B and C.



Plate 25. View to the north of WQ-17 (upstream), located north of the proposed Kirby Parkway on Alternative D and Sycamore View Road.



Plate 26. View to the south of WQ-17 (downstream), located south of the proposed Kirby Parkway on Alternative D and Sycamore View Road.



Plate 27. View to the north of WQ-18 (upstream), located just south of the proposed Kirby Parkway on Alternative D and Sycamore View Road.



Plate 28. View to the south of WQ-18 (downstream), located south of the proposed Kirby Parkway on Alternative D and Sycamore View Road.



Plate 29. View upstream of WQ-19, the Wolf River, located south of Walnut Grove Road on the proposed Alternatives A, B, and C.



Plate 30. View downstream of WQ-20, the Wolf River, located on the north side of Walnut Grove Road on the proposed Alternatives A, B, and C.



Plate 31. View of WQ-21, a pond, located east of Humphrey's Boulevard along the south side of Walnut Grove Road and the proposed Alternatives A, B, C, D, and E.



Plate 32. View of WQ-22, a pond, northeast of Humphrey's Boulevard and northwest of Walnut Grove Road and the proposed Alternatives A, B, C, D, and E.



Plate 33. View to the north of WQ-23 (upstream), located south of Humphrey's Boulevard and north of Walnut Grove Road on the proposed Alternatives D and E.



Plate 34. View to the southeast of WQ-23 (downstream). This stream flows underneath Humphrey's Boulevard at this location on the proposed Alternatives D and E.



Plate 35. View to the south of WQ-24 (upstream), located to the north of Walnut Grove Road and southwest of Humphrey's Boulevard along all of the proposed Alternatives.



Plate 36. View to the north of WQ-24 (downstream), located north of Walnut Grove Road and southwest of Humphrey's Boulevard along all of the proposed Alternatives.



Plate 37. View to the west of WQ-25 (upstream), located east of I-240 and north of Walnut Grove Road along the proposed Alternatives D and E.



Plate 38. View to the east of WQ-25 (downstream), located east of I-240 and north of Walnut Grove Road along the proposed Alternatives D and E.

