Swan Lake Habitat Rehabilitation and Enhancement Project, Flood Damage Assessment Letter Report with Environmental Assessment

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Executive Summary

The Swan Lake Habitat Rehabilitation and Enhancement Project (HREP) is located along the Illinois River just north of its confluence with the Mississippi River in Calhoun County, IL. The design of the original Swan Lake HREP aimed to provide the physical conditions necessary to improve and enhance wetland and aquatic habitat quality for both waterfowl and fish. The HREP project included approximately 4,600 acres of habitat: 2,900-acre Swan Lake, 200-acre Fuller Lake, 950 acres of bottomland forest, and 550 acres of cropland surrounding the lakes. Construction of the HREP project was completed in 2003.

Since the Swan Lake project feasibility report was completed in 1991 (revised edition completed in 1993), there have been an unprecedented number of historic floods occurring in the area. Seven of the top ten historic floods have been measured at the Grafton, IL river gauge which lies directly south of the project area. These floods all occurred since 1993 after the feasibility report was complete. Five have occurred since the project construction was completed in 2003. Most recently, the flood of 2019 was the second highest on record for this area; the highest occurred in 1993 prior to start of project construction. Surveys and site visits at the Swan Lake project area in the fall of 2021 identified significant flood damage impacts, affecting the ability of the area to function as intended. A comprehensive list of flood-related damages can be found in Appendix A of this report. Some of the damages include: multiple breaches in the sediment deflection berm and cross dike, erosion of the berm, and excessive sedimentation to the interior and exterior of the sediment deflection berm.

A US Army Corps of Engineers Project Delivery Team (PDT) was organized to analyze the extent of damages at Swan Lake and determine what repair options may be possible. The PDT evaluated two alternatives for the repair of the Swan Lake HREP: the "No Action Alternative" and the "Repair with Resiliency Alternative." The Recommended Plan for the Swan Lake project is the Repair with Resiliency Alternative. The Repair with Resiliency Alternative is the minimum repair option to ensure habitat stability and allow the project to function as intended for the life of the project. The resiliency design measures only reflect programmatic lessons learned to ensure project success.

The Recommended Plan includes the following repair with resiliency design measures to address flood damages:

- Realign the northern sediment deflection berm tie-in at Fuller Lake
- Place service road on top of berm at Fuller Lake
- Excavate deposited sediment in channels to pump stations and pump bays
- Eliminate the cross dike spillway between Fuller Lake and Middle Swan Lake and the uncontrolled spillway by the Fuller Lake pump station
- Elevate the Lower Swan Lake spillway to an elevation that allows sufficient back flooding capability, approximately one foot below berm height

- Reposition water control structure in cross dike between Fuller Lake and Middle Swan Lake
- Restore the cross dike between Fuller Lake and Middle Swan Lake to as-built conditions
- Regrade exterior sediment deflection berm (where not being realigned) to as built elevations with an interior 1:8 slope for added resiliency
- Repair breaches in exterior sediment deflection berm
- Plant riparian vegetation for added resiliency of the exterior sediment deflection berm

1.0 Project Background

1.1 Original HREP Project:

Swan Lake HREP is located in the upper portion of the Alton Pool (Pool 26) in the Upper Mississippi River System (UMRS), about 5.5 miles north of the confluence between Illinois River miles 5 – 13 (Figure 1). While it is a single project, the area is broken into multiple units as seen in Figure 2. The Lower and Middle Swan Lake units lie within the Two Rivers National Wildlife Refuge (Refuge) which is managed by the US Fish and Wildlife Service (USFWS). Fuller Lake, the northern most unit, lies within the State Fish and Wildlife Area managed by Illinois Department of Natural Resources (IDNR). The project is commonly referred to as "Swan Lake," and it is generally understood that this includes Fuller Lake unless otherwise noted.

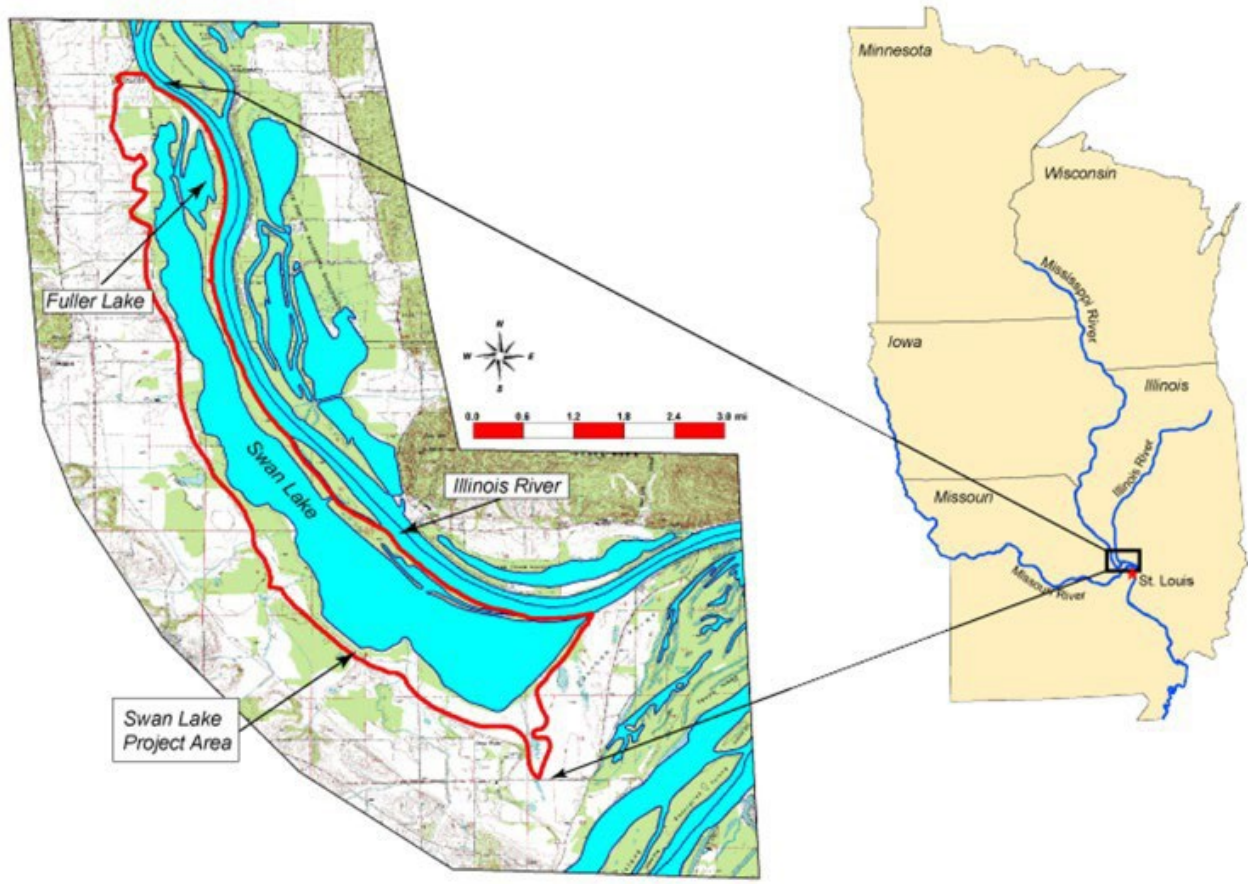

Figure 1. Location of Swan Lake HREP

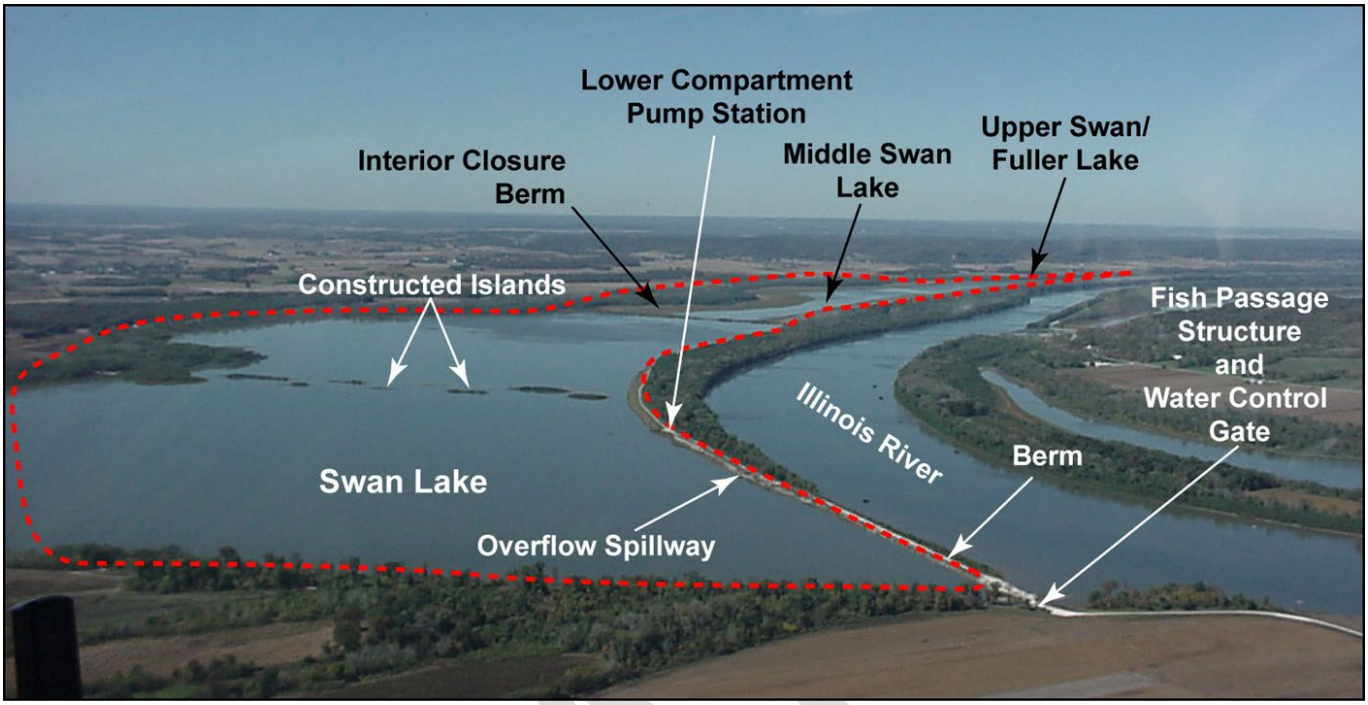

Figure 2. Swan Lake Compartments and Features

The Swan Lake HREP project includes approximately 4,600 acres of habitat: 2,900-acre Swan Lake, 200-acre Fuller Lake, 950 acres of bottomland forest, and 550 acres of cropland surrounding the lakes. The project was designed to alleviate sedimentation and -improve aquatic over-wintering, spawning, and rearing habitat for fish and waterfowl. The Swan Lake project area along with Calhoun Point and Stump Lake account for approximately 25% of the deep-water wetland habitat on the lower 80 miles of the Illinois River. The Swan Lake project consisted of a riverside sediment deflection berm to retard river sedimentation (sediment deflection berm) (Figure 3); an interior lake closure to subdivide the lake (cross dikes); water and sediment control structures to trap upland watershed sediment (sediment detention basins); island groups to reduce turbidity levels caused by wind generated wave action in Middle and Lower Swan Lake (Figure 4); Corrugated Metal Pipe (CMP) gated structure between the Middle and Lower Swan Lake; pumping capability, water control structures in the cross dikes and exterior berm, and boat access in Lower Swan and Fuller Lakes.

