Mississippi Valley Division,
Regional Planning and Environment Division South

Yazoo Backwater Area Water Management Project

APPENDIX I - 404(b)(1) Evaluation

June 2024

2024 YAZOO AREA WATER MANAGEMENT PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

404 (b) (1)

DRAFT 404 (b) (1) EVALUATION

1.1 Introduction

The Yazoo Backwater Area Water Management Plan Draft Environmental Impact Statement (DEIS) analyzed the environmental impacts associated with four alternatives. Two strategies in addition to the no-action were presented. The first strategy was a combination of a structural and nonstructural solution with two different operation scenarios. A sole nonstructural solution was also presented.

1.1.1 Alternative 1, No Action

The following is the no-action alternative. Choosing this alternative would mean that flood risk within the YSA would not be reduced. As a result, both residential and nonresidential structures, as well as agricultural production within the YSA would still be susceptible to flooding, which would have an economic impact on the area. Flood-fighting efforts, as well as repairs to urban and rural roads, bridges, and other infrastructure, will continue to be funded by local, state, and Federal governments. It's important to note that selecting the no-action alternative will not have any project impacts.

1.1.2 Combined Structural and Nonstructural Plans

The following alternatives contain a combination of structural, operational, nonstructural, federal memorandums of agreement, environmental enhancement, and mitigation components. The alternatives listed throughout the DEIS, referenced here forth as Alternative 2 & Alternative 3, contain identical components and differ only on the crop season range shown below.

1.1.2.1 Alternative 2 (Crop Season 16 March – 15 October and non-crop season 16 October – 15 March)

Structural Feature

To reduce flood stages across all frequency flood events a 25,000 cfs pump station is presented adjacent to the Steele Bayou structure. To minimize and/or avoid potential adverse project impacts on the environment and still meet the goals of the project discussed in Chapter 2, two different operations were presented; water levels managed at 90.0 ft during crop season (16Mar-15Oct) and up to 93.0 ft during noncrop season (16 October -15 March).

Operation Conditions

In its current state, the YSA is an isolated system due to the Yazoo Backwater levee and outlet structures preventing inflow of water from the Yazoo-Mississippi Rivers. During potential flood-prone periods with rising Mississippi and Yazoo rivers, the operations plan for the Steele Bayou Water Control Structure (WCS) would allow free movement of water into and out of the lower Yazoo Basin up to an elevation of 75.0 feet, NGVD before closing the gate. This full utilization of the current Water Control Manual (1985) for the operation of Steele Bayou WCS will promote fishery species diversification. During low-water periods, the operation plan of the Steele Bayou WCS is currently operated to maintain water elevations between 68.5 and 70.0 feet, NGVD, and this will be continued. This operation plan optimizes the potential for inter-basin water exchange improving reaeration in the lower Yazoo basin and benefits fisheries exchange. No additional real estate is required for this feature. Consideration of new or different operating elevations to encourage aquatic resource recruitment and retention will be evaluated in the M&AM process.

Low Flow Wells

In addition to the pump operations and structure operations to reduce adverse environmental impacts through design; releases from low-flow wells from shallow groundwater is also being presented as part of

this alternative. Since the fish-carrying capacity of a river system is dependent in part on the habitat quantity and quality during annual low flow conditions a measure is being presented to supplement the existing river flows. 34 low-flow groundwater wells within 30,000 feet of the Mississippi River channel and upstream of the YSA are being presented as a part of this alternative. It is expected to deliver a maximum of 5.0 cfs during traditionally low flow periods. The increased low-flow aquatic habitat provided with the operational feature could significantly increase standing stock and production for many fish species and benefit aquatic resources in the YSA.

Nonstructural Feature

To further manage flood risk below the pump operation elevation (i.e. 90 ft), mandatory acquisition of all structures (101 Structures) is being presented; while voluntary acquisition or floodproofing of residential and commercial properties (231) up to 93.0 ft is being presented. This measure would address the most vulnerable structures at risk from frequent flooding. As discussed in the measures listed above, it is important to note that the number of structures implemented in the mandatory and voluntary plan could be less once individual structure investigations take place.

The plan would also include the acquisition of up to 11,816 acres of cleared land at or below the 2-year floodplain through fee or a restrictive easement based on voluntary participation. As discussed in the measures above, it was assumed that this land was agricultural land in production. For this alternative, the report evaluated acquiring these lands on a voluntary basis, even when tied to a structure at or below the 2-year floodplain. It was assumed that some of the land ownership (outside of the structure footprint) was tied to structures being presented for mandatory acquisition. In those cases, the lands associated with the structures would still be on a voluntary basis acquired through fee or through a restrictive easement to limit activities. This would still allow private ownership of the land once the structures have been removed, but it would also limit the risk of flooding crops in this floodplain by taking them out of production permanently. The same consideration would be given to lands not tied to structures.

In addition to the cleared lands at or below the 2-year floodplain, this alternative includes the acquiring of lands through fee or a restrictive easement for cleared lands above the 2-year floodplain. There are a total 27,675 acres of cleared lands between the 2 year and 5-year floodplain. Consistent with acquiring structures on a voluntary basis in this floodplain (2-year -5 year) to further reduce risk, the alternative proposes to voluntary acquire these using fee or through a restrictive easement to further reduce flood risk to crops.

Considerations for nonstructural measures (structural and land acquisition) above the 5-year floodplain were not considered with the alternative since the pump operation is expected to maintain stages at or below the 5 year floodplain elevation.

Compensatory Mitigation

Although the variable pump operations and modification of the operation of the Steele Bayou WCS to optimize fisheries exchange minimized and/or avoid potential adverse project impacts on the environment. It did not remove all impact. It is expected that this proposal would impact wetlands, aquatic resources and fisheries habitat, waterfowl habitat, and terrestrial wildlife habitats. A detailed analysis of the affected environment that evaluates both beneficial and adverse effects to significant resources in the YSA is provided in Section 5.0 of this Water Management Plan and DEIS. A compensatory mitigation plan for unavoidable environmental impacts would be included with this plan.

1.1.2.2 Alternative 3 (Crop season 25 March – 15 October and non-crop season 16 October – 24 March)

Structural Feature

To reduce flood stages across all frequency flood events a 25,000 cfs pump station is presented adjacent to the Steele Bayou structure. To minimize and/or avoid potential adverse project impacts on the environment and still meet the goals of the project discussed in Chapter 2, two different operations were presented; water levels managed at 90.0 ft during crop season (25Mar-15Oct) and up to 93.0 ft during noncrop season (16 October - 24 March).

Operation Conditions

In its current state, the YSA is an isolated system due to the Yazoo Backwater levee and outlet structures preventing inflow of water from the Yazoo-Mississippi Rivers. During potential flood-prone periods with rising Mississippi and Yazoo rivers, the operations plan for the Steele Bayou Water Control Structure (WCS) would allow free movement of water into and out of the lower Yazoo Basin up to an elevation of 75.0 feet, NGVD before closing the gate. This full utilization of the current Water Control Manual (1985) for the operation of Steele Bayou WCS will promote fishery species diversification. During low-water periods, the operation plan of the Steele Bayou WCS is currently operated to maintain water elevations between 68.5 and 70.0 feet, NGVD, and this will be continued. This operation plan optimizes the potential for inter-basin water exchange improving reaeration in the lower Yazoo basin and benefits fisheries exchange. No additional real estate is required for this feature. Consideration of new or different operating elevations to encourage aquatic resource recruitment and retention will be evaluated in the M&AM process.

Low Flow Wells

In addition to the pump operations and structure operations to reduce adverse environmental impacts through design; releases from low-flow wells from shallow groundwater is also being presented as part of this alternative. Since the fish-carrying capacity of a river system is dependent in part on the habitat quantity and quality during annual low flow conditions a measure is being presented to supplement the existing river flows. 34 low-flow groundwater wells within 30,000 feet of the Mississippi River channel and upstream of the YSA are being presented as a part of this alternative. It is expected to deliver a maximum of 5.0 cfs during traditionally low flow periods. The increased low-flow aquatic habitat provided with the operational feature could significantly increase standing stock and production for many fish species and benefit aquatic resources in the YSA.

Nonstructural Feature

To further manage flood risk below the pump operation elevation (i.e. 90 ft), mandatory acquisition of all structures (101 Structures) is being presented; while voluntary acquisition or floodproofing of residential and commercial properties (231) up to 93.0 ft is being presented. This measure would address the most vulnerable structures at risk from frequent flooding. As discussed in the measures listed above, it is important to note that the number of structures implemented in the mandatory and voluntary plan could be less once individual structure investigations take place.

The plan would also include the acquisition of up to 11,816 acres of cleared land at or below the 2-year floodplain through fee or a restrictive easement based on voluntary participation. As discussed in the measures above, it was assumed that this land was agricultural land in production. For this alternative, the report evaluated acquiring these lands on a voluntary basis, even when tied to a structure at or below the 2-year floodplain. It was assumed that some of the land ownership (outside of the structure footprint) was tied to structures being presented for mandatory acquisition. In those cases, the lands associated with the structures would still be on a voluntary basis acquired through fee or through a restrictive easement to limit activities. This would still allow private ownership of the land once the structures have been removed, but

it would also limit the risk of flooding crops in this floodplain by taking them out of production permanently. The same consideration would be given to lands not tied to structures.

In addition to the cleared lands at or below the 2-year floodplain, this alternative includes the acquiring of lands through fee or a restrictive easement for cleared lands above the 2-year floodplain. There are a total 27,675 acres of cleared lands between the 2 year and 5-year floodplain. Consistent with acquiring structures on a voluntary basis in this floodplain (2-year -5 year) to further reduce flood risk, the alternative proposes to voluntary acquire these using fee or through a restrictive easement to further reduce flood risk to crops.

Considerations for nonstructural measures (structural and land acquisition) above the 5-year floodplain were not considered with the alternative since the pump operation is expected to maintain stages at or below the 5 year floodplain elevation.

Compensatory Mitigation

Although the variable pump operations and modification of the operation of the Steele Bayou WCS to optimize fisheries exchange minimized and/or avoid potential adverse project impacts on the environment. It did not remove all impact. It is expected that this proposal would impact wetlands, aquatic resources and fisheries habitat, waterfowl habitat, and terrestrial wildlife habitats. A detailed analysis of the affected environment that evaluates both beneficial and adverse effects to significant resources in the YSA is provided in Section 5.0 of this Water Management Plan and DEIS. A compensatory mitigation plan for unavoidable environmental impacts would be included with this plan.

1.1.2.3 Alternative 4, Nonstructural Plan

Only this alternative contains operational and nonstructural features which influence land-use patterns and activities. There is a no-pump station feature in this alternative. To be consistent with other alternatives (i.e., some level of benefit across the YSA), this alternative would include voluntary acquisition of structures and croplands to the historical flood elevations (i.e. 98.2 ft NGVD).

Operational

In its current state, the YSA is an isolated system due to the Yazoo backwater levee and outlet structures preventing inflow of water from the Yazoo-Mississippi Rivers. During potential flood-prone periods with rising Mississippi and Yazoo Rivers, there would be no changes to the existing operations plan for the Steele Bayou and Little Sunflower Water Control Structures (WCS). As with the No Action Alternative, Alternative 4 will continue to facilitate conditions of hypoxia within the floodplain during prolonged inundation periods. No additional real estate is required for this feature. Consideration of new or different operating elevations to encourage aquatic resource recruitment and retention will be evaluated in the M&AM process.

Nonstructural Feature

There are a total of 1,845 structures within the most recent historical floodplain (2019) that could be considered for voluntary acquisition under this alternative. In addition to the structures, the plan would also include the acquisition of up to 137,926 acres of cleared land to the most recent historical floodplain through fee or a restrictive easement based on a voluntary basis. As discussed in the measures above, it was assumed that this land was agricultural land in production. Using a restrictive easement would still allow private ownership of the land once the structures have been removed, but it would also limit the risk of flooding crops in this floodplain by taking them out of production permanently.

1.2 Presented Water Management Plan

When comparing plans, the only difference between Alternative 2 (Crop Season 16 March – 15 October and non-crop season 16 October – 15 March) and Alternative 3 (Crop season 24 March – 15 October and non-crop season 15 October – 24 March) are the different crop seasons that were considered with discussions with stakeholders. Choosing between these two plans would come with two different mitigation requirements for indirect impact, but all other features associated with these two alternatives are the same such as pump location, pump size, operational elevations, low flow wells, and nonstructural features.
Alternative 4, the Nonstructural Plan Only, is being considered but there are concerns since it may not meet the purpose and need of the study when the flood risk is considered to the YSA local economy, in particular for agricultural production, a critical element of the overall project purpose. The following are concerns that will need to be considered in the evaluation of Alternative 4 and if this Alternative addresses the project purpose.

- As discussed previously, there are a total of 1,845 structures within the most recent historical floodplain (2019) that could be considered for voluntary acquisition basis and there are also up to 137,926 acres of cleared land (farmland) that could be considered through fee, or a restrictive easement based on a voluntary basis. When compared to Alternative 2 or 3, Alternative 4 works toward the goal of reducing flood risk in the study area; however, there is an unknown risk associated with assumed participation rate. The initial planning assumption to compare Alternative 4 to the other alternatives assumed a 100% participation rate; however, in socially vulnerable areas, the realized participation rate may be lower than the initial planning assumption. A reduced participation rate limits the ability of the nonstructural plan to provide adequate flood risk reduction. Also, there would be no flood risk management provided to ineligible structures or structures whose owners choose not to participate. While the nonstructural plan would provide flood risk management benefits to eligible and participating structures, the nonstructural plan would not address any other ongoing flooding issues within the YSA. A better understanding of the participation rate would be helpful to gather through public comment to better inform this alternative.
- Significant portions of the study area have been identified as low-income communities; therefore, some structure owners may not have the financial ability to address potential additional costs such as relocating outside of the floodplain. Primary residential structures are only eligible for acquisitions; however, due to the fact that they are voluntary in nature, uniform relocation assistance would not apply. This may be a financial hardship for low-income communities which may reduce the participation rate.
- A significant element of the overall project purpose is flood risk reduction for the local economy of the YSA, in particular to agricultural production in the YSA. As discussed above, Alternative 4 would include the acquisition of nearly 140,000 acres of cleared land, which are assumed to be in agricultural production within the floodplain of the 2019 flood. Although this acquisition would be voluntary through fee or a restrictive easement, these agricultural lands would be taken out of crop production and converted to conservation lands. This could have significant impacts on the tax base of the local communities going from agricultural productive lands to conservation, thereby impacting the economy of the YSA.
- The acquisition and subsequent loss of up to 140, 000 acres of YSA agricultural lands could also impact employment within the YSA with the loss of jobs directly or indirectly supported by agricultural production, thereby impacting the local economy.
- Flooding displacement, whether through voluntary or involuntary methods, does not ensure communities access to improved environmental conditions following migration, and may compromise human security. Displacements can be detrimental to communities, in particular EJ

communities, ability to secure food and income. (Kakinuma et al, 2020) The complex dynamic between a community's "right to stay" and their inability to mobilize is difficult to untangle. (Black et al, 2013)

- Public input on these issues regarding Alternative 4 are anticipated to be received during public comment to help inform further analysis on this alternative, in particular whether the Alternative 4 can meet the stated project purpose. USACE is particularly interested in the willingness and ability of the backwater community to accept a fully nonstructural solution to flood risk reduction and hopes to receive feedback in the public comment period on this topic.