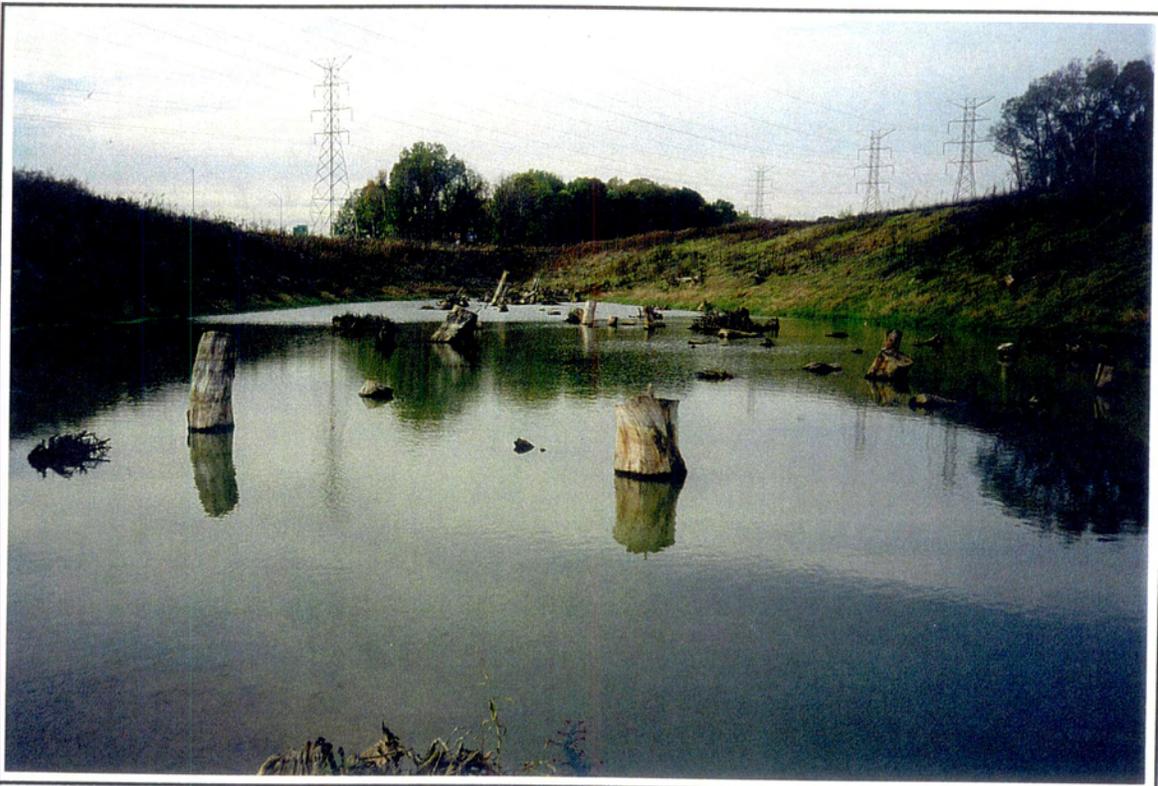


Plate 39. View of a borrowpit, WQ-26, located east of I-240 along the proposed Alternative D. Photo was taken from the southern end of the pit.



Plate 40. View of a borrowpit, WQ-27, located east of I-240 along the proposed Alternative D. Photo was taken from the northern end of the pit.



Plate 41. View of Wolf River at WQ-30 (downstream), located along the proposed Alternative E and east of I-240 in the Lucious Birch Junior Natural Area.



Plate 42. View of Wolf River at WQ-31 (upstream), located along the proposed Alternative E and east of I-240 in the Lucious Birch Junior Natural Area.



Plate 43. View to the west of WQ-36, upgradient of the Wolf River, along the north side of Walnut Grove Road and south of the proposed Alternatives A, B, and C.



Plate 44. View to the east of WQ-36, upgradient of the Wolf River, along the northside of Walnut Grove Road and south of the proposed Alternatives A, B, and C.

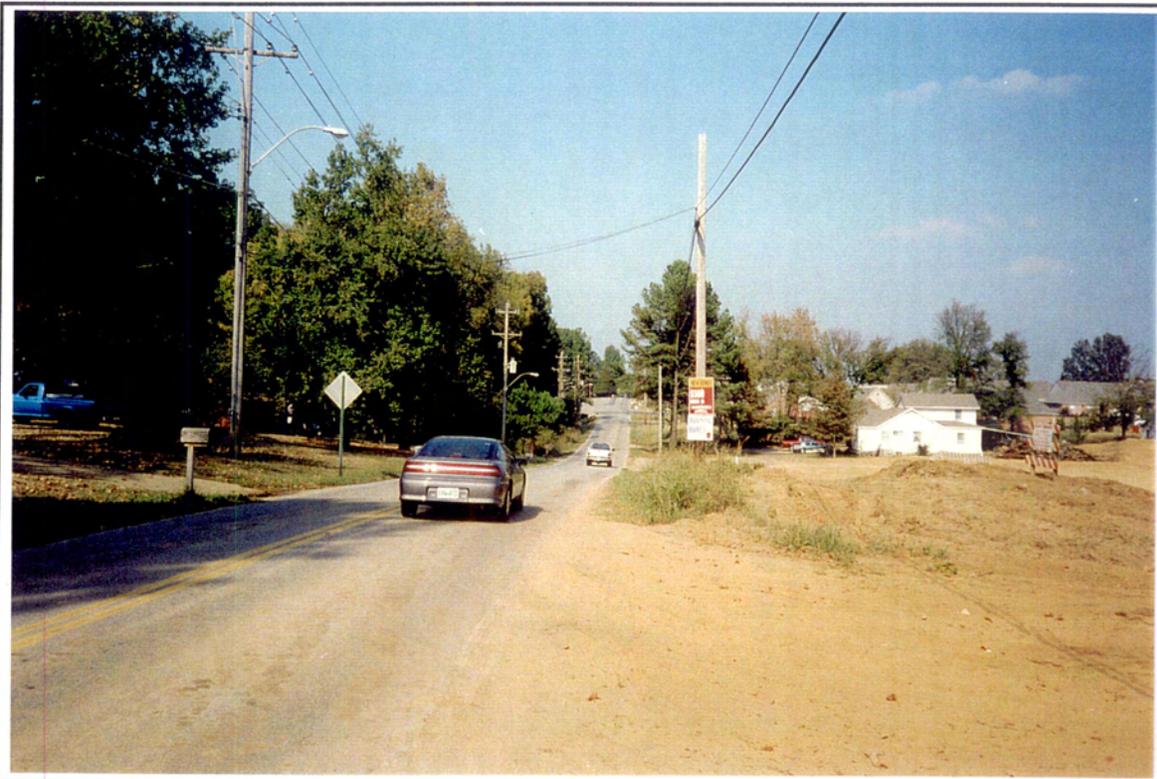


Plate 45. View to the north on Whitten Road, just north of the Whitten Road and Mullins Station Road Intersection.