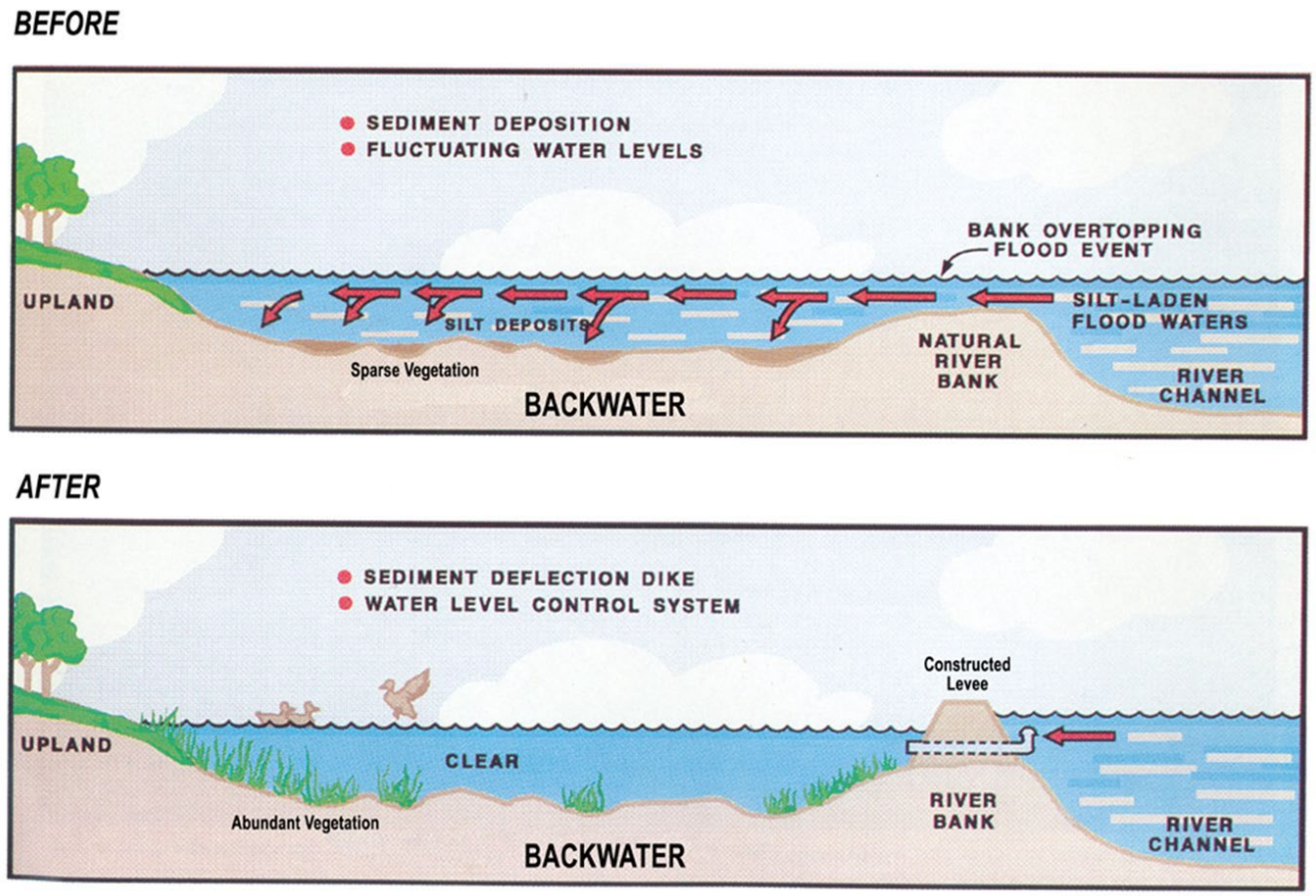

Figure 3. Sediment Deflection Berm and Water Control Systems (USACE 2003)

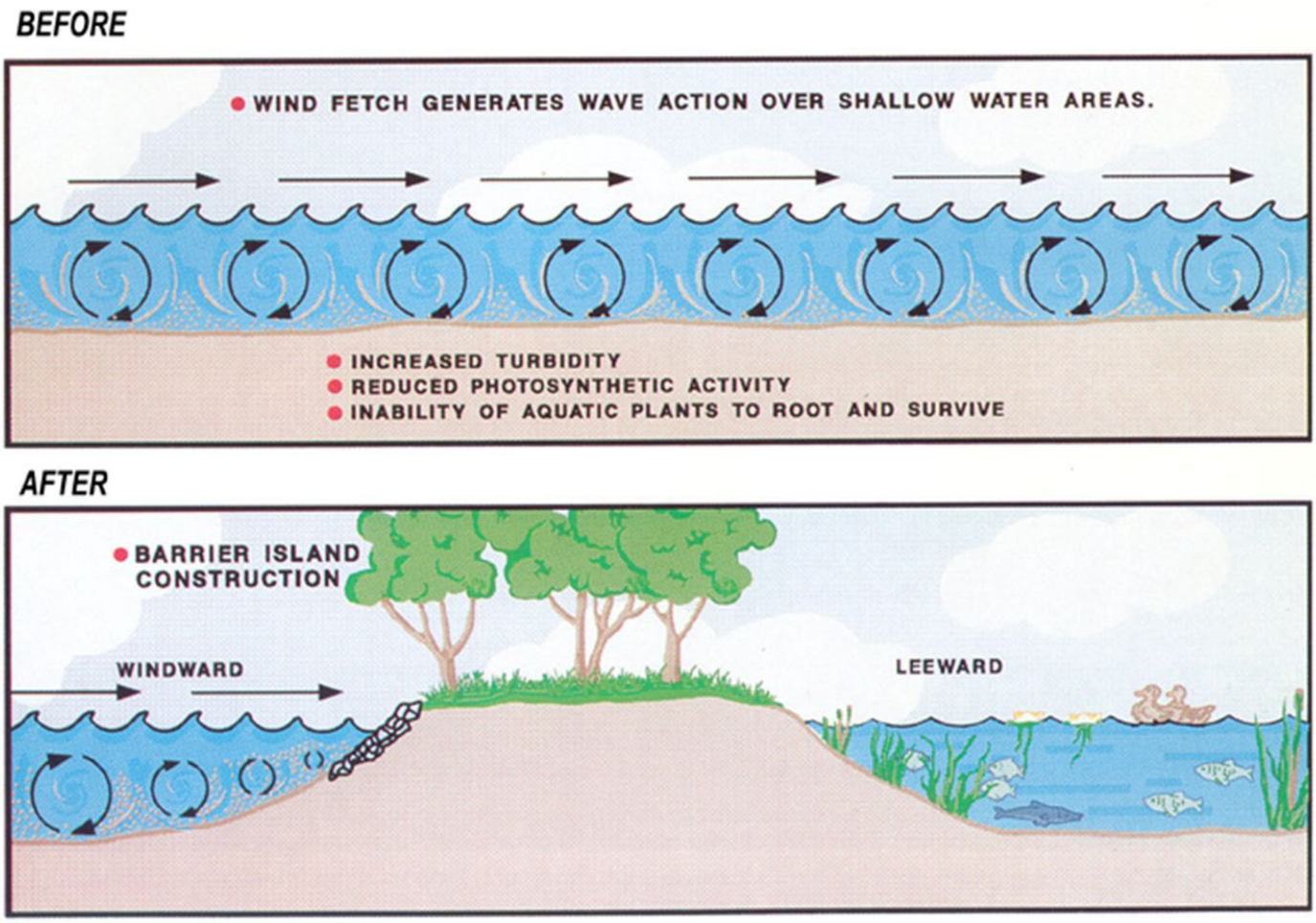

Figure 4. Islands Created to Reduce Wind Fetch and Turbidity (USACE 2003)

The objectives for the project included providing aquatic plant (macrophyte) beds suitable for a variety of invertebrates which are a food source for migratory waterfowl, and to provide adequate habitat for over-wintering, spawning, and rearing for slackwater fishes.

The Swan/Fuller Lake project was designed to provide the physical conditions necessary for creating a wide spectrum of strategies for waterfowl and fisheries management. Sedimentation, lack of water level management, and wind fetch at the site contributed to the direct loss of fish and wildlife habitat and a decrease in fish and wildlife habitat quality. As stated in the Definite Project Report, the Swan Lake HREP was undertaken to address these three primary problems.