As required by Section 404(b)(1) of the Clean Water Act (CWA), a final evaluation will identify the least environmentally damaging practicable alternative (LEDPA) and assess the short- and long-term impacts associated with the discharge of dredged and/or fill materials into waters of the U.S. resulting from this alternative. At this stage of the EIS process, USACE is still evaluating the environmental impacts along with the local acceptability of the four alternatives identified above and has not yet identified a final alternative. While the LEDPA has not yet been identified, USACE ASA(CW) will identify a preferred alternative taking into consideration public comment. As discussed in Chapter 3 of the DEIS, the presented alternative includes all the structural, nonstructural, and other features that are shared between Alternatives 2 and 3. The only difference between Alternatives 2 and 3 are the dates when the pumping station could be relied upon to remove floodwater from the Yazoo Study Area (YSA). As noted above, under Alternative 2 the pumping station would operate during the time period between 16Mar-15Oct while under Alternative 3 the pumping station would operate between 25Mar-15Oct.

Since implementation of Alternatives 1 and 4 are not expected to require the discharge of dredged or fill material, this interim draft CWA Section 404(b)(1) Evaluation considers the direct, indirect, and cumulative effects of the discharge of dredged or fill material associated with Alternatives 2 and 3, providing the range of estimated impacts for these two alternatives.

1.3 Project Description

1.3.1 Location

The Yazoo Backwater Area Water Management Plan is in west-central Mississippi and is bordered by the left descending bank of the mainline Mississippi River levee on the west, the connecting channel on the east, and the Yazoo River on the south. The area which includes portion of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo counties, Mississippi and part of Madison Parish, Louisiana, contains approximately 926,000 acres. In addition, this area is subject to headwater flooding from the Yazoo and Sunflower Rivers and backwater flooding from Steele Bayou that is induced from high stages on the Mississippi River. The presented location of the 25,000 cfs Pump Station is adjacent to the Steele Bayou water control structure (0.5 miles) in Issaquena County, Mississippi. The presented site lies to the west of the Steele Bayou water control structure between the Yazoo Backwater Levee and the Yazoo River; approximately 4.75 miles west of Highway 61 and approximately 7.5 miles north of Vicksburg, Mississippi (Figure 1 & 2). The supplemental low flow groundwater wells will be located within 30,000 feet of the Mississippi River Channel in Washington, Bolivar and Coahoma counties (Table 1 & Figure 3-6).

1.4 General Description of Yazoo Area Backwater Plan

The purpose of the Yazoo Backwater Area Water Management Plan is to provide significant flood risk reduction for communities in the Yazoo Study Area and the local economy while also avoiding and minimizing impacts to important environmental resources. The selected approach includes both structural and nonstructural features. The structural component consists of a 25,000-cubic-foot-per-second (cfs) pump managed to an elevation of 90.0 ft NGVD during crop season and up to an elevation of 93.0 ft NGVD during non-crop season at the Steele Bayou Pump Site. The construction of this structural feature shall

include the pump station pads, inlet channel, outlet channel, a new levee access associated with the pump station, modified Hwy 465 realignment, and bridge to connect Hwy 465 over the outlet channel. This feature will also require the removal of part of the existing levee for construction of the inlet channel and subsequent construction of a bridge over the inlet channel. The pump station right of way (ROW) will be approximately 445 acres. The borrow material which is suitable for construction of these features will originate from excavation of the existing features of the Steele Bayou Pump site and from the onsite and offsite borrow areas. A comprehensive soil borings analysis shall be conducted prior to final design of the pump station and supporting features. If the analysis shows that the quantity and quality of borrow material found at the onsite Borrow Area does not meet the needs of the project features, additional material shall be collected from the offsite borrow area. The offsite Borrow Area is located on Highway 61, east of the Steele Bayou Pump site.

Dependent on the selection of Alternative 3 or Alternative 2, the presented compensatory mitigation feature includes the acquisition of approximately between 5,722 and 7,650 acres of land, respectively, with a portion of these acres at or below the 2-year flood frequency with the remaining remnant at or below the 5-year frequency to the greatest extent possible. These acres would be restored to wetlands and used to compensate for the unavoidable impacts resulting from the construction and operation of the Yazoo Backwater Pump. This acquisition of land for reasons of compensatory mitigation shall be referred to as "5,722 to 7,650 acres of land (compensatory mitigation feature) primarily located at or below the 2-year flood frequency elevation with the remaining remnant at or below the 5-year frequency elevation" for the remainder of this report.

An additional feature of the presented alternative includes the construction of approximately 34 independent supplemental low flow groundwater wells strategically spaced within 30,000 feet of the Mississippi River Channel and along headwater streams of the Big Sunflower, Bogue Phalia, Upper Deer Creek and Steele Bayou Basins. The presented wells will help alleviate the negative environmental impacts observed during minimum flow conditions within these four watersheds of the Yazoo Basin. The locations of these well sites are upstream of the backwater area in the counties of Washington, Bolivar, and Coahoma. This programmatic water management feature shall be implemented gradually over the early stages of the project. The goal will be to improve water quality and rehabilitate aquatic resources utilizing a sub watershed approach. This strategy will take full advantage of the adaptive management structure associated with the Yazoo Backwater Management Plan so that subsequent sub watersheds can be tailored to maximize benefits. USACE will coordinate with technical resources from EPA and FWS to craft implementation strategies as well as desired metrics and outcomes. The well sites will utilize locations that are adjacent to agricultural fields which will minimize potential disturbance.

Each groundwater well will mimic a common design capable of delivering a maximum of 5.0 cfs during low or no flow periods which now occur in the fall months. The pump for each well field will be situated on the top bank of a headwater stream with a pipe discharging water onto a splash pad which will then flow down a constructed reaeration trough to the channel. A negligible quantity of material will be moved for construction of each well. Each well site will be complemented with riprap for stabilization. Access roads to each well site will utilize existing, unimproved agricultural roads adjacent to row-crop, agricultural fields in an effort to minimize impacts. will be constructed for each well site. The total right of way for the 34 well sites will be approximately 30.9 acres and the right of way for the access roads (unimproved, agricultural road) to the well sites will be approximately 12.19 acres. This information is presented in Table 2. Maps of the headwater streams targeted for potential well locations are presented in Figures 3 – 6.

The presented backwater flood water management plan at the Steele Bayou site comes as a result of over 20 years of extensive analysis of structural and nonstructural alternatives. This analysis combined with subsequent studies and a robust interagency process, led to the presented alternative which includes a pumping station situated at the lower end of the Yazoo Backwater Area capable of discharging 25,000 cfs

during flood events when interior stages reach 90.0 and 93.0 feet NGVD for the crop and noncrop seasons, respectively. Features of the presented Steele Bayou Pump Site from both the onsite and offsite borrow areas, are subject to Section 404 of the Clean Water Act. This evaluation shall address direct, indirect/secondary and cumulative effects associated with the discharge of dredged and fill material for construction and operation of the project features to waters of the United States, including emergent wetlands, scrub-shrub wetlands, Conservation Reserve Program wetlands, forested wetlands and open water.

1.4.1 Purpose and Authority

The purpose of the presented Steele Bayou Pump Site is to reduce flood risk to primary residences and agricultural production in the Yazoo Study Area. In addition, the purpose of the presented Steele Bayou Pump Site is to enhance aquatic conditions within the Yazoo Study Area. This pump feature will allow full utilization of the gate operation for the Steele Bayou Control Structure optimizing the potential for inter-basin water exchange and improving reaeration in the lower Yazoo basin. The purpose of the presented well sites is to provide increased flow during low or no flow periods in headwater streams that flow into the Yazoo Study Area. The flow would help to sustain aquatic resources during these critical periods. The aggregate flow derived from these 34 wells will help to maintain a flow rate of 0.1 to 0.2 cubic feet per second (cfs) per square mile in the three basins during the critical low flow periods. Project authority is derived from the Flood Control Act of 18 August 1941.

1.4.2 General Description of Dredged or Fill Material

1.4.2.1 General Characteristics of Material

Fill material used in the presented Yazoo Backwater Area Water Management Plan (Steele Bayou Site) construction would predominantly consist of clay with some silt, sand, gravel, cement, and riprap for other project features. Dredged material from the periodic maintenance dredging would predominantly consist of silt and clay. The construction of the well sites would predominantly consist of sand, gravel, cement, and riprap.

1.4.2.2 Quantity of Material

Approximately 2,000,000 cubic yards of fill material will be required to construct the cofferdam, preload pad, Hwy 465 roadbed for realignment, Northwest Pad, Southwest Pad, levee west, levee east, and structural backfill. The cofferdam fill will require approximately 46,000 cubic yards. The preload pad will require roughly 560,000 cubic yards. The realignment of Hwy 465 will require approximately 552,000 cubic yards for roadbed. The Northwest and Southeast pads associated with the pump station will require 248,000 and 214,000 cubic yards, respectively. Construction of the East and West levees will require 82,000 and 284,000 cubic yards of fill material, respectively. This material will come from excavation of the onsite and offsite borrow areas as well as onsite grading at the Steele Bayou Pump Station site. A net excess of 1,400,000 cubic yards of cut material produced during the excavation of the inlet and outlet channels, cofferdam removal, preload pad removal, and excavation needed for general construction which is deemed unsuitable for structural features of the pump station shall be disposed in strategic locations within the ROW of the pump station as well as in the onsite and offsite borrow areas. Anticipated project maintenance requirements over the project life will entail the periodic removal and deposition of sediment accumulations from the inlet and outlet channels. This material will be deposited in the disposal area located within the ROW of the Steele Bayou borrow area.

Each supplemental low flow groundwater well shall utilize a reaeration trough to deliver water from the well head on top bank down to the water surface of the channel. Fill material in the form of concrete or rip rap will be placed on the channel slope for this purpose. The template design for the reaeration trough will likely be 15 feet wide with 10-foot rip rap buffers on either side that extends approximately 30 linear feet

below ordinary high-water level to the water surface of the channel depending on existing channel slopes. The footprint of this reaeration trough would impact approximately 1,050 square feet. A portion of the sloped reaeration trough determined to exist below ordinary high water will likely impact WOTUS. The cumulative fill to WOTUS from the 34 well sites would equate to less than 1.0 acre. The geometric dimensions presented are believed to be adequate for impacted areas below ordinary high water for each reaeration trough. However, the design of each trough will likely be subject to minor modifications through an adaptive management strategy until an accepted model is reached. Actual Impacted area of each trough shall be computed at the time of final design.

1.4.2.3 Source of Material

With exception of gravel, riprap, and concrete, fill materials would be generated onsite from construction associated with the pump station site, inlet and outlet channels, and various roadways and levees. A minimal quantity of filter material will be used around the annulus of each supplemental low flow groundwater well screen. Concrete and bentonite will be used to seal each well at the surface.

1.4.3 Description of the Presented Discharge Sites

1.4.3.1 Location

The discharge would be at the pump station site which includes the cofferdam, preload pad, Hwy 465 roadbed for realignment, Northwest Pad, Southwest Pad, levee west, levee east, inlet and outlet channels, and borrow areas.

1.4.3.2 Size

Total area impacted by presented project construction would be approximately 655 acres, of which 318 acres are considered wetlands or open waters. Project construction could also impact approximately 1,118 feet of potentially jurisdictional other waters. A Preliminary Jurisdictional Determination of the various classes of Wetlands associated with the construction of the pumping station and the onsite and offsite borrow areas has been defined by personnel from the U.S. Army Corps of Engineers – Vicksburg District, Regulatory Division. All the various wetland and non-wetland classes within the project boundaries have been identified in Figures 7 & 8. Given the uncertainty associated with the preliminary design of the overall footprint of the pump station, the entire pump station ROW has been assumed to incur permanent impacts to wetlands where applicable. It is likely that much of the area contained within the pump station ROW but outside of the pump station footprint will not incur permanent impacts to existing wetlands. However, a conservative approach to wetland impacts has been assumed. A more detailed assessment of both temporary and permanent impacts will be determined upon final design of the pump station after soil borings and related design criteria has been collected. The construction area ROW for the Steele Bayou Pumping Station, which includes all necessary features for the project, contain the following classes of wetlands and non-wetlands: Traditionally Navigable Water (TNW) (Steele Bayou & Yazoo River *Section 10* (34.74), Open Water *Section 10* (34.89 acres), Open Water *Section 404* (25.1 acres), Other Waters/Relatively Permanent Waterway (RPW) *Section 10/404* (1.68 acres), Other Waters/RPW *Section 404* (0.17 acres), Forested Wetland *Section 10/404* (25.49 acres), Forested Wetland *Section 404* (133.98 acres), Emergent Wetland *Section 404* (25.40 acres), Scrub-Shrub Wetland *Section 404* (31.74 acres), Potentially Jurisdictional Other Waters (1,118 feet), and Uplands (131.81 acres) This is based on an overall ROW area of 445 acres for the Steele Bayou Pump site. (Figure 7). An additional construction area ROW for the pumping station included an offsite borrow area with the following classes of wetlands: Emergent Wetland *Section 404* (4.76 acres) and Uplands (currently in agricultural usage) (210.24 acres). This is based on an overall ROW area of 215 acres for the offsite borrow area site. (Figure 8). It should be noted that the that the overall impact/ROW areas previously described may differ from the areas described in the text of the Wetland Appendix – 4.1 No Action Alternative as well as the values displayed in Table 92. The analysis performed for the Wetland Appendix did not benefit from the PJD conducted for the offsite borrow

area. Furthermore, the entire 215 acres of overall ROW located at the offsite borrow area was conservatively assumed to be classified as wetland for the purpose of the assessment. This evaluation, having the benefit of a PJD, accounted for overall wetland impacts totaling 4.75 acres instead of 215 acres. These cumulative areas for both overall impact/ROW and classified wetland types will be reconciled throughout the main report and the appendices for the final EIS. For the remainder of this report, the values described above shall continue except for Emergent Wetland *Section 404* which totals to 30.16 acres for both sites.