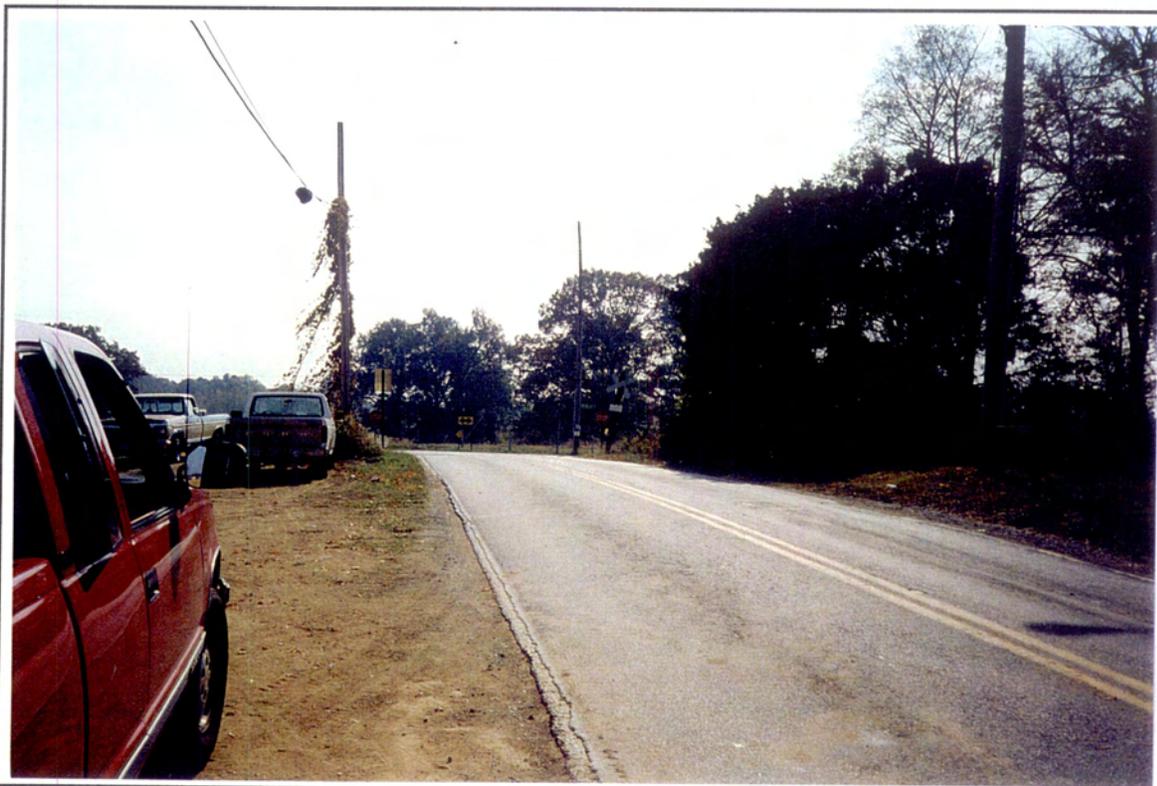


Plate 46. View to the south of the Whitten Road and Mullins Station Road intersection.



Plate 47. View to the north, through the central portion of the proposed project. Photo was taken on an unnamed road in the Shelby Farms Park.



Plate 48. View to the south, through the central portion of the proposed project. Photo was taken on an unnamed road in the Shelby Farms Park.



Plate 49. View to the north of an unnamed lake, located just north of Walnut Grove Road, at the eastern most end of the proposed Walnut Grove Road improvements.



Plate 50. View to the southwest across the Shelby Farms Park, taken from just south of the Whitten Road and Mullins Station Road Intersection.