1.2 Purposes of Swan Lake HREP Flood Damage Assessment:

The purposes of the Swan Lake Flood Damage Assessment (FDA) are as follows:

1. Document the flood damages to the project

2. Categorize and prioritize the repairs needed to obtain original intended performance
3. Evaluate repair options for resiliency and effectiveness
4. Coordinate with additional ecosystem restoration projects within the immediate vicinity of Swan Lake to avoid negative impacts
5. Review engineering performance criteria to aid in design of future projects

1.3 Authority:

The Upper Mississippi River Restoration (UMRR) Program was authorized in the Water Resources Development Act (WRDA) of 1986 (P.L. 99-662), Section 1103, the Upper Mississippi River Plan. Section 1103(e) of WRDA 1986 outlines the following undertakings:

A. a program for the planning, constructing, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement (UMRR-HREP),
B. implementation of long-term resource monitoring program (LTRM), and
C. implementation of a computerized inventory and analysis system.

The original authorizing legislation has been amended several times since its enactment. In accordance with the 1992 WRDA, the sole responsibility for Operation and Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) of habitat projects is assigned to the Federal, State, or local agency owner that is responsible for management activities for fish and wildlife on project lands. Any major rehabilitation resulting from major storm or flood events remains the responsibility of the Department of the Army (DOA).

The Memorandum of Agreement (MOA) signed between the USFWS and the DOA for the Swan Lake HREP included the following language related to Department of the Army responsibility:

Section IV: Responsibilities

A. DOA is responsible for:
    2. Major Rehabilitation. The Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operations and maintenance identified in the definite project report and that is needed as a result of a specific storm or flood events.

1.4 Historic High-Water Events:

Since the Swan/Fuller Lake project was completed in 2003, there have been an unprecedented number of historic floods occurring in the area. The United States Geological Survey (USGS) has recorded peak measurements at the Grafton gauge since 1844. In the subsequent 178 years, seven of the top ten historic floods have occurred post project planning and design, as seen in Table 1. Five of those floods have occurred since the project construction was completed in 2003. The plan report was finalized in 1991, two years before the top historic flood in the area

which occurred in 1993. The second highest flood event in this area occurred in 2019 and resulted in numerous damages which are a primary focus of this report and the recommendation. A comprehensive list of flood-related damages can be found in Appendix A. Damages to be addressed by the FDA project include: multiple breaches in the sediment deflection berm and cross dike, erosion of the berm, and excessive sedimentation interior and exterior of the sediment deflection berm. Consequently, the impacts to the project have been significant, detrimental, and impacted the project's ability to function as intended.

Table 1. Mississippi River Historic Flood Categories (National Weather Service)

Mississippi River Historic Flood Categories (in feet) at the Grafton Gauge (RM 218)		
Major Flood Stage		29
Moderate Flood Stage		24
Flood Stage		20
Action Stage		18
Historic Crest (in order of rank)	**Crest Level (in feet)**	**Date of Occurrence**
1	38.17	08/01/1993
2	35.17	06/17/2019
3	33.12	4/28/1973
4	32.13	06/18/1844
5	32.10	05/07/2019
6	30.94	06/04/2013
7	30.91	12/31/2015
8	30.80	06/29/2008
9	30.70	06/15/1858
10	30.40	05/29/1995

* 2008, 2013, 2015, 2019, 2019 – floods occurring post construction

1.5 History of Repairs:

OMRR&R of the Swan Lake HREP is the responsibility of the USFWS and the IDNR. These functions are further defined in the OMRR&R Manual (U.S. Army Corps of Engineers, 2014). The project features were designed and constructed to minimize the OMRR&R requirements. Project OMRR&R generally consisted of the following:

- Mowing and other maintenance of the perimeter and interior berms to ensure integrity during flood events. Other berm maintenance activities include grading and repairing minor erosion on dikes, maintaining the gravel road on top of the riverside dike, removing flood debris, herbicide applications, burrowing animal control, reseeding, fertilizing, etc.
- Operation, repair, and maintenance of the pump stations and water control structures to achieve desired water levels, fish passage, sediment control, etc. during all seasons.

- Inspections conducted in conjunction with USACE personnel semi-annually through adaptive management processes.
- Emergency operations during flood conditions.

The following OMRR&R activities have occurred at the sponsors expense since the last Project Evaluation Report in 2010 (the 2010 report indicated the operations and maintenance [O&M] manual was still in development, however operation and maintenance by the sponsor has been conducted in accordance with the project goals and objectives):

- Gear bearing for the belt drive pump at Lower Swan Lake replaced in 2010 and again in 2016 at an average cost of $17,000 per repair.
- The interior berm separating Middle and Lower Swan Lake cut open to allow better drainage and water level management in Middle Swan Lake in response to flood-related damage.
- The Lower Swan spillway required frequent repairs due to flood damage.
- Routinely added rock to the sediment deflection berm due to erosion and reshaping/repair of washouts (2-3 feet in depth).
- Routine mechanical excavation of material around pump with excavator.
- Mowing of sediment deflection berm and invasive species control.
- Addition of articulated concrete matting to spillway at Lower Swan Lake.
- Repair of repeated breeches to sediment deflection berm including those from 2019.
- Annual sediment removal from road at Fuller Lake to access project area.
- Excavate lake access channel – every 10 years (last completed in 2021- major sediment load from 2019 flood).
- Repair of the Fuller Lake pump station (approximately 2005). Currently in the Sponsor's queue for additional repairs – estimated repair cost $28,000.

1.6 Site Visits:

A team of personnel from US Army Corps of Engineers (USACE), USFWS, and IDNR visited the site to evaluate the flood damages and take a holistic approach to repairing the system with resiliency to enable it to function as intended. The first site visit was conducted in October 2021 with a follow up site visit in December 2021. During the October 2021 site visit, the team viewed the damages at Lower and Middle Swan Lake. They accessed the southern end of Fuller Lake by the cross dike and pump station, but road conditions prevented access to the majority of the berm along Fuller Lake. The second site visit predominantly focused on viewing the cross dike between Middle Swan and Fuller Lake, as well as multiple breaches on the berm near the tie into higher elevation at Fuller Lake. Figure 5 below shows approximate locations of the major problems noted at those site visits. These are the problems recommended to be

addressed with the Repair with Resiliency Alternative. A comprehensive list of all the problems observed can be found in Appendix A.

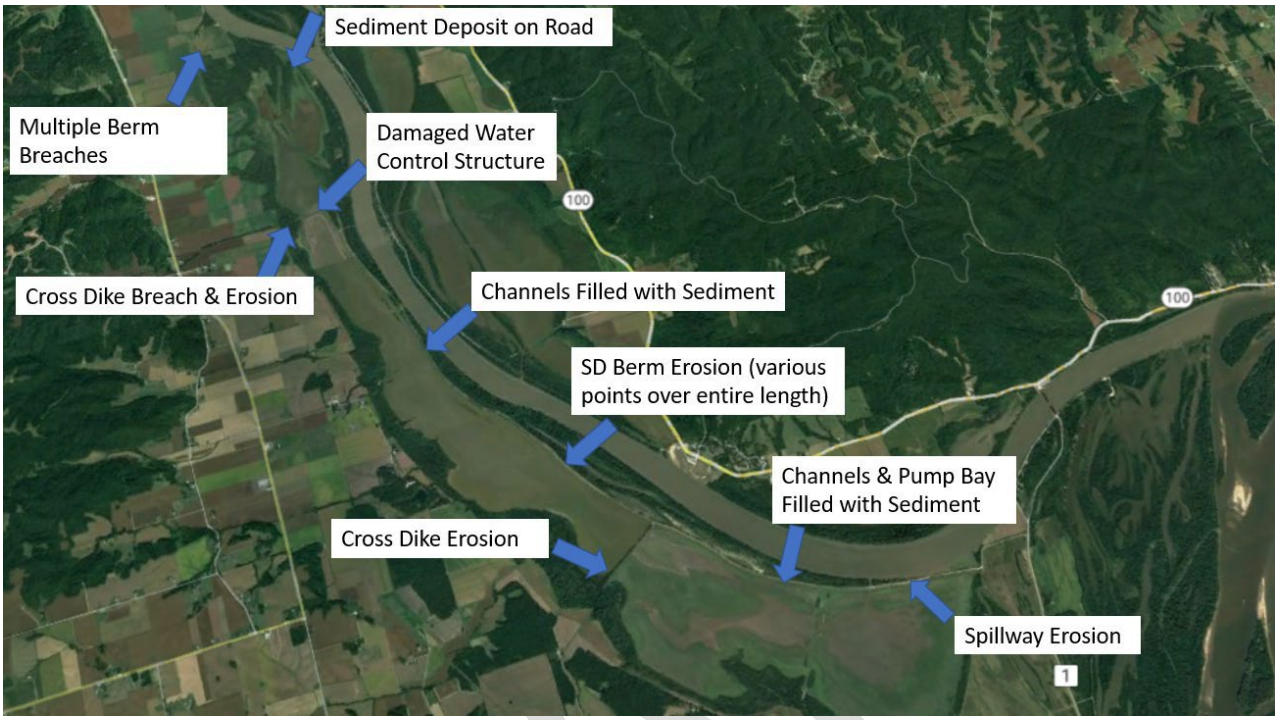

Figure 5. Issues Affecting Swan Lake Functionality

The team developed a comprehensive list of all the problems, damages, and functionality issues within Swan Lake. Once developed, the team reviewed and determined which of the damages could be attributed to specific flood events, exceeding normal operations and maintenance and rated them in terms of priority in need of repair. The team also coordinated with the team members of the UMRR practitioners and programmatic documentation of HREP Lessons Learned and Yorkinut HREP projects, as both teams had valuable information pertinent to the Swan Lake FDA project. The potential changes to the area associated with the Yorkinut HREP would not affect the viability of the changes proposed for this FDA and vice versa. A summary of lessons learned, as it relates to the Swan Lake FDA project, can be found in Appendix G. Regarding the comprehensive list of problems, each team identified which issues potentially fell under their purview and had the possibility to be addressed to determine project overlaps and impacts. Subsequently, the Swan Lake FDA team created a list of measures (a feature or an activity that can be implemented at specific geographic site(s)) to address the problems identified and determined which repairs might have ancillary benefits to address multiple issues as shown in Appendix A.

2.0 Existing Conditions

2.1 Damage Results:

Frequent historic high-water events have led to the following problems:

-
- Repeated sediment deflection berm breaches
- Repeated sediment deflection berm soil and riprap erosion
- Excessive island erosion
- Cross dike breaches
- Excessive sedimentation creating additional wear and tear in pumps leading to premature equipment failures
- Excessive sedimentation of channels leading up to the pump stations

Figures 6 -13 show examples of flood damages at Swan Lake.