Well sites would be installed within five miles of the Mississippi River Channel and on the top bank of low flow channels to provide easy access for water to discharge into the stream. The location of headwater streams targeted for potential well locations have been identified in Table 2 and Figures 3–6. Each well site footprint will disturb no more than 1.25 acres. The associated access roads for the well sites will predominantly utilize unimproved, existing agricultural roads. The average overall acreage for each access road will be 0.36 acres. Approximately 34 wells shall be installed for this project which have an approximate cumulative construction area of 43 acres. Due to the uncertainty associated with the availability of land for the identified well field sites from willing landowners, Preliminary Jurisdictional Determinations (PJD) were not conducted. Siting criteria for these proposed well site locations are subject to limitations with HTRW, cultural artifacts, power availability, or unwilling land sellers. Furthermore, locations of each well site along top bank shall make every attempt to minimize impacts to WOTUS. However, given the nature of the project application, it is assumed that some temporary impacts to WOTUS will occur from construction of the water delivery mechanism to the channel. Based on initial reconnaissance efforts for potential well sites, cumulative impacts from fill material into WOTUS is anticipated to be less than 1 acre. Upon approval of the Yazoo Area Backwater Management Plan and after funding has been allocated and as final well sites locations are determined, JDs shall be conducted to fully quantify impacts. A supplemental EIS shall be utilized if it is determined that unavoidable impacts to WOTUS shall be incurred through the construction of the supplemental low flow wells.

1.4.3.3 Types of Sites

According to preliminary plans, material taken from the channel and cofferdam excavation will be used to build the new levee, cofferdam, and structural backfill. If any of this material is deemed unsuitable for construction, fill will be collected from the onsite and offsite Borrow Areas. Up to 1,118 linear feet of Potentially Jurisdictional Other Waters located within the offsite borrow area could be altered during the construction process. Approximately 34.74 acres of TNW *Section 10* (Steele Bayou Channel &Yazoo River) will be temporarily impacted during the construction of the inlet and outlet channels to the Steele Bayou Pump Station. The existing inlet and outlet channels which have been preliminarily classified as Open Water *Section 10* will be dredged to establish the needed channel bottom depth which could impact up to 34.89 acres. Development of the pump site could also impose impacts to Open Water *Section 404*, Other Waters/(RPW) *Section 10/404*, and Other Waters/RPW *Section 404* accounting for a cumulative area of 26.95 acres. A maximum of 221.37 acres of wetlands will be filled during the construction of the presented Steele Bayou Pump Site.

The well sites will be located primarily on agricultural lands adjacent to headwater streams. Disturbed areas around each well site shall be permanently stabilized with concrete and riprap. Any other minimal disturbances shall be seeded for permanent stabilization.

1.4.3.4 Types of Habitats

Habitat types include forested wetlands, agricultural wetlands, uplands, and open water. The forested wetland habitat is dominated by hackberry, persimmon, sugarberry, boxelder, bitter pecan, cottonwood, and buttonbush, with rattan vine and muscadine as common vines. Other less common species include Nuttall oak, bald cypress, and black willow.

1.4.3.5 Timing and Duration of Discharge

Discharge timing during the period of pump construction would depend on preconstruction planning and construction activities. The timing of periodic maintenance dredging in the inlet and outlet channels will depend upon hydrologic events and the rate of deposition in these channels. Well installations shall take place as environmental conditions dictate from the associated adaptive management plan. Each well installation shall occur independent of other well sites. The time frame for the overall construction for all well sites will be one to five years contingent on the findings from the adaptive management plan.

1.4.4 Description of Disposal Method

Fill material for disposal, realignment of levee, backfill around the pump station, and construction of roadways would be transported and deposited by truck, bulldozer, and/or dragline. With the exception of gravel, riprap, and concrete, all fill material would be generated onsite Steele Bayou Pump Site ROW or from the offsite borrow area. Material from the periodic maintenance dredging will be placed in a government approved upland disposal area. No disposal of fill material is anticipated by the installation of the well sites during construction.

1.5 Factual Determinations

1.5.1 Physical Substrate Determinations

1.5.1.1 Substrate, Elevation, and Slope

The inlet and outlet channels will form a secondary means of transferring floodwaters from the Steele Bayou Channel into the Yazoo River via a pump station to reduce the damages from interior ponding resulting from Mississippi River backwater flooding. There will be no change in substrate, elevation, or slope within the Steele Bayou Channel or the Yazoo River. When completed, the inlet channel will be 3,100 feet long and have a bottom elevation of 71.0 feet, NGVD, and side slopes of 1V on 4H. When completed, the outlet channel will be 3,500 feet long and have a bottom elevation of 76.0 feet, NGVD. Side slopes for the outlet channel will also be 1 on 4. The banks of the inlet and outlet channels will be armored to prevent erosion at their confluence with the Steele Bayou Channel and the Yazoo River. Any erodible soils on the channel slopes will be protected by filter fabric and riprap to reduce the potential for erosion. Erosion that would arise from the discharge pipe of water from the wells placed in the receiving streams shall be mitigated with the placement of an impervious reaeration trough and riprap.

1.5.1.2 Sediment Type

Sediments will consist predominantly of clays and silts. A comprehensive soils analysis shall be defined for the Steele Bayou Pump activity when soil borings are collected at the initial stages of construction.

1.5.1.3 Dredged/Fill Material Movement

Any movement of dredged or fill material after placement at the pump station site would be disposed of onsite in the onsite or offsite borrow areas. This may include fill materials derived from the coffer dam and preload pad. If the soil borings analysis at the Steele Bayou Pump Station shows that the quantity and quality of borrow material does not meet the needs of the project features, additional material shall be collected from the onsite or offsite borrow areas for use.

1.5.1.4 Physical Effects on Benthos

During construction, the installation of the culvert crossing within the offsite borrow area could impose temporary impacts to benthic organisms in the 1,118 linear feet of Potentially Jurisdictional Other Waters. Temporary impacts to benthic organisms from fill material would also be unavoidable within the TNW *Section 10* (Steele Bayou &Yazoo River), Open Water *Section 10,* Open Water *Section 404*, Other

Waters/(RPW) *Section 10/404*, and Other Waters/RPW *Section 404* accounting for a cumulative area of 96.58 acres. Periodic maintenance dredging of the inlet and outlet channels would unavoidably disturb benthos inhabiting the channels. Maintenance dredging, however, is only predicted to be needed once or twice during the life of the project. The physical effects on benthos shall be positively influenced during traditionally low or no flow periods by the supplement of water from the presented well sites on as much as 750 miles of streams in the Big Sunflower, Deer Creek and Steele Bayou basins, with 340 miles of those streams located within the Yazoo Backwater area.

Actions Taken to Minimize Impacts

The impacts associated with construction of the pump station in the lower end of the drainage basin and the deposition of dredged or fill material in the identified open waters and wetlands are unavoidable. The major portion of lands impacted by construction and deposition of fill material will be isolated from neighboring water bodies by dikes and existing levees. Impacts will be minimized through the use of best management practices (BMPs) for nonpoint source pollution at the construction site. These nonpoint source control measures will include but are not limited to silt screens, buffer zones, and containment dikes. The construction site will be reseeded with native species to stabilize the soil and prevent aerial drift of dust once construction activities are completed. Other control measures associated with the installation of utility lines from Highway 61 to the pumping station may include the use of drill and bore techniques as opposed to open trench methods. A Stormwater Pollution Prevention Plan (SWPPP) that outlines the specific steps that will be utilized to minimize nonpoint source runoff will be filed with the Mississippi Department of Environmental Quality (MDEQ). The greatest potential for substrate movement would be when the inlet and outlet channels are connected to the Steele Bayou Channel and the Yazoo River. Effects would be temporary and would be minimized using tracked based equipment wherever possible to reduce compaction to soils outside the direct impact's areas. When completed, the banks of the inlet and outlet channels will be armored to prevent erosion at their confluence with the Steele Bayou Channel and the Yazoo River. Any erodible soils on the channel slopes will be protected by non-synthetic filter fabric where effective and riprap to reduce the potential for erosion. Channel banks will be seeded once slopes are completed. Material removed from the channels during periodic maintenance dredging will be placed in onsite borrow/disposal areas.

Well installation will disturb approximately 1.25 acres per site or 42 cumulative acres of land. The impacts to these disturbed areas shall be minimized with BMPs.

1.5.2 Water Circulation, Fluctuations, Chemical, and Physical Determinations

1.5.2.1 Water

Most of the changes to water quality will be within the normal range of values observed during any year. Impacts will depend upon the time of year and the ambient concentrations in each of the receiving water bodies. Impacts to water quality could be caused by stormwater runoff at the construction site, by increases in turbidity when the inlet and outlet channels are de-watered, by increases in turbidity when the inlet and outlet channels are connected to the Steele Bayou Channel and the Yazoo River, and by increases in turbidity during periodic maintenance dredging. Impacts to water quality resulting from project construction activities include short-term localized increases in turbidity and suspended solids due to rainfall runoff at the construction site.

The addition of 34 independent supplemental low flow groundwater wells in the headwaters of the Big Sunflower and Steele Bayou basins shall supply as much as 170 cfs during traditional periods of low or no flow which will have a positive effect on the hydrology in the three basins. Base flow shall be enhanced to levels that can better sustain aquatic life year-round. Increased base flow will likely reduce the effects of low dissolved oxygen (DO) during stagnant conditions.

1. Salinity.
    a. No impacts to existing salinity conditions are anticipated from the construction of the Yazoo Backwater Pump.
    b. The well sites will draw from the Mississippi River Alluvial Aquifer. The basin already receives significant volumes of well water during the irrigation season. The discharge of well water will not alter the normal range of salinity the surface waters have experienced over the last 40 years. This additional water is not believed to influence salinity conditions in existing channels.
2. Water chemistry.
    a. Changes to water chemistry could occur within the mixing zone such that adsorbed materials on soil and sediment particles become dissolved or suspended in the water column. During construction, most of the pump station site will be isolated from the Steele Bayou Channel and the Yazoo River by a cofferdam. The most likely periods for increases in suspended sediment would be during unwatering of the inlet and outlet channels, particularly as the water levels in the two channels approach the channel bottom surface elevations and when the channels are connected to the Steele Bayou Channel and the Yazoo River. Increases in turbidity would depend upon the time of year and the ambient concentrations in each of the receiving water bodies. Turbidity outside the mixing zone will be monitored to ensure concentrations do not exceed the state criterion. Other than localized short-term increases in suspended solids and turbidity, there will be no impacts to water chemistry from construction activities at the pump station site or from periodic maintenance dredging of the inlet and outlet channels.
3. Clarity.
    a. The localized increases in turbidity caused by construction of the Yazoo Backwater Pump would influence clarity. The preexisting condition for clarity should return shortly after the presented construction is completed.
    b. Water from well sites may be high in dissolved iron. When the well water meets the stream, the iron will precipitate. If present in large enough quantities, the precipitates will stain the stream bottom. Before settling, these precipitates may have a local impact on water clarity at the point of discharge. These impacts should quickly diminish.
4. Color.
    a. Any changes in watercolor at the construction site of the Yazoo Backwater Pump would be temporary and minor.
    b. Color could potentially be influenced by the precipitation of iron at the point of discharge from the well sites.
5. Odor.
    a. Construction operations for the Yazoo Backwater Pump may result in the release of odors otherwise contained. However, this condition is not expected to be hazardous and would be localized and short-lived.
    b. Sulfides have been traditionally associated with the Mississippi River Alluvial groundwater. A local change in ambient air conditions may occur at the point of discharge from the well sites.
6. Taste.

a. Not applicable. There are no potable water intakes in the immediate vicinity of the presented Yazoo Backwater Pump site.

b. The presence of iron and hydrogen sulfide from extracted well water from the MRVA (Mississippi River Alluvial Valley) may have an impact on the taste at the point of discharge into the streams influenced from the well sites.

7. Dissolved gas levels.

a. Increased organic loadings due to construction activities could increase biological and chemical oxygen demand and reduce dissolved oxygen levels (DO). However, DO levels would return to preconstruction levels following completion of construction activities.

b. Local DO concentrations of surface waters could be reduced with the addition of well water containing low DO concentrations as it is pumped to the surface. Reaeration troughs shall be incorporated into each well site design to mitigate for low DO concentrations associated with groundwater. The design of each trough will likely be subject to minor modifications through an adaptive management strategy until an accepted model is reached. The addition of overall water supply to existing low flow channels will further stimulate agitation and reaerate low DO levels in surface water pools. The cooler temperature regime typically associated with groundwater will also have a positive effect on the DO saturation when mixed with warmer surface waters.

8. Nutrients.

a. Sediment disturbance during construction of the Yazoo Backwater Pump may cause temporary increases in nutrient levels areas as a result of reseeding and fertilization of graded surfaces. Such increases would be of short duration, and nutrient levels would return to preconstruction levels following completion of construction. During the stages of establishing permanent stabilization at the pump site, the use of fertilizers may contribute to short term increases in nutrient concentrations downstream to the Yazoo River and Mississippi River. These nutrient contributions would not likely have a significant impact on the overall hypoxic zone in the Gulf of Mexico.

b. Any iron present in the groundwater that has not been oxidized prior to introduction to the stream will have the potential to bind with total phosphorus present in the stream. This chemical reaction will promote precipitates that will enhance removal of phosphorus from the water column via settling. This will have an overall positive impact to the ambient phosphorus concentrations from agricultural runoff.

9. Eutrophication.

a. No change in the trophic state of the waters around the construction site is expected to result from the temporary and minor increase in nutrients that may reach area surface waters during construction of the Yazoo Backwater Pump Site.

b. No change in the trophic state is expected to result from the addition of water from the well sites.

10. Current patterns and circulation.

a. Completion of inlet and outlet channels will connect the pump station to the Steele Bayou Channel and the Yazoo River. This will allow floodwater to be pumped across the Yazoo Backwater levee when Steele Bayou and Little Sunflower water control structures are closed. While relationship of the 25,000 cfs pump capacity to the overall volume of the lower Steele Bayou and Little Sunflower Basins is great, this would result in a slight

change in current pattern. This mechanical action will stimulate a slow movement of water through the system which should have a positive impact on overall water quality parameters when compared to the current conditions which are stagnant.

b. Addition of water from the well sites to the headwaters of the Yazoo Backwater Area shall have a positive effect on the minimum flow conditions observed in the basin. These additional flows shall enhance stream flow for many of the primary tributaries, which have suffered from reduced base flow.