Figure 6: 2019 Flooding at Two Rivers NWR (Photo courtesy of: www.riverbender.com)

Figure 7: Island Erosion at Lower (left- 2013) and Middle (right- 2021) Swan Lake

Figure 8: Examples of Erosion and Riprap Movement (left) and Sedimentation of Interior of Water Control Structure (right) (2020)

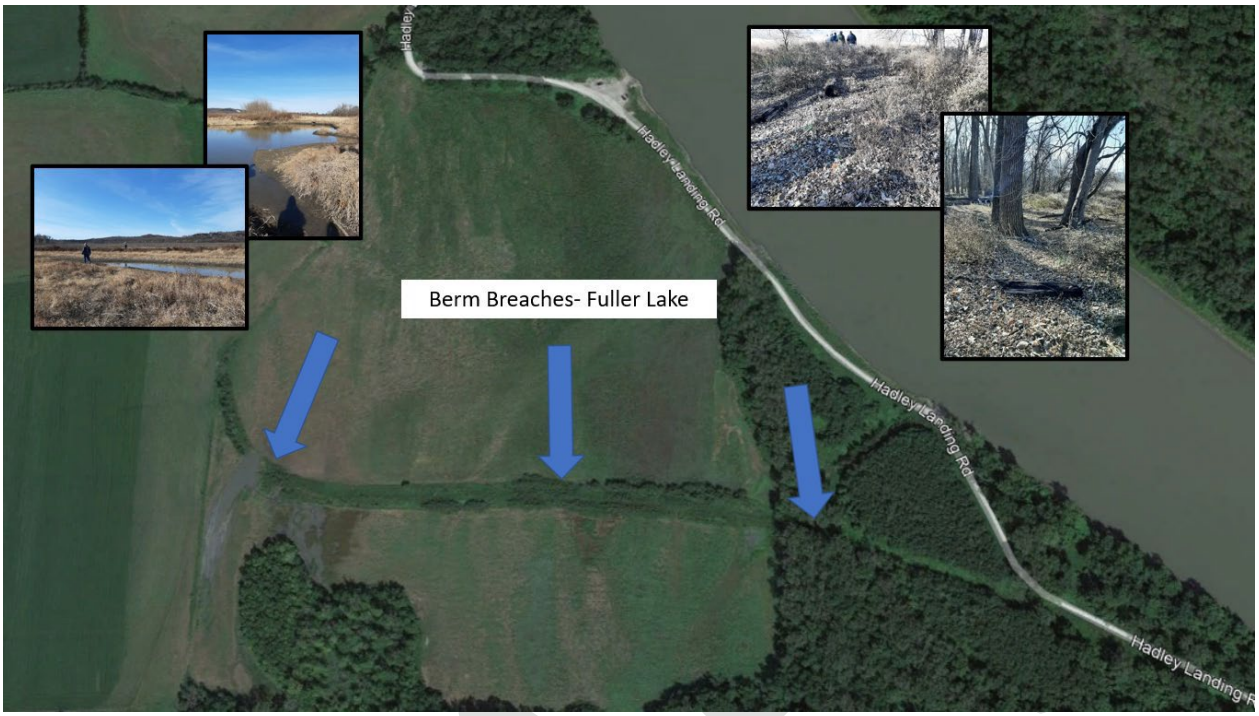

Figure 9: Approximate Locations of Fuller Lake Sediment Deflection Berm Breaches (Post 2019 Flood)

Figure 10: Approximate Location and Ground Level View of Excessive Sedimentation at Fuller Lake

Figure 11: Lower Swan Channel Sedimentation (post 2019 flood- photos provided by USFWS)

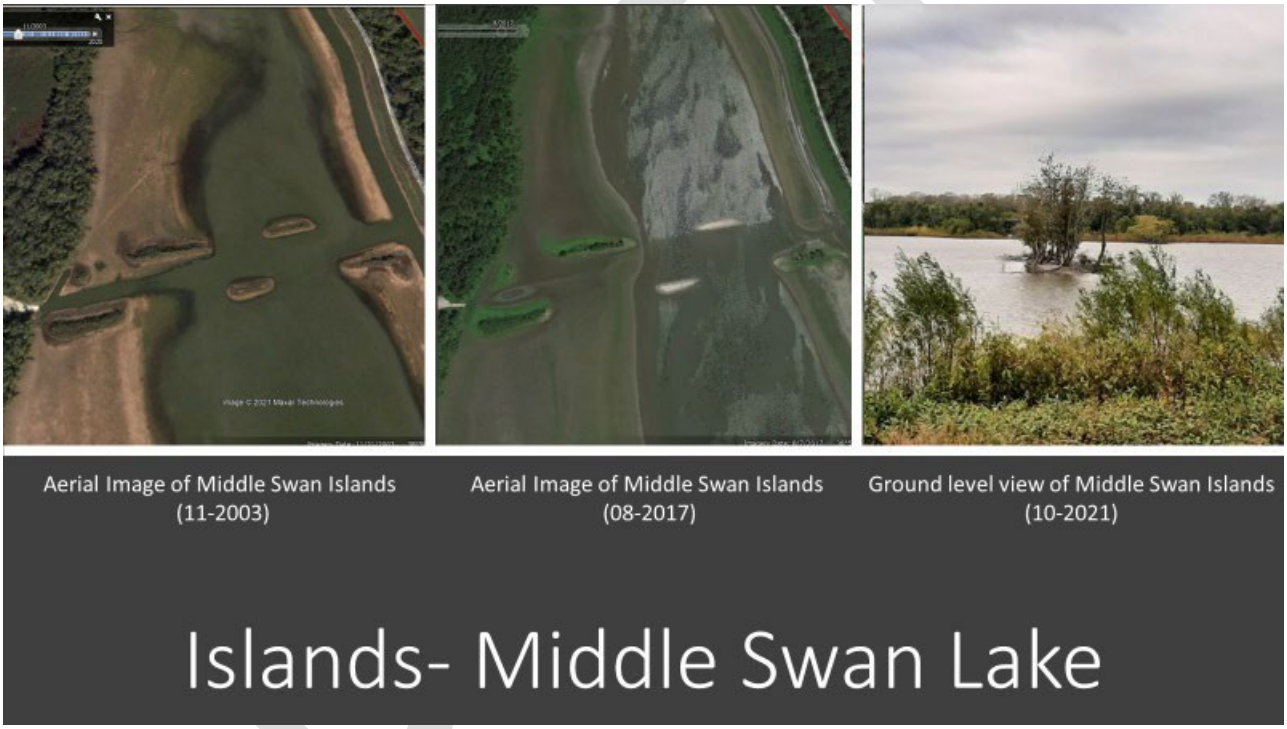

Figure 12: Island Erosion at Middle Swan Lake

Figure 13: Island Erosion at Lower Swan Lake

2.2 Hydraulics & Hydrology:

Hydraulic modeling was performed using HEC-RAS version 6.2 software to evaluate the repair alternative. Data from the model was reviewed to demonstrate the hydraulic performance, specifically the potential for impacts to water surface elevations and scour, for each measure. A summary of the results is given below, with additional details provided in Appendix E: Hydraulics and Hydrology.

Throughout this and all subsequent sections, flood and precipitation events and their resultant inundation will be referred to by Annual Exceedance Probability (AEP), which is the probability that a storm or level of flooding may be realized or exceeded in any given year. For example, a flood event with a 1% AEP would have a 1% probability of occurring every year. This is a change in terminology from the recent commonly used industry term “annual chance of exceedance” (ACE). Historically, flood events have also commonly been described by their “return period” – or the estimated average length of time between flood events of a similar magnitude. A 1% AEP event would have a 100-year return period or be referred to as a 100-year event. This terminology is obsolete because it incorrectly conveys a sense of time and lowers public risk perceptions. Table 2 provides a list of AEP flooding events considered during the study with their equivalent return period. It is important to note that AEP can be used to describe both expected water levels from flood events as well as anticipated precipitation amounts from meteorological events. Additionally, a 1% flood event is not the same as and does not necessarily occur as a result of a 1% storm event. References to AEP events will specify the type of event.

Table 2: Comparison of AEP, ACE, and Return Period Terminology

AEP/ACE	Return Period*
20%	5-year
10%	10-year
4%	25-year
2%	50-year
1%	100-year
0.5%	200-year
0.2%	500-year
0.1%	1000-year
*Note: Return Period is a term that can be misleading, is often misunderstood, and is no longer used by USACE (see ER 1110-2-1450).	

The frequency of overtopping was determined by plotting the berm elevation against flood elevations. Fuller Lake and Swan Lake both have locations that are currently below the 50% AEP flood event level. Additionally, the vast majority of the sedimentation deflection berm is below the 20% AEP flood event level. The proposed berm realignment and restoration to as-built elevations result in the Fuller Lake portion of the berm being above the 20% AEP flood event level, specifically at a 16% AEP level, and the spillway on Lower Swan being between the 50% AEP and 20% AEP flood event levels, specifically at a 34% AEP level. Figure 14 shows plots of the berm elevation against flood elevations.