11. Velocity.

a. Deposition of dredged or fill material into the designated disposal areas will have no effect on velocities within the Yazoo Backwater Study Area. Operation of the backwater pump station should not impact velocities within the Mississippi River, Yazoo River, Steele Bayou Channel, or Big Sunflower River. Velocities of flow in the pump inlet and outlet channels at full capacity will be less than 2 feet per second. During low-water periods, both channels will become slack-water areas. Water levels in the outlet channel will fluctuate with water levels in the Yazoo River, while water levels in the inlet channel would fluctuate with water levels in the Steele Bayou Channel.

b. Addition of water from the well sites will increase the velocities in the streams of the headwaters of the Yazoo Backwater Area. Flow from each well will not exceed 5 cubic feet per second which will be well below the stream carrying capacity during low flow periods. This additional flow should not induce channel degradation or bank erosion. The addition of this water at each site will not adversely influence stream morphology but will be beneficial to aquatic life.

12. Stratification.

a. Water temperatures in the immediate construction area may be affected due to short-term increases in turbidity during construction. Any impact resulting in a change in stratification processes would be minor and temporary.

b. Water from the well sites will likely decrease the ambient temperature of the streams. The addition of well water will likely take place during the hot and dry fall months and will likely be beneficial to aquatic life.

13. Hydrologic regime.

a. The presented alternative of the Yazoo Backwater Area Water Management Plan would provide for the reduction in interior flooding during backwater flood events. Pumping will lower the water surface of floods greater than the 5-year frequency flood, which will reduce the extent and duration of the flood. These changes to flood extent and duration would be slow and gradual. The actual change in the water surface elevation will be greatest near the pump station and less in the headwaters. An estimated 351,203 acres are currently supported by flooding within the 5-year floodplain, and the majority of those wetlands (between 258,337 and 261,987 acres) are not predicted to exhibit a change in hydrology due to operation of the pumps. Operation of the pumps is estimated to change the flood inundation duration of between 89,216 and 92,866 acres of wetlands. - These hydrologic changes were estimated to result in significant adverse impacts to wetlands due to the loss of between 27, 354 and 36, 570 Average Annual Functional Capacity Units (AAFCUs) within the YSA (see Wetlands Appendix). The presented compensatory mitigation is designed to fully offset these adverse impacts to wetlands resulting from changes in hydrology.

b. The addition of water from the well sites will increase flow during traditionally low or no flow periods. The wells will only be operated during periods of low or no flow (generally during the fall) and will not contribute to water levels during backwater flood events. Well operations will be monitored, and some or all of the wells would be closed during significant precipitation events. It should be noted that the use of the supplemental low flow wells comes as stream stages begin to decline from diminished irrigation return flow after the agricultural growing season. The supplemental flow delivered to the streams should not be viewed as a water source for irrigation (via surface water) to nearby farming operations.

14. Normal water level fluctuations.

    a. Deposition of fill material into the ROW areas adjacent to the Steele Bayou Pump site and the offsite borrow area will have no impact on normal water level fluctuations. The actual change in water surface elevation will be greatest at the Steele Bayou Pump Site and less in the headwaters. Water levels in the completed 40-acre outlet channel will fluctuate with water levels in the Yazoo River. The increased stage of the Mississippi River at the Vicksburg gage from the additional 25,000 cfs flow should be less than 0.4 foot (See Engineering Appendix G – Downstream Impacts of the Presented Pump). This minor increase will not likely have a significant impact on the local downstream communities in the Vicksburg area during a flood event.

    b. The addition of water from the well sites shall have a positive influence on stages during low or no flow conditions.

15. Salinity gradients.

    a. Not applicable for the presented Yazoo Backwater Pump Site.

    b. This additional water, supplied by the well field, is not believed to influence salinity conditions in existing channels.

1.5.2.2 Actions Taken to Minimize Impacts

During construction, most of the pump station at the Steel Bayou site will be isolated from the Steele Bayou Channel and the Yazoo River by levees and dikes. Impact of stormwater runoff will be minimized by implementation of BMPs in accordance with the State of Mississippi laws and regulations. Adverse impacts to water quality associated with removal of vegetation will be minimized by seeding disturbed areas after construction. Disposal areas shall be located on the construction site or the defined borrow area. Turbidity will be monitored during activities that remove or resuspend sediment.

The presented compensatory mitigation measures including the acquisition and restoration of wetlands on between 5,722 and 7,650 acres of land (primarily located at or below the 2-year flood frequency elevation. The remaining remnant at or below the 5-year frequency elevation) are designed to offset unavoidable adverse impacts associated with the construction and operation of the presented pumping station.

Each supplemental low flow groundwater well installation shall incur minor disturbances of soils at the well head and the area associated with installation of the reaeration trough to the receiving stream. The reaeration trough will deliver water from the well head on top bank down to the water surface of the channel. Fill material in the form of concrete or rip rap will be placed on the channel slope for this purpose. The portion of the slope determined to exist below ordinary high water will likely be impacted. The geometry for a typical reaeration trough will be approximately 15 feet wide with 10-foot rip rap buffers on either side that extends approximately 30 linear feet below ordinary high-water level to the low water surface. This linear distance is largely dependent on existing channel slopes. With these estimations, the geometric area impacted would cover 1,050 square feet. The approximate cumulative fill to WOTUS from the reaeration

troughs would equate to less than 1.0 acre. The geometric dimensions presented are believed to be adequate for impacted areas below ordinary high water for each reaeration trough. However, the design of each trough will likely be subject to minor modifications through an adaptive management strategy until an accepted model is reached. Actual Impacted area of each trough shall be computed at the time of final design.

1.5.3 Suspended Particulate/Turbidity Determinations

The temporary effects of clearing, filling, and/or dredging associated with the presented project construction of the Steele Bayou Pump and well sites may induce localized increases in soil erosion and/or turbidity. Eroded material from the construction site may be transported into near waterways. This could result in short-term and localized increases in suspended particulates and turbidity levels. Dewatering the inlet and outlet channels at Steele Bayou Pump Station could also cause temporary increases in turbidity, particularly when the water levels in the two channels approach the channel bottom surface elevations. Turbidity increases will also occur when the channels are connected to the Steele Bayou Channel or the Yazoo River. Increases in turbidity would depend upon the time of year and the ambient concentrations in each of the receiving water bodies. Increases in turbidity are expected to be short term. Well site installations will have little effect on turbidity.

Light penetration. Short-term reductions in light penetration are likely to occur during construction activities at the Steele Bayou Pump site. These reductions in light penetration are anticipated to be localized to the area adjacent to construction operations. Light penetration levels should return to preconstruction levels soon after construction is completed.

DO. Temporary decreases in light penetration from localized increases in turbidity could cause reductions in photosynthesis. This could result in temporary, localized decreases in DO concentrations. The DO should return to preconstruction concentrations once the turbidity clears and photosynthesis rates return to normal at the Steele Bayou Pump site. A minimal disturbance of suspended sediments will likely be incurred at the point of discharge of the wells. These disturbances are perceived to be minimal, and sediments should settle out of the water column quickly. The increased turbidity will have minimal impacts on light penetration and DO.

1.5.3.1 Toxic Metals and Organics

The presented Steele Bayou Pump Station site lies in an area that has been relatively dormant since the initial construction activities occurred in 1986. There is little reason to believe that the disturbance of the sediments will increase the concentration of trace metals. Prior to periodic maintenance dredging, sediments to be dredged will be sampled and analyzed for toxic metals or organics that have known potential sources in the watershed. Samples from the offsite borrow area will be collected and analyzed for toxic metals and organics before relocating for use in the pump station construction. Dredged materials will be placed in government approved disposal areas. Given the minimal area associated with the construction of each well site, there is little reason to believe that the disturbance of the sediments will increase the concentration of toxic metals in the adjacent streams.

The water extracted from the MRVA is known to have higher levels of iron concentrations. Currently there are more than 25,000 wells in use for agricultural irrigation in the Yazoo Backwater Area. While the operation of these irrigation wells has had a significant contribution to Yazoo Basin via irrigation return flow, the surface water quality has not experienced a noticeable change. The ferrous iron pumped by each supplemental low flow groundwater well will likely precipitate in the reaeration trough adjacent to the channel and should not have an adverse effect on stream water quality (may improve water quality by

removal of phosphorus). The clean groundwater taken from the MRVA has been found to be free of harmful contaminates and should have a positive impact on the overall water quality in the Yazoo Basin.

1.5.3.2 Pathogens

While coliform and enterococci bacteria may be present in project waters, project construction would not affect this condition.

1.5.3.3 Aesthetics

Construction of the pump station and well sites will have short-term impacts on the natural esthetics adjacent to the sites. Turbidity plumes may be created as a direct response to construction activities in and adjacent to area surface water by the Steele Bayou Pump Station. If created, these plumes would be infrequent and short term. The esthetics of up to 660 acres of wetlands, open waters or uplands associated with the construction of the pump site would be impacted until vegetation is reestablished on the regraded surface and the physical structure is complete.

The well sites would cause minimal disturbance to turbidity at the point of discharge into the receiving waters. The induced turbidity should dissipate in a relatively short distance downstream. In addition to a well head and service panel, completed well site installations would utilize power poles for needed power. The esthetics associated with these features will not look out of place given the existing 20,000 well heads installed in the study area for agricultural irrigation.

1.5.3.4 Pesticides

The primary source of pesticides is from runoff from agricultural fields in the basin. The agricultural community in the Yazoo Basin has implemented significant measures (land leveling, pads & pipes, drop pipe structures) to control runoff over the last few decades which has resulted in a significant reduction in siltation in the Big Sunflower and Steele Bayou Basins. This has had a positive environmental impact on pesticide contributions to the waterways. Because the presented offsite borrow area lies on agricultural fields, the excavated soil may contain pesticides within the top two to five feet from the surface. This along with the excess material excavated from the inlet and outlet channels shall be confined using onsite storage. Disposal of the offsite borrow topsoil will likely be permanently capped with additional material during construction. The presented construction activities will not increase the levels of pesticides in runoff.

The minor disturbance of soils at the well sites, will not likely have an impact on pesticide levels in adjacent streams.

1.5.3.5 Effects on Biota

The temporary reduction in light transmission resulting from erosion associated with construction may temporarily reduce photosynthesis and primary productivity to a minor degree in aquatic areas adjacent to the construction site. Deposition of erosive material on the channel substrate from the construction area may have a minor impact on the of the local biota.

The addition of water to the headwater streams of the Big Sunflower, Upper Deer Creek and Steele Bayou basins during low flow periods would have a positive effect on the overall health of the aquatic ecosystems. The additional supply of ground water should stimulate agitation and potentially lower water temperatures of stagnant pools during warmer months thus enhancing DO concentration levels. The additional water supply would also increase water depths providing for a more diverse aquatic habitat. These benefits would increase the fish passage opportunities in each basin. The increased water depth would also increase the wetted perimeter of the channel bottom during low flow periods providing for year-round habitat for endangered mussel species. These benefits are further explained in Aquatic Resources Appendix.

These temporary effects on light transmission resulting from erosion are not anticipated for the construction of the supplemental low flow well sites.

1.5.3.6 Suspension/Filter Feeders

Eroded material from the construction site may be transported into near waterways. This could result in short-term and localized increases in turbidity levels and corresponding reduction in DO. Dewatering the inlet and outlet channels at Steele Bayou Pump Station could also cause temporary increases in turbidity, particularly when the water levels in the two channels approach the channel bottom surface elevations. Turbidity increases will also occur when the channels are connected to the Steele Bayou Channel or the Yazoo River. These localized construction effects may have a short-term impact on filter feeders. Well site installations will have little effect on turbidity and corresponding DO to filter feeder aquatic habitats.

1.5.3.7 Sight Feeders

No Significant Effects. These organisms are generally highly mobile and would avoid or escape any areas of high turbidity.

1.5.3.8 Action Taken to Minimize Impacts

BMPs which include silt screens, buffer zones, turbidity curtains, containment dikes, hay wattles, and construction entrance/exit for offsite tracking will be utilized to minimize impacts from stormwater runoff. Temporarily disturbed areas would be revegetated with native species as soon as possible following construction at the Steele Bayou Pump site.

Efforts shall be taken to minimize disturbance at the point of discharge of the well sites into the receiving streams.

1.5.4 Contamination Determinations

A HTRW assessment was conducted for the structural features identified in alternative 2 and 3. This includes the pump site for the 25,000 cubic-foot-per-second pump and the corresponding borrow area. An online environmental record search was performed using the federal government's online resources on the site areas in question. This record search did not identify any environmental records that would have an impact on this presented plan. A site reconnaissance of the borrow area and pump area was conducted on April 8, 2024, and April 11, 2024, respectively by MVK staff. The inspection was conducted on-foot and by vehicle around the two sites in question. Limited access was available at the time of the site visit to one area of the Steele Bayou Pump site due to inundation from recent heavy precipitation. A 55-gallon drum partially full of liquid was observed in the Right of Way (ROW) near the presented outlet channel. No indications of distressed soil or offensive odors were detected in the immediate area. Based on the findings from the records search and site reconnaissance there is little reason to believe that a HTRW will be encountered for the presented construction. A follow up HTRW Assessment will be conducted of the defined ROW of the pump site and the borrow area during the design phase of this project.

The environmental restoration feature associated with alternative 2 and 3 involves the construction of thirty-four low flow wells along the banks of the headwater of the Yazoo Basin. A HTRW assessment of the presented low flow wells sites was completed in August 2020 by MVK staff. Based on the results of this assessment there is little reason to believe that a HTRW will be encountered. A follow up HTRW assessment will be conducted at each of the finalized low flow well sites during the design phase.

1.5.5 Aquatic Ecosystem and Organism Determinations

1.5.5.1 Effects on Plankton

Temporary decreases in light penetration through the water column from localized increases in turbidity could cause reductions in photosynthesis. This may in turn have an impact on phytoplankton communities in the adjacent channels. These impacts to plankton will likely be short term for the construction period. localized decreases in DO concentrations as well as the suitability of The DO should return to preconstruction concentrations once the turbidity clears and photosynthesis rates return to normal at the Steele Bayou Pump site.

There would be no adverse effect on Plankton by the installation of each well site. Plankton communities downstream of each well site should benefit from the additional water to the streams during low or no flow periods.

1.5.5.2 Effects on Benthos

Some benthic organisms would be adversely impacted by deposition of fill material and by unwatering the inlet and outlet channels to facilitate completion of these channels. Completion of the inlet channel would create 34 acres of permanent open water behind the presented Steele Bayou Pump Site. Completion of the outlet channel would create up to 40 acres of open water that would fluctuate with the water level of the Yazoo River. Up to 1,118 linear feet of Potentially Jurisdictional Other Waters located within the offsite borrow area could be altered during the construction process. It should be noted that flow along this open water feature will be maintained using culverts which shall be installed with inverts set to facilitate passage.

There would be no adverse effect on benthos by the installation of each well site. Benthos communities downstream of each well site should benefit from the additional water to the streams during low or no flow periods.