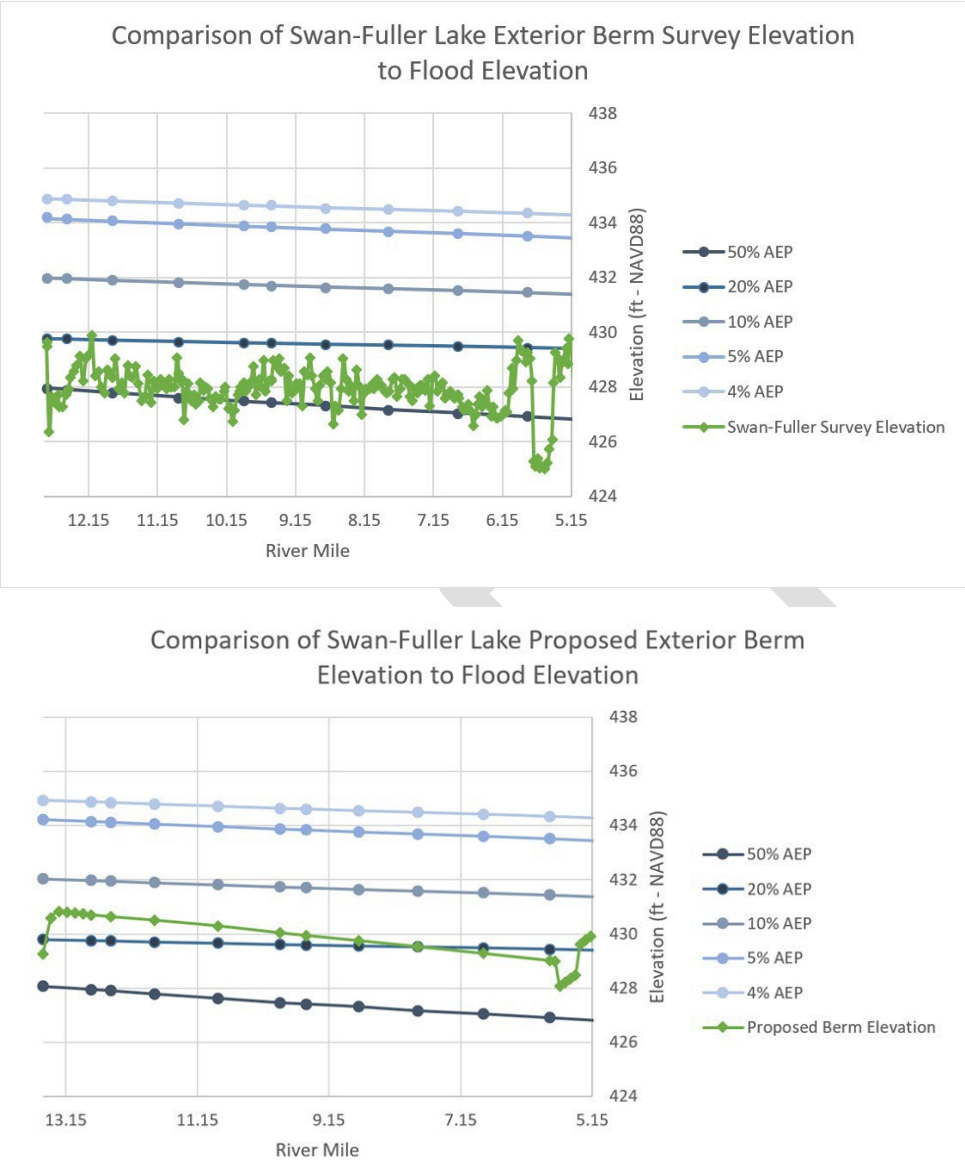

Figure 14: Comparison of Exterior Berm Elevation to Flood Elevation

A no-rise analysis was performed on the repair with resiliency alternative and concluded that there is no rise in the water surface elevation for the 1% AEP flood event. Modeling of the entire Fuller Lake and Swan Lake system was undertaken to evaluate cross dike elevations and varying drainage scenarios. The modeling indicated that a water control structure connecting Fuller Lake to the Illinois River allows for better control of the water levels within Fuller Lake. Greater control of the water level reduces the impacts of Fuller Lake to Swan Lake by reducing the likelihood of the cross dike overtopping compared to no water control structure. Modeling analysis also concluded that restoration of the cross dike to as-built conditions would suffice to achieve the desired operational water levels.

A subsequent model was created to evaluate water velocities along the sediment deflection berm in order to identify locations that may experience elevated velocities. Higher velocities can indicate areas where scour is more likely. Such areas may require mitigation such as armoring, shallower slopes, or a vegetation buffer. Two portions of the berm were identified as having higher velocities than the surrounding areas and are shown in Figure 15. The western portion of the existing berm alignment experiences water channeling between the backside of the berm and the high ground to the west. Elevated velocities also occur due to water channeling down the clearing in the trees caused by the existing roadway to the east. Elevated velocities caused by the road clearing can be mitigated by planting trees in this area once the road has been relocated on top of the berm.

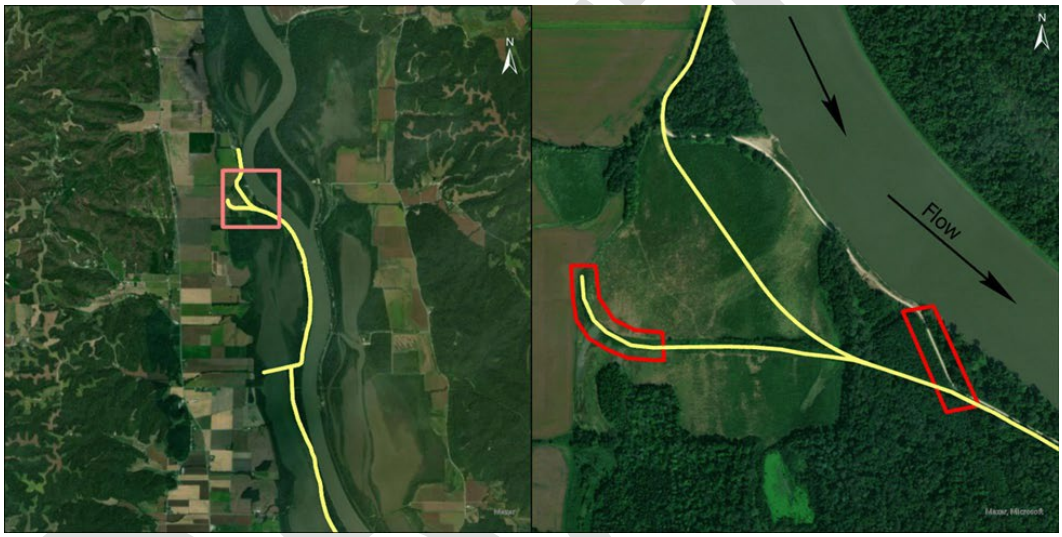

Figure 15: Locations of Elevated Velocities- Fuller Lake

2.3 Environmental: Existing and Future Without Project Conditions:

Since the construction of the Swan Lake HREP in 2003, the management of Swan Lake includes activities that promote waterfowl habitat. Water level management is focused on structured timing of water level changes in Swan Lake and Fuller Lake based on their respective management goals: Fuller Lake is managed by IDNR with its primary focus on public waterfowl hunting opportunities with water levels increasing in the fall and held throughout the hunting season to allow hunter access to duck blind locations. Swan Lake is managed by USFWS as a waterfowl refuge, to include feeding and resting habitat for migrating waterfowl. To accomplish this, the USFWS's objective is to time a mid-to-late summer drawdown in Swan Lake for food production; then a slower, incremental filling of Swan Lake over the course of the migration

season to provide increasing areas of freshly inundated vegetation and food resources for feeding and resting.

The repeated flood damages and existing conditions at Swan Lake makes managing water levels an extremely difficult and inefficient task. When precipitation or river flood events happen, site managers are unable to maintain their water level management goals due to the inefficiency of the system. In some years, they are unable to de-water the area in order to produce enough food for migrating waterfowl because of these events. In other years after good vegetative growth has been established, they are unable to move water off the lake after a precipitation or even minor flood event in a timely manner, so as to avoid drowning out the emergent vegetation.

Sedimentation in the system is another factor that precludes efficient water level management. The many breaches and inadequacies in the sediment deflection berm coupled with upland runoff is causing the inlet channels that feed the water control structures to fill in with sediment and prevent proper and efficient drainage. Sediment deposition will lead to a direct loss of emergent habitat acreage over time. Sediment also contributes to a soft lake bottom, inconducive to plant anchorage, and contributes to high turbidity levels when agitated by wind generated waves. This increased turbidity results in reduced light penetration into the water column, causing reduced photosynthetic activity, and subsequent reduction in plant productivity. Lost plant production results in poor food resource quality and quantity.

The sedimentation and inefficient ability to actively manage water levels over time is also actively leading to a vegetative community shift in the form of willow bars and early successional forests on sediment islands that are displacing acreage of emergent vegetation and waterfowl food resources. This necessitates excavation of material in these areas so that water levels can be adequately and accurately manipulated in accordance with the management goals and objectives of the respective resource agencies for both Fuller and Swan Lake.

The significant flooding impacts have put Swan Lake on a downward trajectory towards inoperability in the future. The additional sedimentation and breaches in the sediment deflection berm will render water level management entirely ineffective, and subject to the flood and precipitation events without the ability to apply mitigative measures by resource agencies. USFWS and IDNR will continue their current approach to keep the project semi-functional as their means and budget allow, but the benefits originally projected from the initial HREP will not come to fruition, causing increased burden on waterfowl seeking refuge throughout their extensive migration.

Swan Lake is an important stopping point for resting, feeding, and wintering areas to birds migrating along the Mississippi Flyway. Several hundred different species of birds travel through this important river confluence on their migration, including over 5,000,000 ducks and 50,000 geese. Swan Lake also holds more than 600 wintering Bald Eagles, which arrive to the

region in October and depart by March (National Audubon Society, 2008). This site was also chosen as an Important Bird Area by the Audubon Society for the critical role it plays in waterfowl habitat. In order to provide vital refuge to these migrating birds, intervention must take place to address the flood damages sustained and restore Swan Lake to the functional ability that was constructed in the original HREP. No action would mean that habitat value in the project area would continue to deteriorate in quantity and quality. With less available habitat providing refuge, more waterfowl would be forced to stop over in less accommodating areas near the confluence, which are heavily hunted. This would lead to an overall adverse impact on migrating waterfowl looking for food and rest.

3.0 Alternatives:

The PDT evaluated two alternatives for the repair of the Swan Lake HREP: the No Action Alternative and the Repair with Resiliency Alternative. A comprehensive list of all damages and subsequent consequent effects was compiled; however, given the constraints of the assessment, it was determined repair of the berm was the most critical. Without addressing the berm issue the other repairs would have been inconsequential and subject to the same repeat flood-related issues. Other repair options were initially discussed by the PDT but were dismissed for critical deficiencies related to lack of efficiency or effectiveness. Repairing the existing berm to the original footprint and profile was also dismissed early and not fully evaluated as it has historically been proved as a stopgap approach and subject to repetitive high water event consequences. Additionally, several alignments were evaluated for overall benefit and minimal negative impacts. Two other alignments, while more sinuous with the river would have negatively impacted more trees and required adding additional culverts and roadwork with no real additional benefit when compared to the alignment recommended. While the sponsors had additional requests for repairs (see Appendix A), it was ultimately decided by the PDT that the repair of these items was not a priority in terms of contributing to the restoration of functionality to the project. The Repair with Resiliency Alternative evaluated in this report is considered the minimum repair option considered in this analysis that would ensure habitat stability for the life of the project. The resiliency design measures only reflect lessons learned (see Appendix G) to ensure project success; removing them from the repair design would potentially result in similar damages currently observed.

3.1 No Action Alternative:

This alternative would result in no correctional repairs at the Swan Lake HREP. The sediment deflection berm, Fuller/Middle Lake cross dike, spillways, and channels to the pump station would not be repaired. The no action alternative would result in continued decline of the HREP. Without repair and realignment of the exterior sediment deflection berm, breaches would continue to grow and the ability of USFWS and INDR to effectively manipulate water levels would continue to decline reducing the benefits provided to wildlife. The government's investment in the Swan Lake HREP would be significantly compromised. The project was designed to create quality habitat at Swan Lake. However, without the resilient repairs and

corrective actions associated with the Repair with Resiliency Alternative, the areas would continue to deteriorate, and the habitat features dependent on them would also continue to degrade.

3.2 Repair with Resiliency Alternative:

The Repair with Resiliency Alternative would consist of several measures throughout the entire project area to allow for continued habitat benefits from the designed HREP. To ensure long-term stability of the repairs, resiliency design modifications from the original HREP design would be included. Resiliency modifications are slight alterations in the original design of the project that reflect lessons learned in the original construction and which would enable stability throughout the project lifecycle.

The Recommended Plan includes the following repair with resiliency design measures to address flood damages:

- Realign the northern sediment deflection berm tie-in at Fuller Lake
- Place service road on top of berm at Fuller Lake
- Excavate deposited sediment in channels to pump stations and pump bays
- Eliminate the cross dike spillway between Fuller Lake and Middle Swan Lake and the uncontrolled spillway by the Fuller Lake pump station
- Elevate the Lower Swan Lake spillway to an elevation that allows sufficient back flooding capability, approximately one foot below berm height
- Reposition water control structure in cross dike between Fuller Lake and Middle Swan Lake
- Restore the cross dike between Fuller Lake and Middle Swan Lake to as-built conditions
- Regrade exterior sediment deflection berm (where not being realigned) to as built elevations with an interior 1:8 slope for added resiliency
- Repair breaches in exterior sediment deflection berm
- Plant riparian vegetation for added resiliency of the exterior sediment deflection berm

3.3 Repair with Resiliency:

The following design changes from the original Swan Lake HREP design would be added to ensure resiliency of repairs and the project as a whole. The design changes identified recognize the repairs proposed are on features damaged by significant high-water events. As such, the design changes reflect (1) lessons learned and (2) adjustments to address expected sediment deposition.

- **Seeding and vegetation establishment** - Vegetative and forest plantings on the exterior of the sediment deflection berm provide resiliency to the berm by

slowing the flood waters, thereby reducing the negative impacts to the sediment deflection berm.

- **Realignment of sediment deflection berm at Fuller Lake -** A more parallel alignment with the river promotes a more efficient pathway for water to flow along the face of the berm during high water events, minimizing scour risk of a berm section that is perpendicular to and directly exposed to Illinois River flows. USFWS and IDNR personnel have observed locally higher water levels and overtopping scour on multiple occasions at this section of the existing alignment.
- **1V:8H Interior slope on sediment deflection berm -** Gradual interior side slopes will better match natural slopes and reduce scour from flood events.
- **Placement of the road on top of the sediment deflection berm –** Sedimentation typically occurs more rapidly in low-lying areas; elevating the road reduces the opportunity for excessive sediment deposition on top of road, vs. existing, low-lying service access roads.

3.4 Cost Analysis

The Planning Level Cost Estimate (Table 3) is as follows for the Swan Lake FDA Project with the documented assumptions below. The approximate total cost of the project is **$9,458,000** in 2023 dollars. The No Action Alternative would have zero cost associated.

Table 3: Planning Level Cost Estimate for Swan Lake Repair with Resiliency Alternative

ITEM	ESTIMATED AMOUNT
Mobilization and Demobilization	$ 450,000
Gravel, Roadway 6"	$ 490,000
Seeding	$ 546,000
Trees (109 stems/acre)	$ 164,000
Tree Removal	$ 132,000
Culvert Pipes	$ 72,000
Screw Gate	$ 12,000
Removals - Gravel	$ 65,000
Reusable Material	$ 6,454,000
Rip Rap - 20" min thick.	$ 1,073,000
TOTAL COST:	**$9,458,000**

The planning level cost estimate lists the constructions costs for the duration of the project. The estimate does not include costs of contingency, engineering and design, or construction management. A recommended contingency based on this level of design would be 20%. These items will be incorporated into the estimate as the project progresses.

ASSUMPTIONS:

- **Reusable Material:** All borrow and excavated material to come from on site, using backfill unit costs. 1V:8H slopes are to be constructed at the Swan Lake Berm, Fuller Lake Berm, and Realignment of the site except for the Cross Dike where a 1V:6H will be performed.
- **Mobilization/Demobilization:** 5% of the overall construction cost.

- **Gravel Roadway 6”/Removal:** Gravel is to be placed at the Swan Lake Berm, Fuller Lake Berm, and Realignment. It is to be removed with the same crew at the Swan Lake and Fuller Lake Berm only. Gravel can be disposed of on site and could be used as fill material later. Hauling and disposal fees have not been included in the estimate.
- **Seeding:** This line item includes a typical seeding mix, applying fertilizer, soil preparation including mulching and oat straw (1” deep), and assuming two waterings throughout all four locations.
- **Trees/Tree Removal:** These are assumed to be planted at 109 stems per acre at the Fuller Lake Berm and Realignment locations. Trees can be removed at the Swan Lake and Fuller Lake Berm and around the Realignment. These can also be assumed to be kept on site, as a possibility for habitat purposes. Hauling and disposal fee have not been included in the estimate.
- **Culvert Pipes:** A 72” Corrugated Metal Pipe was assumed to be the size of the structure for this line item. Excavation/Backfilling costs have been included, assuming a minimum of 6-foot-wide trench at a 10-foot depth, along with a 20% swell factor for backfilling the trench where the Realignment ties in. The two large culverts will be replaced and extended past the previous existing culverts due to not being in great condition.
- **Screw Gate:** A 36” x 36” Slide Gate was assumed to be used for this line item, with removing and replacing the old structure using the same crew at the south end of Fuller Lake near the pump station.
- **Riprap – 20” Minimum Thickness:** 400-Pound Riprap is the assumption made for material used, with purchasing from Calhoun Quarry Inc, in Fieldon, Illinois. Hauling to and from this quarry along with placing the riprap at the Swan Lake Berm and Cross Dike has been included in the estimate.
- **Clearing and Grubbing** has not been included in the estimate but will be needed when a clear amount of acreage has been calculated throughout the entire project.

3.5 Quantifying Environmental Benefits:

Objectives outlined in the original 1991 (revised 1993) DPR/EA included sedimentation reduction, the ability to maintain water levels, the control of wind driven wave action, creation of smaller independently managed lake units to provide deep water areas, the allowance of free movement of fish between the impoundments and the river, the ability to buffer impacts of cold water and ice, and to provide alternate structures to assure fish passage.

It is important to note that the primary focus of management of the Swan Lake complex has shifted from fisheries dominant to waterfowl dominant since the construction of the original HREP. This alteration in management direction was authorized, as the original DPR stated in the Executive Summary as follows:

> "The project design will provide the physical conditions necessary for creating a wide spectrum of strategies for waterfowl and fisheries management. The precise manner in which the lake will be managed in the future will evolve during the initial years of the project. This fine tuning of the management plan will take into account the results of biological response analyses to access the benefits of various alternative water control regimes."

The original HREP utilized the Aquatic Habitat Appraisal Guide (AHAG) (O'Neil, 1985) and the Missouri Wildlife Habitat Appraisal Guide (WHAG) (Baskett et al., 1980) habitat models for assessment of habitat quality in a comparison of Swan Lake with project features against Swan Lake in the future without project conditions.

Presently, the AHAG and WHAG models are no longer approved for use in the USACE planning process and would need to undergo a one-time use approval to be utilized in this FDA effort. Also, as previously mentioned, Swan Lake has shifted management focus from fisheries and waterfowl to a more dominant focus on waterfowl; therefore, rather than seeking approval to use the same models as the original project for this effort, the Dabbling Duck Migration Model (Devendorf, 2013) was utilized, which was developed using the basic tenets of the WHAG model and is currently certified for use by USACE. With that shift in management focus and modeling effort, the comparison of benefits in this effort will also be restricted to waterfowl habitat units.

The original DPR/EA indicated the project would have substantial beneficial effects on aquatic and terrestrial resources, citing an anticipated net gain of +1,021 average annual habitat units (AAHUs) for waterfowl with a resulting total score of 1,711 AAHUs under the selected plan; a substantial increase above the original baseline of 690 AAHUs, in comparison to the original No Action Plan (Table 4).The original project was designed to provide habitat benefits for approximately 50 years.

Table 4: Comparison of AAHUs from Original Project to 2022 Recommended Plan

1991 DPR	**No Action Alternative (Baseline)**			**Selected Plan**		
	Waterfowl			Waterfowl		
AAHU	690			1,711		
2022 FDA	**No Action Alternative (FWOP)**			**Recommended Plan (Repair Alt)**		
	Fuller Lake	Middle Swan	Lower Swan	Fuller Lake	Middle Swan	Lower Swan

AAHU	122	293	397	201	459	623
Total AAHU	812			1,283		

This FDA repair effort, and associated Environmental Assessment is focused on recommendations that will guide the current trajectory of Swan Lake from its flood damaged and degraded state, back toward project success, and more closely in line with the anticipated functions and ecological benefits outlined in the original DPR. To be clear, the intent of this current FDA project is not directly tied to increasing habitat benefits, but more focused on repairing project features that have been damaged by previous flood events, as described above in Chapters 1 and 2. Habitat values were assessed only to provide assurance that the proposed actions would not have adverse effects on the original project, but aim to realign Swan Lake with the ecological benefits that were outlined in the original HREP. Therefore, the timeline of this EA and documentation will extend to the original 50-year project lifespan, which would be the year 2053 based on original project construction ending in 2003.