1.5.5.3 Effects on Nekton

Up to 74 acres of permanent open water would be created by completion of the inlet and outlet channels. The open water will fluctuate with the water level of the Yazoo River and the Steele Bayou Channel. It should be noted that flow along the open water identified within the offsite borrow area will be maintained using culverts.

Installation of wells would have no effect on nekton however the addition of water during low or no flow periods would improve the habitat for nekton in as much as 750 miles of streams in the Big Sunflower and Steele Bayou basins, with 340 miles of those streams located within the Yazoo Backwater area.

1.5.5.4 Effects on Aquatic Food Web

The aquatic food web would experience adverse impacts due to the loss of between 27, 354 and 36, 570 AAFCUs within the YSA associated with the direct and indirect impacts of construction and operation of the presented pumping station. The presented compensatory mitigation measures, including the acquisition and restoration of wetlands on between 5,722 and 7,650 acres of land (compensatory mitigation feature – primarily located at or below the 2-year flood frequency elevation with the remaining remnant at or below the 5-year frequency elevation), are designed to offset unavoidable adverse impacts associated with the construction and operation of the presented pumping station.

There would be no effect on the aquatic food web by the installation of the well sites. However, hydrologic conditions sustained by supplemental flow in the upper watershed of the Yazoo Basin shall help to maintain aquatic biota year-round.

1.5.5.5 Effects on Special Aquatic Sites

1. Wetlands.

The Regional Guidebook for Applying the Hydrogeomorphic (HGM) Approach to Assessing Wetland Functions of Selected Regional Wetland Subclasses, Yazoo Basin, Lower Mississippi River Alluvial Valley was used as the assessment tool to quantify impacts that may result from the implementation of the presented alternative of the Yazoo Backwater Area Water Management Plan. The construction of the Steele Bayou pump station and borrow areas comprise the direct impact area for the wetlands assessment, as these areas are expected to be converted from wetlands to non-wetlands as the result of implementation of the Water Management Plan. Additionally, changes in wetland hydroperiods induced by implementation of the presented Water Management Plan were evaluated to quantify potential impacts to wetlands within all forested and agricultural areas subject to floodwater inundation below an elevation of 93 feet, an area which encompasses the entirety of the 5-year floodplain (i.e., indirect impact area). Some areas within the indirect impact area are anticipated to experience decreased flood hydroperiods (i.e., fewer days of inundation), but are not anticipated to be converted from wetlands to non-wetlands. The wetland assessment calculated impacts to wetland resources resulting from the implementation of the Water Management Plan. This analyzed the future alterations to wetland hydrology and incorporated land cover type and flood duration and frequency intervals over a 50-year period. The wetland assessment also details the calculation of compensatory mitigation acreages required to offset direct impacts occurring at the pump location and indirect impacts associated with alterations to wetland hydrology.

Within the direct impact area (i.e., the area within the footprint of the pumping plant and associated infrastructure), a preliminary jurisdictional wetland delineation was conducted by staff from the Vicksburg District Regulatory Branch. As outlined in the Wetlands Appendix, the execution of a full, traditional wetland delineation within the assessment area would result in a decrease in the extent of wetlands, the estimated wetland functions associated with those wetlands under the no-action alternative, and the compensatory mitigation required to offset impacts to wetland resources under the presented alternative. It was assumed that all of the forested and agricultural lands in the assessment area meet the wetland criteria which varies from a more traditional wetland delineation approach, the selected approach 1) ensures that no wetlands in the assessed area were not accounted for and 2) very likely resulted in an overestimation of wetlands in the assessed area and associated compensatory mitigation requirements. The results of preliminary assessment of the Steele Bayou Pump Station as well as onsite and offsite borrow areas are as follows: Forested Wetland *Section 10/404* (25.49 acres), Forested Wetland *Section 404* (133.98 acres), Emergent Wetland *Section 404* (30.16 acres), and Scrub-Shrub Wetland *Section 404* (31.74 acres) at the Steele Bayou Pump site which includes the onsite and offsite borrow areas.

Implementation of the presented alternative would result in a decrease of between 25,470 and 34,687 AAFCUs for indirect project impacts associated with changes in flood duration intervals. This would require the establishment of between 5,328 and 7,256 acres of reforested and restored compensatory mitigation lands. Direct impacts associated with the project's physical footprint (e.g., pump station, borrow areas) would result in a decrease of 1884 AAFCUs, requiring an estimated additional 394 acres of mitigation lands. The sum of these two values for compensation of wetland impacts was rounded to between 5,722 and 7,650 acres of land primarily located at or below the 2-year flood frequency elevation with the remaining remnant at or below the 5-year frequency elevation . A detailed explanation of the wetland impact analysis can be found in the Wetlands Appendix.

No disposal of fill material is anticipated by the installation of the common design for the 34 supplemental low flow groundwater well sites.

2. Mudflats. Not applicable.
3. Vegetated shallows. Not applicable.
4. Coral reefs. Not applicable.
5. Riffle and pool complexes. Not applicable.
6. Threatened and endangered species. Eleven federally-listed threatened and endangered species were identified by the U.S. Fish and Wildlife Service (USFWS) that should be addressed as part of the presented project. The eleven species are Piping Plover, Red Knot, Wood Stork, Least Tern, Eastern Black Rail, Northern Long-eared Bat, Pallid Sturgeon, Fat Pocketbook, Rabbitsfoot, Sheepnose, and Pondberry. The USACE made the determination that any impacts that might occur would be insignificant and the presented project **may affect but is not likely to adversely affect** any of the listed species, with the exception of Pondberry. Additionally, in Section 7, consultation is gongoing with USFWS regarding impacts to Pondberry pursuant to the Endangered Species ActIt is anticipated that a **may affect but is not likely to adversely affect** determination will be reached. Refer to the Threatened and Endangered Species Appendix for additional information.
7. Other wildlife. Forested wetland habitat (up to 221.37 acres) and associated wildlife would experience unavoidable adverse impacts due to loss of this habitat at the Steele Bayou Pump site. Because of the mitigation and reforestation measures, unavoidable adverse impacts to wildlife wetland habitat would be fully compensated. The installation of the well sites would have no effect on wildlife.
8. Actions to minimize impacts. Compensatory mitigation for the significant direct and indirect/secondary effects associated with the construction and operation of the presented pumping stations is discussed above. In addition, impacts at the Steele Bayou pump construction site will be minimized by the application of BMPs for stormwater runoff. A SWPPP Notice of Intent will be filed with MDEQ, outlining the steps that will be used to reduce nonpoint source runoff. Control measures will include those recommended in the *Mississippi Stormwater Pollution Prevention Plan (SWPPP) Guidance Manual for Construction Activities.* The location of well sites would be situated in areas primarily utilized for agricultural production and will enhance the environment for terrestrial and aquatic biota.

1.5.6 Presented Disposal Site Determinations

1.5.6.1 Mixing Zone Determinations

The mixing zone will be 750 feet from the boundary of the defined work area at the Steele Bayou Pump site. No water quality criteria should be exceeded by the discharges.

The supplemental groundwater wells are designed to operate during periods of low flow. As such, the volume of water added will be proportionally high compared to the existing stream flow during low flow conditions. During the late summer and early fall months, minimal flow rates in many of the headwater streams of the Yazoo Basin were observed between 1.0 to 10.0 cfs. The addition of 5.0 cfs will significantly increase the overall volume and expedite mixing times after the point of injection. Minimal turbidity values may increase at the point of injection. These increases should dissipate in a relative short distance

downstream. There should be no problem with the mixing of ground water from the wells into the receiving streams.

1.5.6.2 Determinations of Compliance with Applicable Water Quality Standards

Changes to water quality conditions resulting from construction Steele Bayou Pump Station or operation of the Yazoo Backwater Area Water Management Plan are not anticipated to cause long-term changes in the existing water quality within the study area. Only temporary, short-term impacts to water quality are anticipated as a direct result of project construction. These impacts include temporary increases in suspended solids and increases in turbidity levels, which would occur only during construction operations. Completion of the nonstructural flood reduction feature (reforestation) should improve water quality during most times of the year. However, during flood events the export of organic carbon from leaf litter will likely aggravate low DO conditions.

Changes to water quality conditions, as a result of the supplemental flow from the well sites to the headwater streams in the Yazoo Backwater Area, shall have minimal local impacts at the point of introduction. Water quality impacts should include local increases in suspended solids, turbidity levels, and thermal stratification, as well as changes in conductivity and pH. However, the local impacts to water quality are far outweighed by the positive impacts resulting from the increase in flow during periods of low or no flow.

1.5.6.3 Potential Effects on Human Use Characteristics

1. Municipal and Private Water Supply. No significant effects are anticipated from the construction of the Yazoo Backwater Pump or the well sites. Municipal and private water wells located in the zone of depression for each of the well field sites may temporarily experience change in operation during operational months.
2. Recreational and Commercial Fisheries. No significant effects are anticipated from the construction of the Yazoo Backwater Pump. Recreational and commercial fisheries will likely be enhanced by the introduction of additional water from the well sites during low or no flow periods. By maintaining minimal levels of flow in the primary tributaries of the Yazoo Backwater Area, fisheries will have a chance to reestablish in areas that have suffered in recent decades. Recreational activities would be temporarily curtailed in the vicinity of the presented discharge site during construction of the Steele Bayou Pump project. Temporary increases in turbidity and suspended sediments during construction activities at the pump site would adversely impact recreational fishing downstream of discharge sites. These impacts would be minor and localized and occur only during actual construction.

1.5.6.4 Significant Updates to the Hydrologic Analyses

There are several areas with updated or completely new information for this DEIS hydrologic analyses. This section is intended to provide clarity for the tools used for refinement for this analysis when compared to similar studies completed for the YSA in the past. Updated information includes flooding since 1997, revising the period-of-record (POR) used in the hydrologic analysis of the project, the acquisition of a higher resolution digital elevation model (DEM) using an airplane based LIDAR, the application of the HEC-RAS 2D to model the POR to provide daily stages for the base and with-pump condition, the determination of the areal extent of floods (frequency and duration) based on the new POR utilizing the LIDAR DEM, and finally obtaining new land-use/land-cover information using the NASS-2015 coverage. New information includes daily water elevations in 57 shallow groundwater wells in the project basin and paired groundwater-surface water gages. For more detail, please refer to the Engineering Appendix G – Approach.

1.5.6.5 Determination of Impacts on Fish and Other Aquatic Organisms

Impacts on spawning and rearing fish were determined using ENVIROFISH 1.0. The output is Average Daily Flooded Acres (ADFA) are an area equivalent to one acre that is inundated on average every day of a defined season for a specified number of years. The ADFAs were calculated using the elevation data and hydrologically modeled water surface elevation. A new dataset was used to calculate Average Daily Flooded Acres that included hydrologic data up to 2020 (1978 - 2020) and improved digital elevation mapping data (10-foot DEM) compared to previous evaluations. The aerial measure of inundation (ADFAs) is multiplied by the appropriate Habitat Suitability Index (HSI) value in EnviroFish to output Habitat Units (HU) with which to compare alternatives and annualized over the 50-year project life.

Seasonally flooded habitat types were delineated from the National Agricultural Statistics Service (NASS) 2022 Crop Data Layer and verified with ground- truth to characterize floodplain land-use in the Yazoo Backwater Study Area. ADFAs of each habitat type by stage elevation (i.e., stage-area curves) were determined with EnviroFish. Habitat types are defined as follows:

1. Agriculture – all areas in which an agricultural product was grown including Pecan orchards and pasture lands.

2. Fallow – agricultural lands that have been abandoned where there is a prevalence of herbaceous, non-woody cover.

3. Bottomland hardwoods – Forested areas incorporates 5 NASS land-cover: evergreen forest, deciduous forest, mixed forest, forested wetlands, and herbaceous wetlands.

For this application, only agriculture and bottomland hardwood cover types within the 2- year flood frequency was considered. Fallow lands were not included in ADFA calculations because they represent less than 1% of all land-cover but were used in calculation of reforestation mitigation acres during the growth transition period. EnviroFish calculates ADFAs by land-use (cleared or forested) for spawning and rearing separately. Spawning acres were restricted to a minimum depth of 1.0 foot and flooded for a minimum duration of 8 consecutive days. A minimum water depth of 1.0 foot allows adults to access shallow, flooded areas; a water depth less than 1.0 foot is not considered realistic due to physical limitations in the spawning process. Flood duration of at least 8 consecutive days ensures suitable time for nest construction and other spawning activities by the adults and recognizes that shorter durations may result in the eggs becoming stranded and desiccated if water recedes too quickly. Alternatively, if the water recedes too rapidly off the floodplain, organic matter, nutrients, and newly hatched aquatic organisms may be carried into the river instead of remaining in the floodplain and permanent backwaters. The minimum one foot, 8-day duration rule is considered a conservative value to delineate spawning requirements for warm water fish species found in the Mississippi River basin. This rule guarantees an effective spawning window, emphasizes longer development times, and provides a margin for temporal variation in spawning activities (i.e., adult movement onto the floodplain, nest construction, and guarding/dispersal of fry). The average duration of these activities is eight days, thus the minimum elevation in each 8-day period was used to calculate the spawning acreage. This calculation was accomplished with a moving window. The program determines the minimum elevation in an 8-day period, then the window is moved forward one day, and the calculation is repeated.

The rearing life stage includes yolk-sac and post yolk-sac larval phases, both having volitional behaviors to change locations within the floodplain. Two different types of rearing are calculated. Total rearing is unrestricted and provides the total area flooded for each day. Restricted rearing can establish minimum and/or maximum depths for rearing. For this project the rearing area had no minimum depth, but the

maximum depth was restricted to 10 feet, due to low dissolved oxygen (DO) levels observed in deeper areas (see Section2).

The EnviroFish Program provides two output files, but the main goal is to determine the Average Daily Flooded Acres (ADFA) of flooded land for the period of record (POR). The two output files are a summary file of the ADFA by year and a file of the daily acres flooded. The daily file provides five columns of data. The data fields are stage, total rearing acres, restricted rearing acres and spawning acres. There are separate output files for cleared (agricultural) and forested areas. The second output file is the summary statistics file. This file has 13 output statistics, which are: year, mean-stage, total rearing, restricted rearing, and spawning area, maximum-stage, total rearing, restricted rearing, and spawning area, and minimum-stage, total rearing, restricted rearing, and spawning area.

The majority of the species that spawn and rear in riverine floodplains are pre-adapted to structurally complex habitats such as bottomland hardwoods. Therefore, cleared lands have less value for spawning and rearing habitat and eggs and larvae have a higher risk of becoming stranded or preyed upon in cleared lands as floodwaters recede. The HSI values reflect this trend, with optimum conditions occurring for bottomland hardwoods (HSI = 1.0); intermediate values for fallow fields (HSI = 0.5); and the lowest value for cleared, agricultural lands (HSI = 0.2). These values represent a community-level perspective on the biological response (i.e., spawning and rearing) of the fishes of the Yazoo Study Area to flooding. Further information on HSI development and modeling spawning and rearing habitat in floodplains are provided in the EnviroFish 1.0 manual (Killgore et al. 2012), which was certified in October 2020 by the Ecosystem Restoration National Planning Center of Expertise for this project.