Assessment of the repair alternative in comparison to a no action alternative, utilizing the Dabbling Duck Migration Model, with projections of the project life out an additional 30 years (total 50-year project life) produced a total output of 1,283 AAHU's (see Table 4 above) with project features at the end of the project life expectancy. This is evidence that the proposed project features would be successful at getting the Swan Lake HREP back on track towards its originally intended outcome.

3.6 Comprehensive Benefits

Per the 2021 "Comprehensive Documentation of Benefits in Decision Document" policy, below is a documentation of the proposed project's benefits and impacts to support the USACE recommendation. Benefit categories include social, environmental, and economic (national and regional). For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. This is called the National Ecosystem Restoration (NER) plan. The original DPR selected the NER plan based on the overall habitat benefits compared to the costs associated with each alternative proposed. The repair with resiliency alternative would ensure the achievement of the habitat benefits of the originally selected NER plan. The repair with resiliency alternative, from a social perspective will ensure continued quality recreation opportunities. From an environmental standpoint, the repair will guide the current trajectory of Swan Lake from its flood damaged and degraded state, back toward project success, and more closely in line with the anticipated functions and ecological benefits outlined in the original DPR. Related to the regional economic benefits, during construction, the proposed action would likely result in increased ancillary business activities in the region associated with contractor needs. This repair does not have significant beneficial or adverse national economic development effects. The quantified national economic effects are the repair cost and project operation, maintenance, repair, rehabilitation, and replacement.

4.0 Recommended Plan:

To best achieve functional performance given the constraints and limitations of the FDA, the Recommended Plan for the Swan Lake FDA project is the Repair with Resiliency Alternative. This includes the measures noted in Section 3.2 and can be seen in Figure 16 below (the Repair with Resiliency Alternative maps broken out by lake segments can be seen in Appendix A):

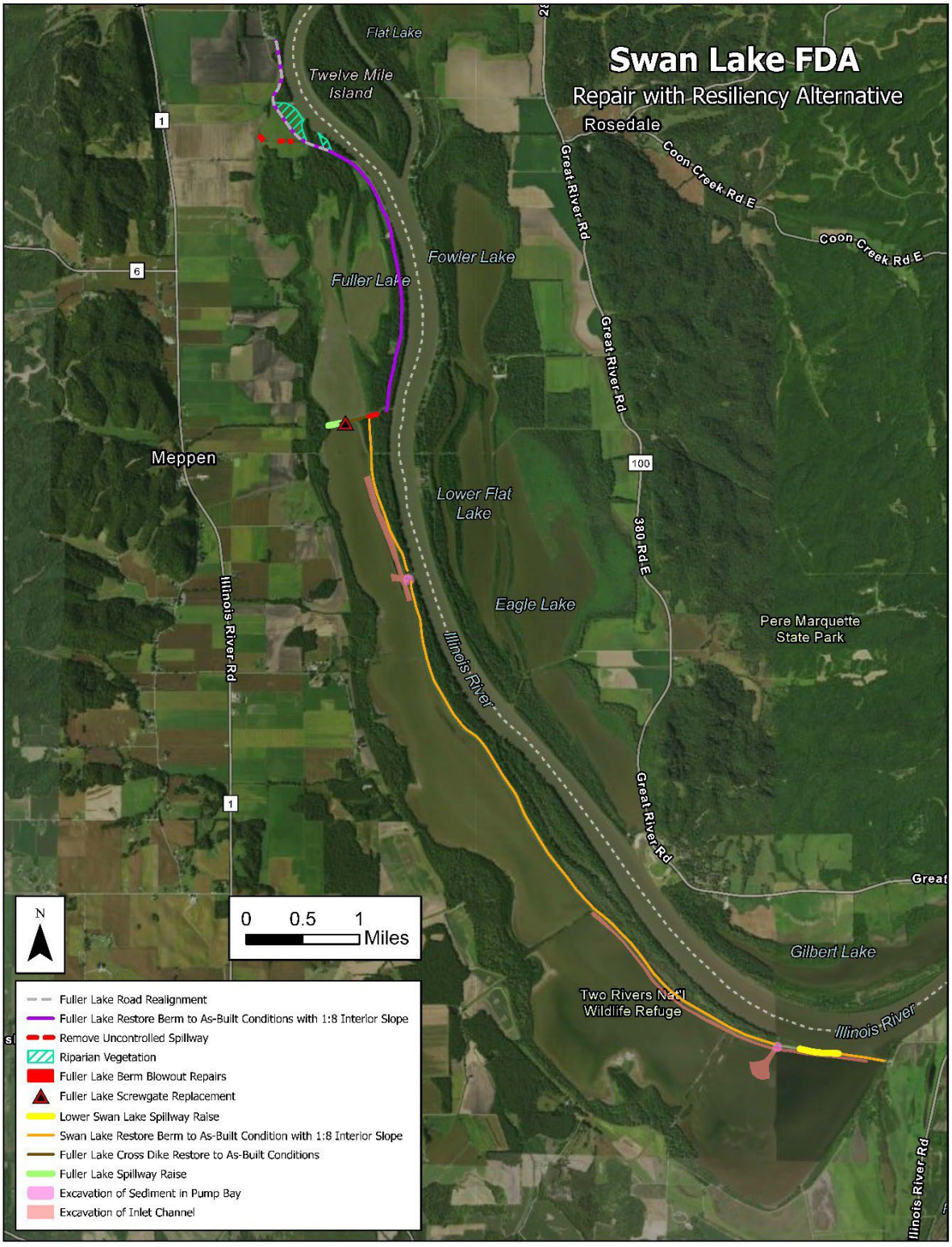

Figure 16: Map of Repair with Resiliency Alternative -The Recommended Plan

As a result of the discussions above, the PDT and sponsors recommend that the Repair with Resiliency be the Recommended Plan. This alternative best meets the study goal and objectives. The lack of any action would result in continued loss of valuable wetland and aquatic habitat, negatively impacting wildlife and recreation opportunities.

The recommended project features all lie within Federally owned lands. The lands for the Swan Lake HREP were initially acquired by the USACE as a part of the Lock and Dam 26 navigation project. Additional tracts were acquired in fee after the Swan Lake HREP was approved in the 1990s. The land within the project boundaries is currently managed by the USFWS and the IDNR, who are in full support of the proposed recommendations made for the Swan Lake FDA.

5.0 Environmental Assessment:

A comprehensive description of resources and the effects of the original project are provided in sections 2 and 7, respectively of the U.S. Army Corps of Engineers Upper Mississippi River System - Environmental Management Program, Definite Project Report (SL-5) with Integrated Environmental Assessment (DPR/EA, 1991).

This section contains an updated list of the important resources located in and near the proposed action and describes in detail, when applicable, those resources that would be impacted directly or indirectly by the proposed repair alternative. This section does not represent effects of the original project, which were covered in the original DPR/EA.
Direct impacts are those that are caused by the action taken and occur at the same time and place (40 CFR §1508.8(a)). Indirect impacts are those that are caused by the action and are later in time or further removed in distance but are still reasonably foreseeable (40 CFR §1508.8(b)). A cumulative impact is defined as the "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR §1508.7).

The resources described in this section are those recognized as important by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Resources that would not be impacted or would only be negligibly impacted are not directly discussed in this document.

5.1 Original Environmental Assessment

The 1991 DPR/EA indicated the project outlined significant beneficial effects on wetlands, aquatic habitat, and habitat diversity and interspersion for a variety of taxa including shorebirds, wading birds, waterfowl, aquatic invertebrates, and a variety of slackwater fishes. Many of the beneficial effects have been observed in association with non-damaged project features over the past two decades since project completion.

5.2 Applicable Environmental Laws and Regulations

The proposed repairs would comply with Federal environmental laws and executive orders, including the National Historic Preservation Act of 1966, as amended; the Bald and Golden Eagle Protection Act of 1940, as amended; the Clean Air Act of 1972, as amended; the Clean Water Act of 1972, as amended; the Endangered Species Act of 1973, as amended; the Fish and Wildlife Coordination Act of 1958, as amended; the National Environmental Policy Act of 1969, as amended; Executive Order 12898, Environmental Justice; Executive Order 11988, Floodplain Management; and Executive Order 11990, Protection of Wetlands (Appendix B).

5.3 Assessment of Existing Resources

5.3.1 Natural Resource Effects

5.3.1.1 Air Quality

The Clean Air Act of 1963 requires the U.S. Environmental Protection Agency (EPA) to designate National Ambient Air Quality Standards (NAAQS). The EPA has identified standards for six pollutants: lead, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and particulate matter (at less than 10 microns and at less than 2.5 microns in diameter), along with some heavy metals, nitrates, sulfates, volatile organic and toxic compounds. EPA regulates these pollutants by developing human health-based or environmentally-based permissible pollutant concentrations. EPA then publishes the results of air quality monitoring, designating areas as meeting (attainment) or not meeting (nonattainment) the standards or as being maintenance areas. Maintenance areas are those areas that have been re-designated as in attainment from a previous nonattainment status. A maintenance plan establishes measures to control emissions to ensure the air quality standard is maintained in these areas.

The region of Calhoun County, Illinois currently meets all USEPA air quality standards and is not a designated maintenance area (USEPA, 2023a).

Under the No-Action Alternative, no direct impacts to air quality in the project area would be anticipated.

Minor, temporary increases in airborne particulates are expected to occur as a result of mobilization and use of construction equipment. These increases would be less than significant. No air quality standard violations are anticipated for any considered alternative. None of the considered action alternatives are expected to have any long-term adverse effects on the air quality of Calhoun County, Illinois. Any required air quality restrictions would be followed and implemented. Therefore, the considered action alternatives would have no effect on air quality.