Because the presented alternative would reduce flooding within the Yazoo Backwater, loss in Average Annual Habitat Units between the No Action Base Alternative and the two presented alternatives were calculated and mitigation requirements determined to offset loss in aquatic habitat. This analysis made certain assumptions on the application of EnviroFish to calculate ADFAs:

1. Larval fish have the potential to utilize the same habitat as spawning sites. Larval fish have smaller physical dimensions that allow access to shallower (< 1.0 feet) water than physically available for spawning needs (typically ≥ 1.0 feet depth, 8 days duration). The EnviroFish software was used to define minimum and maximum allowable depths for spawning and/or rearing to accurately represent a specific situation. For rearing, a maximum depth was used, labelled “Restricted Rearing,” to account for hypoxia in deeper waters.

2. Habitat acres were quantified for floodplain habitat only. This was done because the project would impact the extent of floodplain habitat with no/minimal effect on channel and other permanent aquatic habitat.

3. Many factors dictate the overall timing of the spawning and rearing period. Optimum conditions for spawning occur when the flood pulse and warmer temperatures are coupled. Although there are multiple variables that dictate when fishes will actually spawn, the model assumed that spawning takes place from 1 March to 30 June.

4. Flooded bottomland hardwoods in the 2-year flood frequency are the preferred spawning and rearing habitat.

The EnviroFish analyses were performed on six hydrologic reaches. There are four reaches in the Big Sunflower Basin and two in the Steele Bayou Basin. The four Big Sunflower reaches are Little Callao, Anguilla, Holly Bluff and Little Sunflower, from upstream to downstream. The two Steele Bayou reaches are: Grace and Steele Bayou, also from upstream to downstream. The average annual duration of flooding

varies from upstream to downstream, with the downstream stations experiencing the greatest duration of flooding. A common misconception about the spawning and rearing season is that there is out-of-channel flooding every day during this season. This is not true, and for some of the upstream stations the average annual days with stages equal to or greater than the 1-year frequency flood elevation is less than 10 days. In contrast, for the most downstream station, the average annual days with flooding greater than or equal to the 1-year frequency event is 28 days. The spawning season lasts for 122 days each year; thus most days have less flooding than the 1-year frequency event. The average minimum shows flooding only within the channel areas. The mean annual ADFA has some breakout from the channels but is still within the channels in most places. The mean maximum ADFA has significant out of channel flooding, but the average extent is less than the 1-year frequency flood.

Mean ADFA values for spawning and restricted rearing (max depth=10 ft) were used to determine impacts and mitigation requirements. Forested lands comprised approximately 80% of the total land use in the 2-year floodplain, with Steele Bayou and Little Sunflower being the most heavily forested. Reforestation efforts over the past 30 years in the 2-year floodplain have contributed to large conversions of crop lands to bottomland hardwoods. Overall percent loss of ADFA ranged from 7 to 12 percent depending on life stage and alternative. Comparing Habitat Units between base and alternatives resulted in a loss of 2,264 for spawning and 1,862 for rearing under Alternative 2, and for Alternative 3, the HU loss was 2,184 and 1,747 for spawning and rearing respectively.

For mitigation calculations, Average Annual Habitat Units (AAHUs) were calculated for the conversion of agricultural land to BLH over a 54-year project life. This calculation assumed four years of project construction, and ten years for the reforested areas to obtain full, functional value for spawning and rearing of fishes. This analysis resulted in 0.71 AAHU gained per acre of reforested agriculture land. Reforestation acres to offset impacts were higher for spawning than rearing. Alternative 2 resulted in 3201 acres of reforested habitat to offset impacts, whereas Alternative 3 resulted in 3088 acres. Selection of sites for reforestation should ensure that lands are flooded at depths of least 1-ft over an 8-day period during part of the spawning season.

1.5.6.6 Determination of Cumulative Effects on the Aquatic Ecosystem

As previously discussed, the direct and indirect/secondary effects of the construction and operation of the presented pumping station would result in significant adverse impacts to wetlands due to the loss of between 27, 354 and 36, 570 AAFCUs within the YSA. These wetland functional losses are particularly concerning when considered in light of the cumulative effects associated with the historic wetland losses/degradation in the Lower Mississippi River Valley, which has already lost over 80 percent of its bottomland forested wetlands (DOI 1988). This pattern of cumulative wetland losses and degradation is also evident in the Delta region of Mississippi which includes the YSA where extensive flood risk reduction measures, in particular levees, water control structures, and drainage channels constructed since the 1960s, have significantly reduced the frequency and duration of backwater flooding in the YSA necessary to sustain riverine backwater wetlands (Smith and Klimas 2002, Wetlands Appendix).

The presented compensatory mitigation measures including the acquisition and restoration of wetlands on between 5,722 and 7,650 acres of land (primarily located at or below the 2-year flood frequency elevation with the remaining remnant at or below the 5 year frequency elevation) are designed to offset unavoidable adverse impacts associated with the construction and operation of the presented pumping station. As discussed in the Mitigation Appendix, this compensatory mitigation is also designed to offset estimated impacts to fish and other aquatic organisms as well as most of the impacts to wetland dependent wildlife species. Additionally, approximately 403 acres (Alternative 2 & Alternative 3) moist soil units are presented to compensate for remaining unavoidable impacts to shorebirds.

Therefore, if the pump station is completed and its compensatory mitigation is successfully implemented, net impacts resulting from the presented alternative would, at a minimum, be neutral with regard to wetland resources. Net impacts resulting from the presented alternative could potentially be positive with regards to wetlands as a result of the voluntary acquisition of agricultural lands, but the degree to which this would happen depends on a number of factors including the ultimate number of agricultural lands acquired, their location, and the extent to which these lands develop and retain wetland characteristics absent any restoration or management. However, as discussed above, there is currently a backlog of uncompleted mitigation for related, previously constructed flood risk reduction features in the YSA; this mitigation backlog means that the cumulative effects of USACE's flood risk reduction efforts in the YSA are negative for wetland resources. The large levels of historic wetland loss and degradation across the Lower Mississippi River Valley, including the Delta region of Mississippi and the YSA, underscore the importance of ensuring implementation of effective and timely mitigation for USACE's flood risk reduction efforts.

Notably, full utilization of the gate operation of the Steele Bayou water control structure up to 75.0 ft (as described in the current water control manual) would improve hydrologic exchange between the YBA and the Yazoo River which is expected to benefit fishery resources and water quality. In addition, the construction of the Steele Bayou Pump would create up to 40 acres of permanent water adjacent to the Yazoo River and up to 34 acres adjacent to the Steele Bayou Channel.

the aquatic community in the upper headwater streams in the Yazoo Backwater Area suffer from reduced stages during low or no flow months of most years. This annual condition has hampered aquatic species diversification. The addition of supplemental flow to the headwater streams in the Yazoo Backwater Area could improve the ability of aquatic species to reestablish and proliferate on a year-round basis.

1.5.6.7 Determination of Secondary Effects on the Aquatic Ecosystem

As previously discussed, the indirect effects of the construction and operation of the presented pumping station would result in adverse impacts to wetlands due to the loss of between 25,470 and 34,687 AAFCUs within the YSA. The presented compensatory mitigation measures including the acquisition and restoration of wetlands on between 5,722 and 7,650 acres of land primarily located at or below the 2-year flood frequency elevation with the remaining remnant at or below the 5 year frequency elevation are designed to offset unavoidable adverse impacts associated with the direct and the indirect impacts of the presented pumping station. As discussed in the Mitigation Appendix, this compensatory mitigation is also designed to offset estimated impacts to fish and other aquatic organisms as well as most of the impacts to wetland dependent wildlife species. Additionally, approximately 403 acres (Alternative 2 & Alternative 3) of moist soil units are presented to compensate for remaining unavoidable impacts to shorebirds. The indirect impacts on the aquatic ecosystem derived from supplemental low flow groundwater well flows shall enhance the ability for tertiary and surrogate aquatic communities to thrive.

1.6 Finding of Compliance for Flood Control

1. No significant adaptations of the Section 404(b)(1) guidelines are contemplated for this evaluation.
2. Before issuing a Record of Decision (ROD), USACE will identify the LEDPA and finalize an assessment of the short- and long-term impacts associated with any discharge of dredged and/or fill materials into waters of the U.S. resulting from this alternative.
3. It is not anticipated that Alternatives 2 or 3 would have an effect on operation of the Muddy Bayou water control structure. Currently, the Eagle Lake community (Warren County, Mississippi, and Madison Parish, Louisiana) receives protection from a 50-year frequency flood.
4. Deposition of fill material associated with construction requirements for Alternatives 2 and 3 would adversely impact up to 25.49 acres of Forested Wetland *Section 10/404*, 133.98 acres of Forested

Wetland *Section 404*, 30.16 acres of Emergent Wetland *Section 404*, and 31.74 acres of Scrub-Shrub Wetland *Section 404*The construction requirements associated with the project would also impact up to 34.74 acres of TNW along the Steele Bayou & Yazoo River *Section 10*, 34.89 acres of Open Water *Section 10*, 25.1 acres of Open Water *Section 404*, 1.68 acres of Other Waters/RPW *Section 10/404*, and 0.17 acres of Other Waters/RPW *Section 404*. . Construction of the well sites would temporarily affect adjacent agricultural areas. Supplemental flow, provided by the well sites in the headwater of the Yazoo Basin, would help to reestablish the native aquatic fisheries that have suffered from low or no flow periods.

5. The planned deposition of fill material associated with Alternatives 2 and 3 is not expected to violate any applicable State Water Quality Standards. Further, that fill action is also not expected to violate the Toxic Effluent Standards of Section 307 of the Clean Water Act. The construction of the well sites will also not violate any state law standards.
6. No endangered species or their critical habitat are anticipated to be adversely impacted by Alternatives 2 or 3. Refer to the Threatened and Endangered Species section and appendix for additional information.
7. The direct and indirect effects of the discharge of dredged or fill material associated with the construction and operation of the presented pumping station under Alternatives 2 and 3 would result in significant adverse impacts to wetlands due to the loss of between 27, 354 and 36, 570 AAFCUs within the YSA. This level of wetland functional loss would cause or contribute to significant degradation of waters of the United States. To address these concerns, compensatory mitigation measures, including the acquisition and restoration of wetlands on between 5,722 and 7,650 acres of land primarily located at or below the 2-year flood frequency elevation with the remaining remnant at or below the 5 year frequency elevation are designed to offset the unavoidable adverse impacts associated with the direct and the indirect impacts of the presented pumping station. As discussed in the Mitigation Appendix, this compensatory mitigation is also designed to offset estimated impacts to fish and other aquatic organisms as well as most of the impacts to wetland dependent wildlife species. Additionally, approximately403 acres (Alternative 2 & Alternative 3) of moist soil units are presented to compensate for remaining unavoidable impacts to shorebirds. USACE is currently evaluating whether the presented compensatory mitigation measures would reduce the project's adverse effects below the level of significant degradation.
8. Before issuing a ROD, USACE will determine if all appropriate and practicable steps have been taken to minimize and compensate for the potential adverse impacts of the discharge of dredged or fill material associated with the alternative selected.
9. Before issuing a ROD, USACE will determine whether, pursuant to relevant laws and regulations for federal civil works projects, the presented sites for the deposition of dredged and fill material are specified to the extent required by USACE standards.

1.7 Compensatory Mitigation

The mitigation requirements for the Yazoo Backwater Management project include compensation for the unavoidable loss of habitats as follows:

- Wetlands 36,570 AAFCU*
- Aquatic Resources and Fisheries 3,969 ADFA**
- Waterfowl 2,265,567 DUD
- Terrestrial Wildlife 714 AAHU
- Shorebirds 37 AAHU

The recommended mitigation plan for the Yazoo Backwater Management Project is to pursue a combination of mitigation strategies to meet the full mitigation need and includes:

- Purchase of in-kind credits from the Ducks Unlimited, Inc. Mississippi Delta in Lieu Fee Program (approved: 24 September 2010) located in the YSA if they are available. *

- Purchase of In-Kind Mitigation Bank Credits located in the YSA (will only meet partial mitigation needs due to the availability of credits)*

- Construction of a YSA specific Mitigation Project *

- Management of Agricultural Area Inundation for Shorebirds

**Wetland mitigation will provide the necessary mitigation for the loss of waterfowl, aquatic resources and fisheries and terrestrial wildlife. Aquatic resource and fisheries mitigation will need to be in the 2-year floodplain or below and the difference can be included up to the 5-year floodplain.*

The Final Mitigation Plan in the Final EIS will be adjusted to meet the mitigation needs required by the selected plan for the Yazoo Backwater Management Project and will be based on these same mitigation strategies (ILF credit purchases, Project Specific Mitigation Construction and Mitigation bank credit purchases).

The full mitigation plan (Appendix J: Compensatory Mitigation Plan) provides a more comprehensive explanation.

If needed, unforeseen compensatory mitigation requirements would be calculated, and additional mitigation would be acquired to offset impacts created by construction of the 34 supplemental low flow groundwater wells. Finally, MVK would also obtain water quality certification from the Mississippi Department of Environmental Quality (MDEQ) under Section 401 of the Clean Water Act (CWA) for the Presented Plan upon completion of final design.

YBW FEATURES						
County	**Site Name**	**Water Body**	**Latitude**	**Longitude**	**Area (Acres)**	**Access Road acres**
Coahoma	YBP-HB-RB-1	Ritchies Bayou			1.25	0.01
Coahoma	YBP-HB-RB-2	Ritchies Bayou			1.25	0.47
Coahoma	YBP-HB-RB-3	Ritchies Bayou			0.75	0.52
Coahoma	YBP-HB-HB-4	Harris Bayou			1.00	0.40
Coahoma	YBP-HB-HB-5	Harris Bayou			0.75	0.38
Coahoma	YBP-HB-HB-6	Harris Bayou			0.50	
Coahoma	YBP-HP-HP-7	Hushpuckena River			0.75	0.05
Coahoma	YBP-HP-HP-8	Hushpuckena River			1.00	0.21
Coahoma	YBP-HP-MS-10	McNeil Slough			1.00	
Bolivar	YBP-HP-SB-12	Upper Stokes Bayou			1.25	0.13
Bolivar	YBP-HP-EB-13	Edwards Bayou			0.75	
Bolivar	YBP-BP-BP-14	Bogue Phalia			0.50	0.03
Bolivar	YBP-BP-BP-15	Bogue Phalia			1.25	0.95
Bolivar	YBP-BP-BP-16	Bogue Phalia			1.00	0.03
Bolivar	YBP-BP-LB-18	Lane Bayou			1.25	0.14
Bolivar	YBP-BP-LB-19	Lane Bayou			0.75	0.42
Bolivar	YBP-BP-LB-20	Lane Bayou			1.25	0.32
Bolivar	YBP-BP-LB-22	Laban Bayou			1.00	0.15
Bolivar	YBP-BP-LB-23	Laban Bayou			0.75	0.09
Bolivar	YBP-BP-LB-24	Laban Bayou			1.25	0.12
Bolivar	YBP-BP-SB-26	Lower Stokes Bayou			0.50	2.02
Bolivar	YBP-DC-SB-27	Straight Bayou			1.00	0.23
Bolivar	YBP-DC-BB-28	Browns Bayou			0.75	0.25
Bolivar	YBP-DC-DC-29	Deer Creek			0.75	1.69
Bolivar	YBP-DC-DC-30	Deer Creek			0.75	0.04
Washington	YBP-DC-WB-32	Williams Bayou			0.75	0.06
Washington	YBP-MC-MC-33b	Main Canal			1.00	0.05
Washington	YBP-BB-HB-34	Horshoe Bayou			0.75	1.72
Washington	YBP-BB-HB-35	Horshoe Bayou			1.00	0.29
Washington	YBP-MC-No8-39	Ditch No8			0.75	0.03
Washington	YBP-MC-No6-40	Ditch No6			0.75	0.61
Washington	YBP-MC-No8-41	Ditch No8			0.75	0.45
Washington	YBP-MC-No9-43	Ditch No9			0.75	0.22
Washington	YBP-MC-No6-44	Ditch No6			1.25	0.11

Table 1: Location and acres associated with Well Sites described for the Yazoo Area Backwater Project. Please note that these locations are based on preliminary assessments and may move up to 1,000 feet up or down stream and/or to the opposite bank at final design. (At the time of public notice of the DEIS, the supplemental well locations were not a fee title possession by USACE and could not be displayed.)

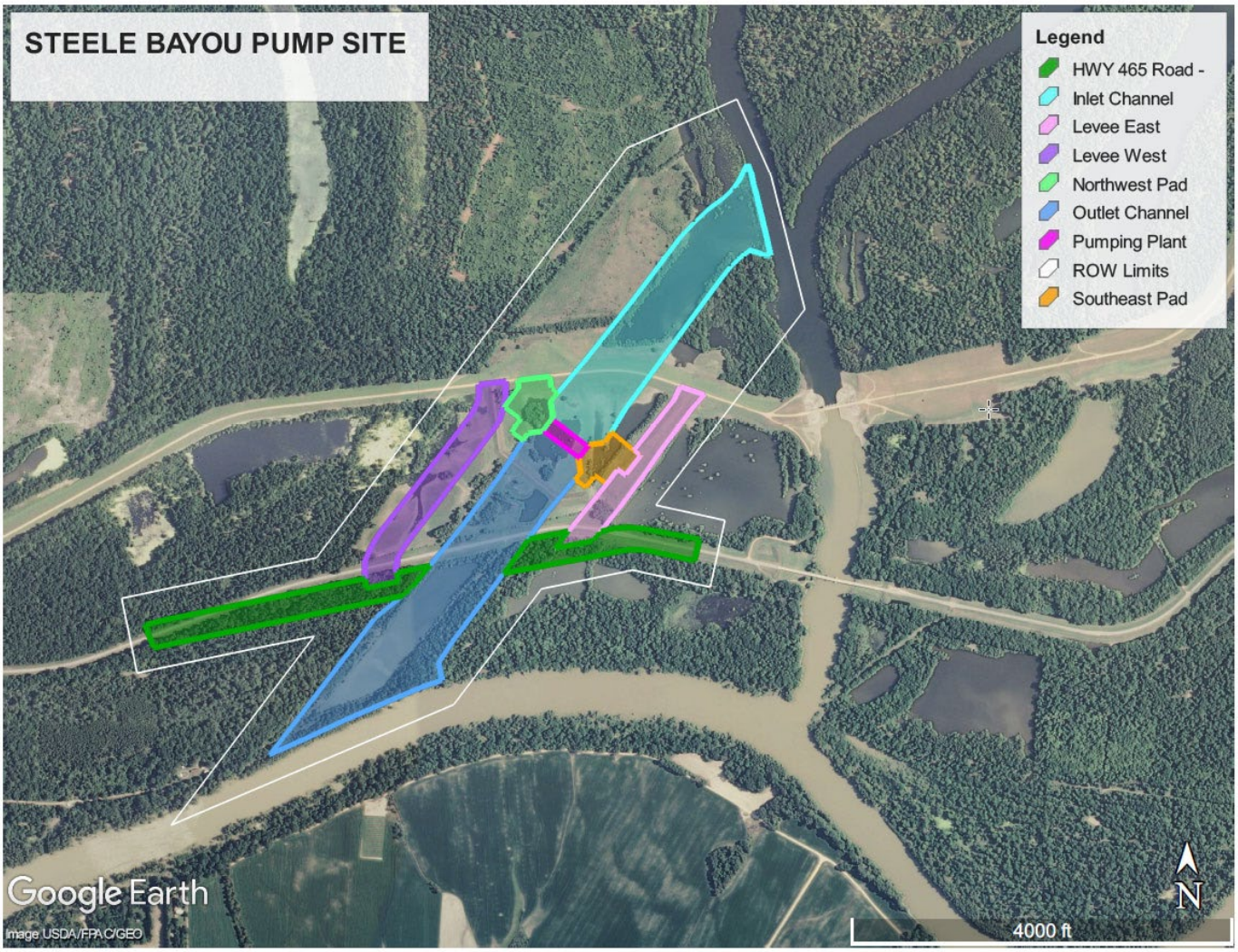

Figure 1. Location of the Steele Bayou Pump Station which includes the Pump Station features and ROW limits.

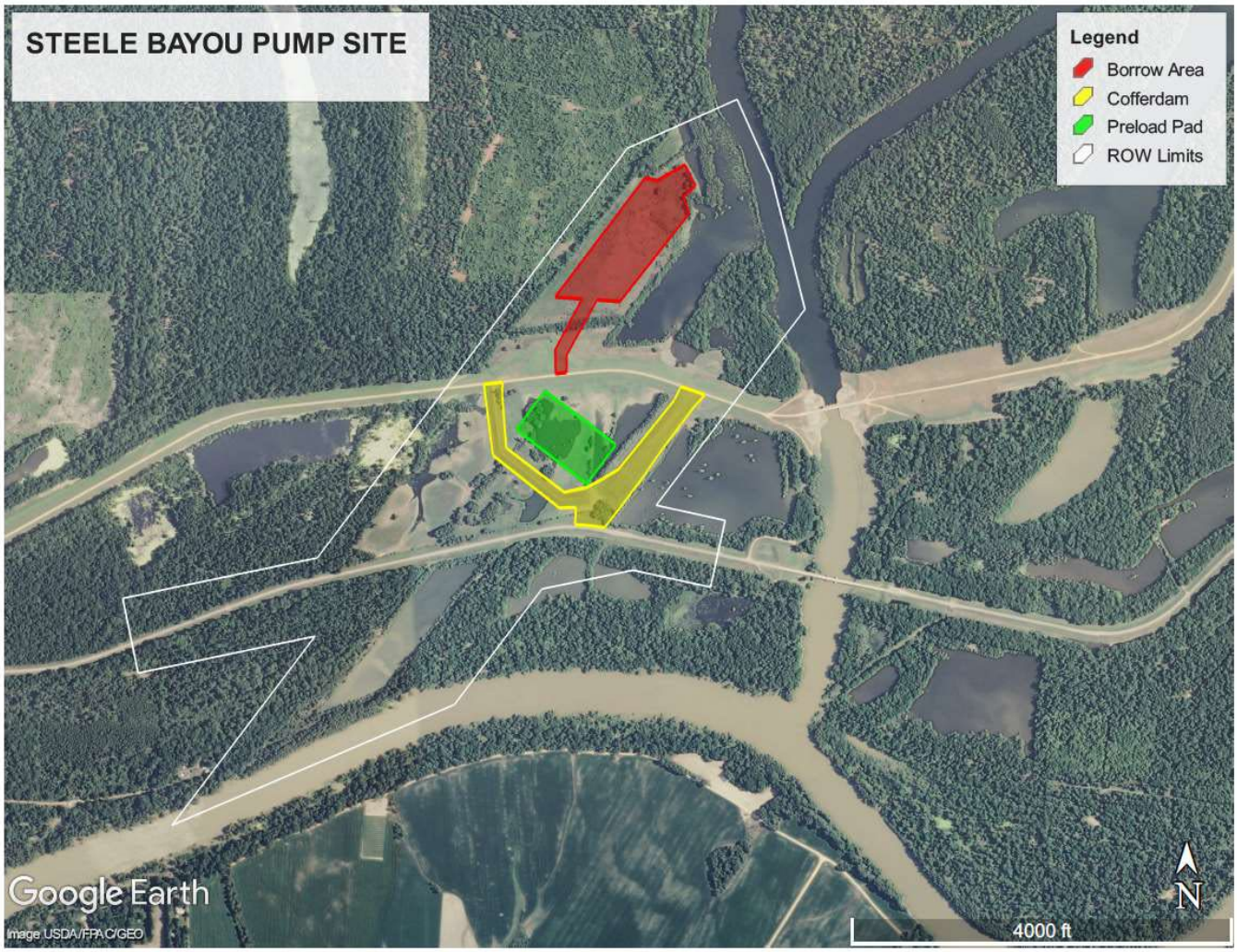

Figure 2. Steele Bayou Pump Site depicting onsite borrow area, coffer dam, preload pad

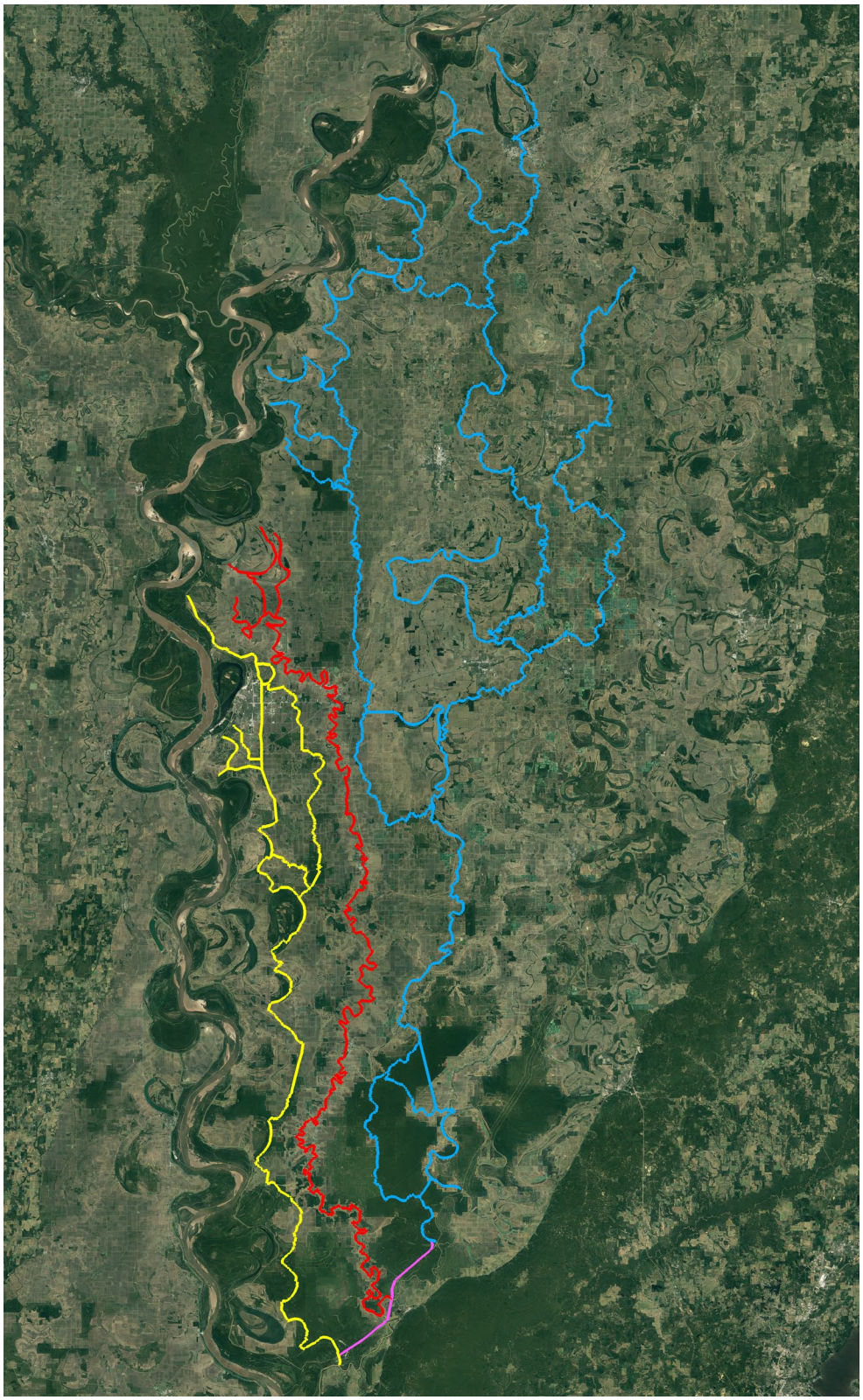

Figure 3. Tributaries contributing to the Yazoo Backwater Area: Big Sunflower (blue), Deer Creek (red), Steele Bayou (yellow), Auxiliary Channel (pink)

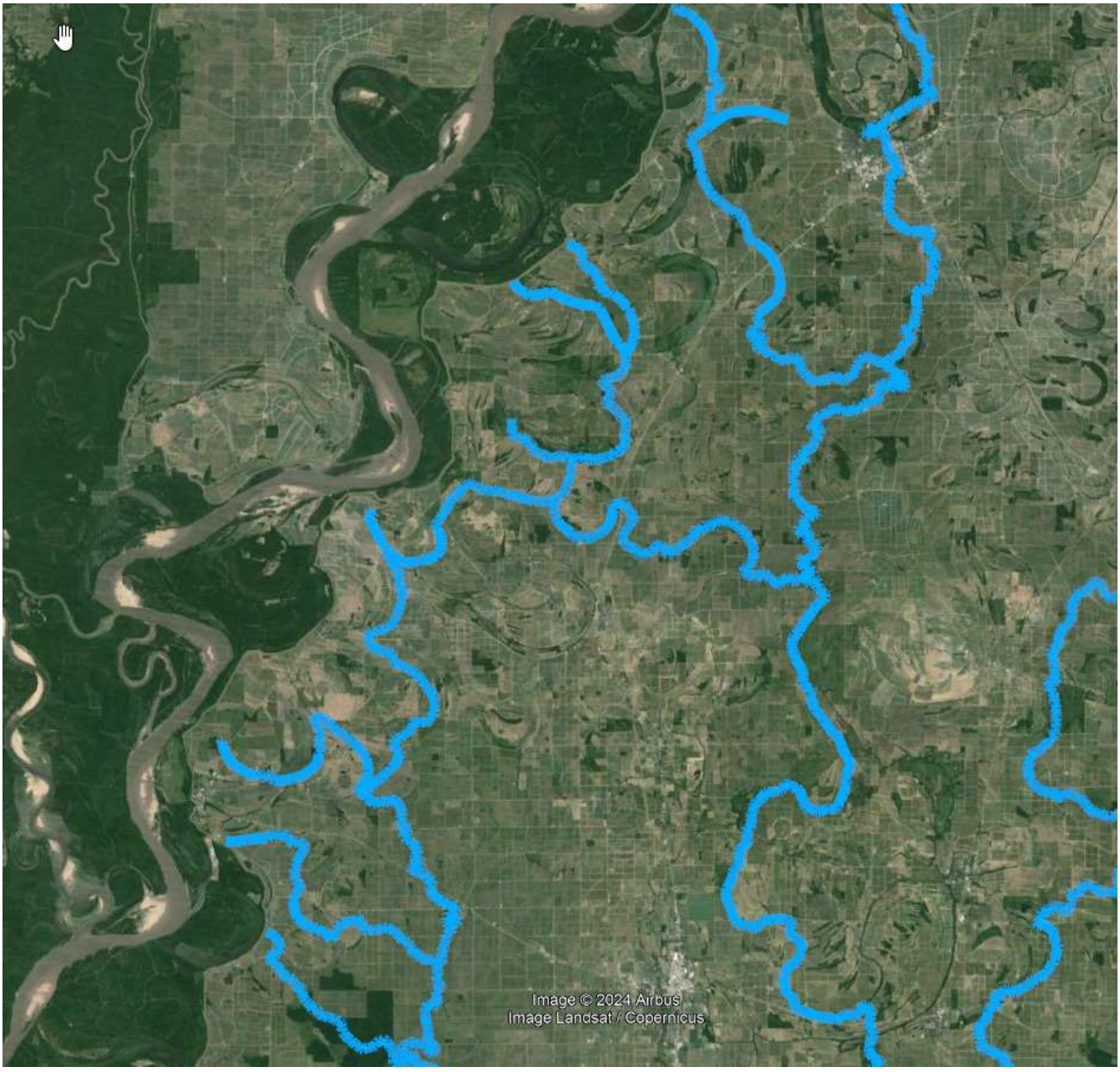

Figure 4. General location of the presented Well Sites within the Big Sunflower Basin

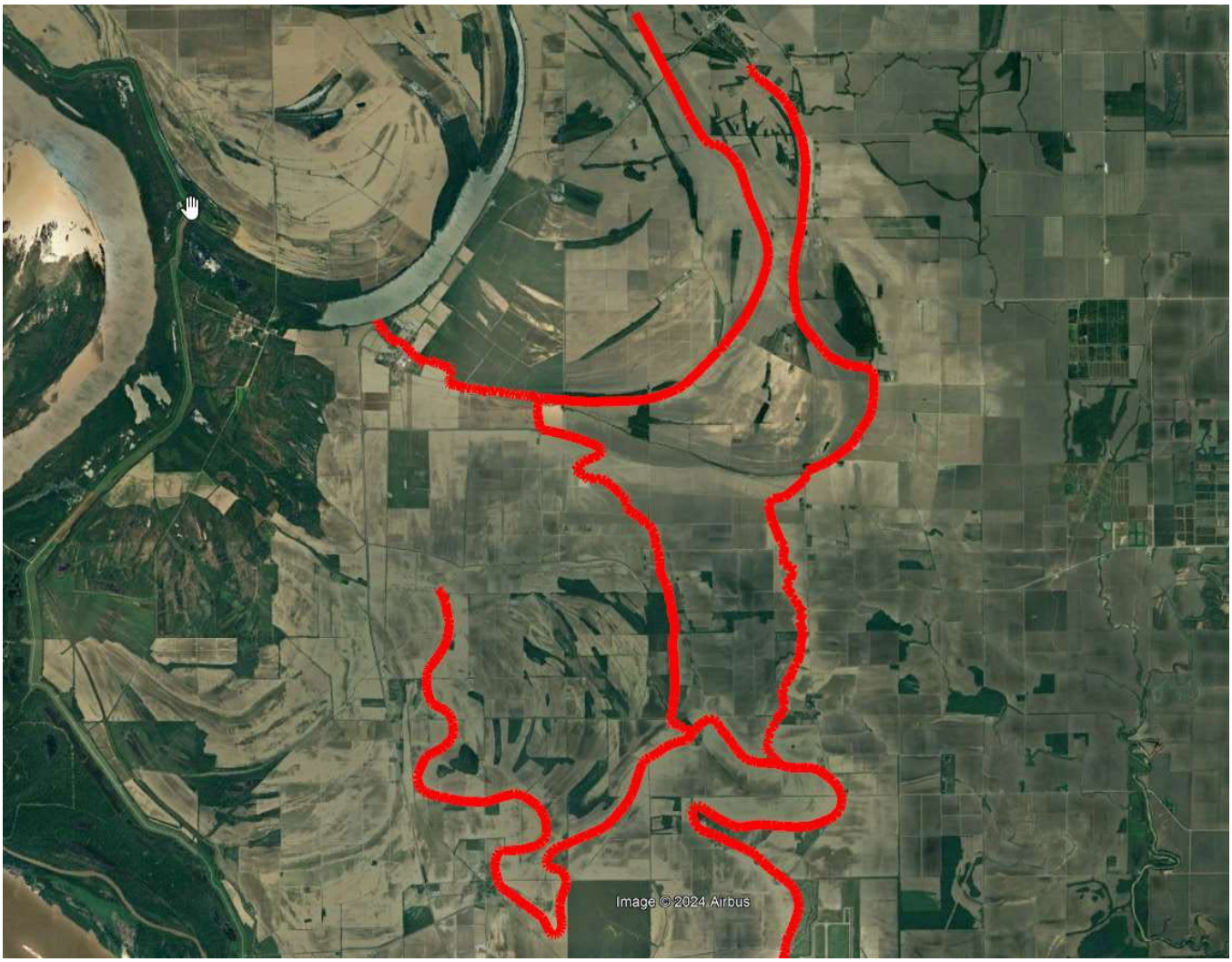

Figure 5. General location of the presented Well Sites within the Upper Deer Creek Basin

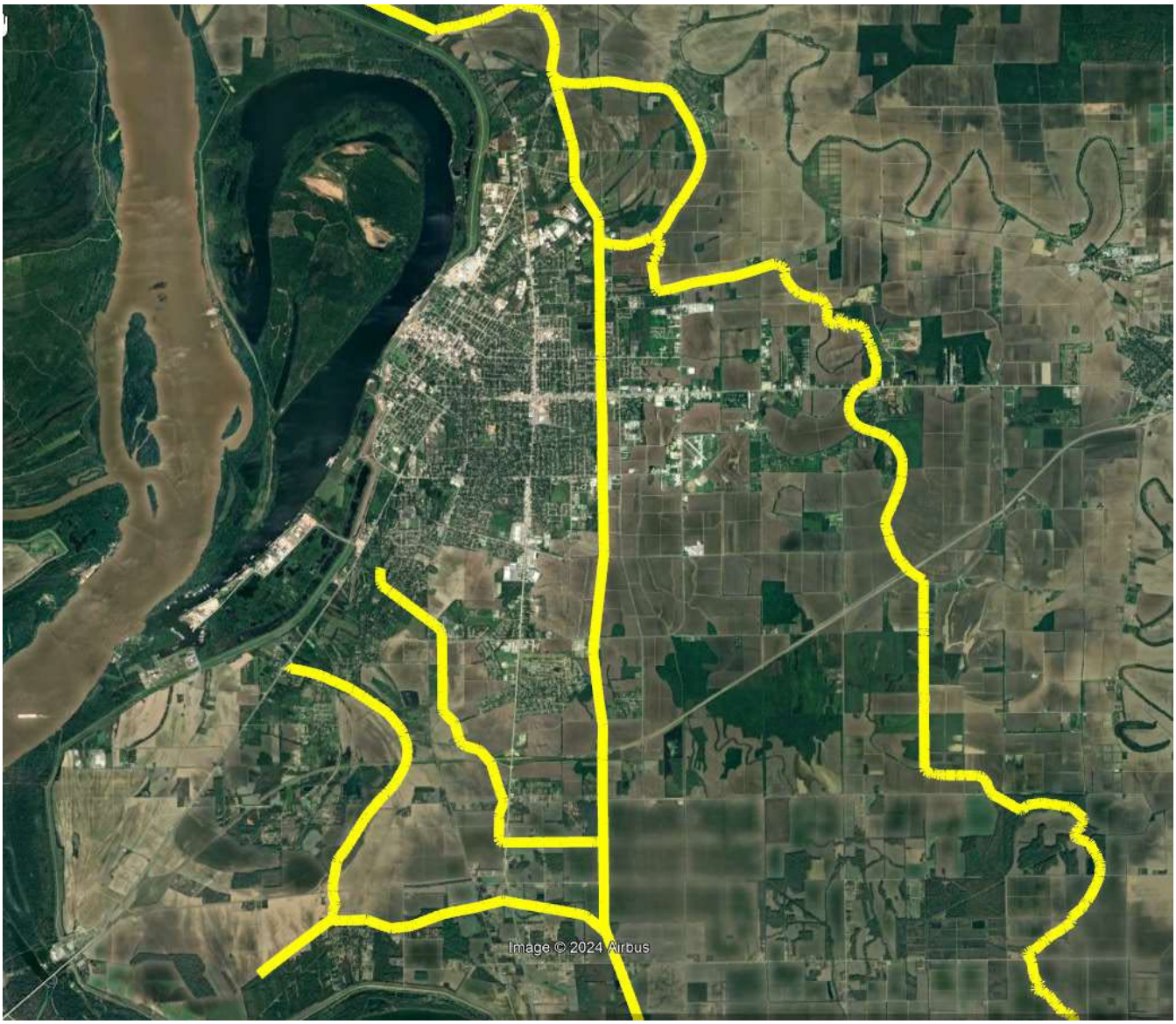

Figure 6. General location of the presented Well Sites within the Steele Bayou Basin

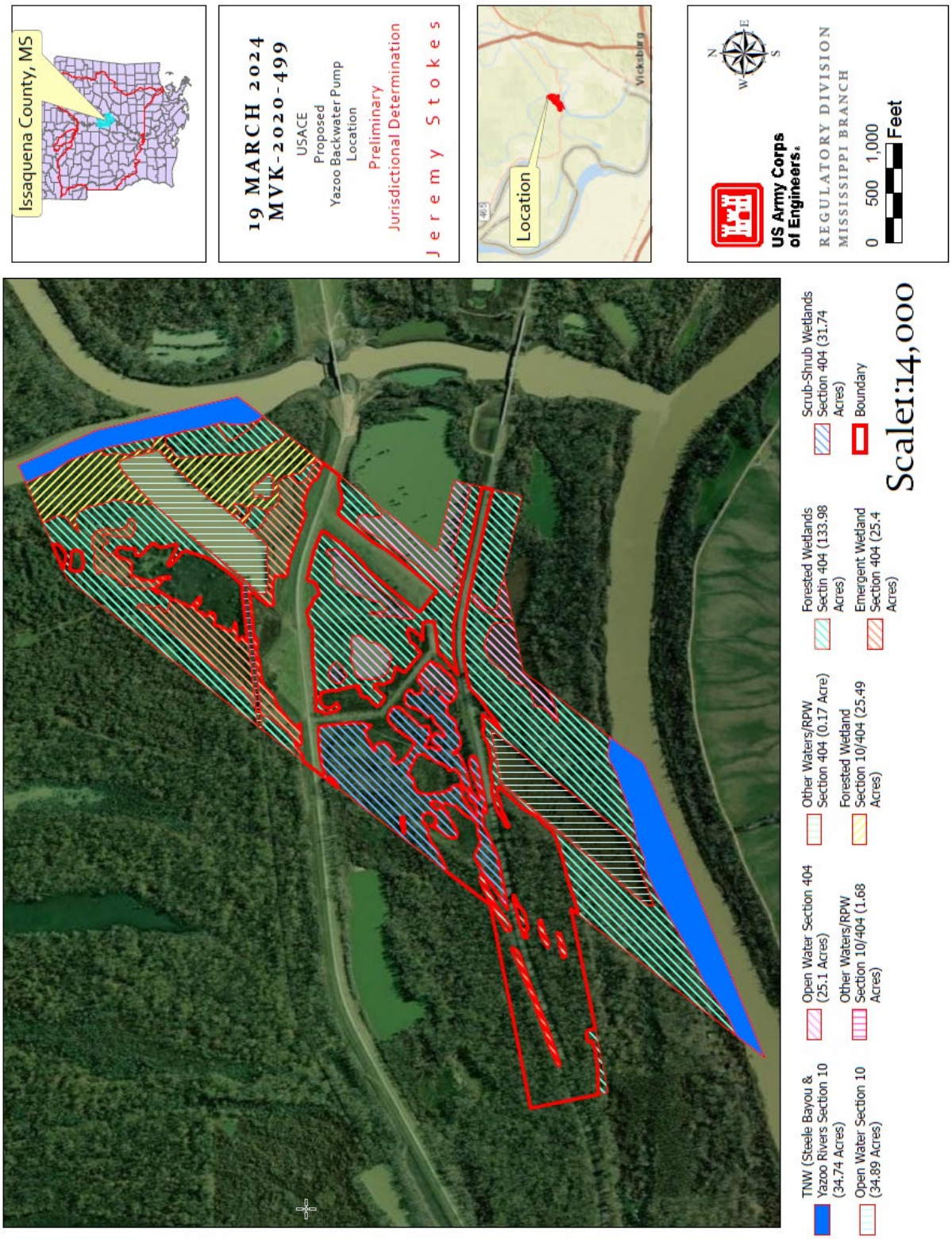

Figure 7. Preliminary Jurisdictional Wetland Determination of Pump Station ROW

Figure 8. Preliminary Jurisdictional Wetland Determination of offsite Borrow Area (At the time of public notice of the DEIS, the offsite borrow area was not a fee title possession by USACE and could not be displayed - Figure 8 was put in place as a place holder.)