5.3.1.2 Water Quality

Currently, Swan Lake has low water clarity due to a combination of shallow depths, unconsolidated bottom, and exposure to periodic high winds. Because the lake is shallow, its water temperatures are unstable. Winter water temperatures in Swan Lake vary greatly, from about 0° C to 10° C (Sheehan, et al., 1989). Dissolved oxygen levels in the lake are usually fairly

high due to high wave action, even though water levels are shallow and water temperatures are high during the summer. Water turbidity and unstable temperatures are expected to continue to be an important problem in the future without the project.

Under the No-Action Alternative, erosion of islands would continue to occur, thus having negative consequences to surface water quality. These would occur primarily during high flow events and during high wind events that cause wave action. Without the project, conditions would continue to see a soft lake bottom with sparse vegetation struggling to effectively buffer against the wind fetch and wave action leading to continually decreasing water quality with elevated levels of suspended fine sediments.

The proposed repairs would initially cause elevated suspended sediments, resulting in short-term and localized minor adverse impacts from excavation and placement of fines, sand, and rock during construction. However, these areas would stabilize over time with the establishment of new vegetation. Over the long term, water quality is expected to increase due to the stabilization and establishment of emergent vegetation and more reliable production of those conditions year after year. The excavation and placement of material would pose a very low risk of contamination given the source and overall, generally good quality of sediments in the area. No long-term impacts to water quality are anticipated.

5.3.1.3 Wetland and Aquatic Habitat

Wetlands provide many ecological functions and services, and the scale of these services can range from local population effects up to the landscape level. Wetlands are often defined as having the presence of water at or near the surface for at least part of the year; possessing hydric soils; and supporting vegetation adapted to saturated soils (Havera, Suloway, & Hoffman, 1997). Functions and services provided by wetlands include sediment retention and processing, flood control, groundwater recharge, wildlife corridors connecting other habitats, and support of wetland-dependent plants and wildlife.

In the United States, between the 1780s and the 1980s, the lower 48 states lost an estimated 53% of the 221 million acres of original wetlands due to land use changes, primarily from conversion into agriculture production, but also to a lesser extent, commercial and residential development. The land within the current states of Illinois and Missouri both lost over 85% and 87% of wetlands during this period, respectively (Johnston, 1994); (Dahl & Johnson, 1991). Many of the remaining wetlands have degraded by fragmentation, pollution, excess siltation, and invasion by non-native plant species (Molano-Flores, et al., 2007). Together these factors have reduced the capacity of remaining wetlands to perform the previously mentioned ecological functions.

Palustrine habitat is found throughout the project area, in the form of emergent, scrub shrub, and forested wetlands; however, no repairs under this flood damage assessment are anticipated to impact any of the wetlands within the project area.

Under the No-Action Alternative, the wetlands and aquatic habitat in the project area would continue to deteriorate in quantity and quality. Increased sedimentation over time would result in shallower water depths that would be more prone to increased turbidity from wind generated wave action, and lead to an ever-increasing conversion to upland acreage, and subsequent loss in overall quantity of available wetland and aquatic habitat.

The proposed repairs would have a minor, but temporary adverse effect on wetlands for the construction window, but an overall net beneficial effect on the wetlands and aquatic habitat at Swan Lake. Repairing the sediment deflection berm, raising the spillways, and excavating inlet channels and built-up sediments in close proximity to the water control structures would decrease adverse sedimentation effects within the Swan Lake complex and provide efficiency in water level management that would also lead to the ability to produce quality emergent vegetation and macroinvertebrate food resources for migrating waterfowl. The repair alternative would have short term adverse effects on water quality and aquatic flora and fauna. Within the footprint of excavated areas, aquatic plants and benthic macroinvertebrates would be destroyed. Sediments would be resuspended in the water column, reducing water clarity and aquatic vegetation. This effect would be temporary and limited to the construction period; however, these areas would stabilize over time with the reestablishment of vegetation. No long-term impacts to aquatic habitat are anticipated.

5.3.1.4 Floodplain Forest

Floodplain forest communities are highly productive, provide valuable habitat for many species of wildlife (support plants and animals adapted to alternating wet and dry periods), improve water quality, control erosion (capture and disperse sedimentation), reduce flood damage by holding water, and contribute to local and regional commerce (Wiener, et al., 1998); (Johnson & Hagerty, 2008) as well as carbon sequestration (Guyon, et al., 2016). The Swan Lake complex has approximately 950 acres of floodplain forest throughout the project area.

Under the No-Action Alternative, no direct impacts to the floodplain forest resources in the project area would be anticipated.

The proposed repairs would directly impact 13.2 acres of floodplain forest by clearing and removal to allow for the expansion of the interior slope along the sediment deflection berm as part of the resiliency measures. The forest resources to be cleared are primarily made up of early successional stage cottonwood and willow that are encroaching on the sediment deflection berm. The proposed repair alternative also includes planting approximately 25.5 acres of trees on the exterior, or riverside of the realigned sediment deflection berm to increase riparian buffer habitat as part of the resiliency measures. The tree species targeted for this riparian buffer effort will be species well suited for the Illinois floodplain with tolerance to high sedimentation and flood frequency, such as willow, cottonwood, and maple. The overall adverse effects to floodplain forest resources would be considered minor, and temporary as the riparian areas reforest, adding more protective value to the project, and increased riverine

corridor habitat to the lower Illinois River basin. Earlier versions of the repair alternative considered the realignment at Fuller Lake to follow a more sinuous path with the Illinois River and cutting through a forested block that contains some mature cottonwood, maple, and pecan trees, which would have impacted an additional 4.8 acres. In an effort to avoid and minimize adverse effects to floodplain forest resources to the maximum extent possible, that particular alignment was abandoned in favor of the current path, which ties into the road and utilizes the existing culvert crossing location.

5.3.1.5 Wildlife

Large river floodplains, such as the UMRS, provide a mosaic of forest, grassland, islands, backwaters, side channels, and wetlands that support a wide diversity of wildlife. In all, the UMRS supports over 550 vertebrate species, and nearly 50 species of mussels (Guyon, et al., 2012). There are over 300 species of bird that migrate along the Mississippi Flyway each year. The Swan Lake project area is uniquely located at the confluence of the Mississippi and Illinois Rivers and is an important link along this migratory corridor. The USFWS manages the study area primarily as a refuge for migratory birds that rest, feed, and winter along the Mississippi Flyway. Recreational opportunities are provided at Fuller Lake, which is managed by IDNR with a primary focus on waterfowl hunting.

Under the No-Action Alternative, wildlife use is anticipated to decline as more preferable habitat continues to degrade in quantity and quality.

The proposed repairs would result in elevated wildlife use in general, as preferable habitat conditions are restored. More specifically, repair features within the Swan Lake complex will provide efficiency in water level management that would also lead to the ability to produce quality emergent vegetation for food and cover, and macroinvertebrate food resources for the shorebirds and waterfowl that rely on Swan Lake for resting and feeding during their annual migrations.

5.3.1.6 Threatened and Endangered Species

The list of federally threatened and endangered species provided in the 1991 DPR/EA is outdated. The USFWS Information for Planning and Conservation (IPaC) website was consulted on September 14, 2022, to determine if any proposed, candidate, threatened, or endangered species occurred within the project area (Appendix C). Due to a change in classification of the northern long eared bat, and the inclusion of the tricolored bat, the IPaC system was again consulted on December 16, 2022, to obtain an updated species list. The results indicate that a total of two federally endangered species, one proposed federally endangered species, one federally threatened species, and one candidate species may occur within the project area.

Two mammalian species, the Indiana bat (*Myotis sodalis*), and the Northern long-eared bat (*Myotis septentrionalis*) are listed as federally endangered. Another mammalian species, the Tricolored bat (*Perimyotis subflavus*), is proposed as endangered. One plant species, Decurrent False Aster (*Boltonia decurrens*), is listed as federally threatened. One insect, the Monarch

Butterfly (*Danaus plexippus*) is listed as a candidate species.

Due to the tree clearing along the interior slope of the sediment deflection berm, USACE has determined that the proposed repair action may affect but is not likely to adversely affect the two listed bat species. Tree clearing is to only occur throughout the winter months of 01 October through 31 March (of any year), and refrain from all tree clearing activities during the summer roosting seasons.

Although not described in the USDA or BONAP's databases as occurring within Calhoun County, Illinois, the decurrent false aster *(Boltonia decurrens*), is known to occur in the Swan Lake vicinity, and therefore, USACE has determined that the proposed repair action may affect but is not likely to adversely affect the listed plant species.

USACE will continue to evaluate impacts to federally listed species and consult with the USFWS under section 7(a)(2) of the Endangered Species Act if new information indicates otherwise.

The Illinois state Ecological Compliance Assessment Tool (EcoCAT) was accessed on September 22, 2022, to determine the likelihood of presence of any state listed species within the project area. The list of species returned in the EcoCAT consultation consisted of the following species: Indiana bat *(Myotis sodalis)*, the Northern long-eared bat *(Myotis septentrionalis)*, the longnose sucker *(Catostomus catostomus)*, the smooth softshell *(Apalone mutica)*, and the Western Sand Darter *(Ammocrypta clarum)*.

Under the No-Action Alternative, overall wildlife use is anticipated to decline as quality, more preferable habitat continues to degrade in quantity and quality. This would increase severity of impact to the already imperiled species that may be found within the project area.

While there is potential for these species to be initially adversely impacted during construction, it is unlikely that populations of these species would be adversely affected throughout the Alton Pool, and the impacts, albeit minor and temporary, would be localized. Overall, the project should improve habitat conditions and have long-term benefits for the listed species.

5.3.2 Cultural Resources

American Resources Group, Ltd. (ARG) conducted a geomorphological and archaeological survey on 95 acres of the original Swan Lake HREP (Survey C-6731) in 1994. The geomorphological survey was conducted to determine if the depth of the historical (post-settlement) alluvium (PSA) deposits exceeded the maximum depth of the construction limits. It found that for the majority of the surveyed area, the depth of the PSA deposits exceeded the depth of the construction limits. Eight areas were archaeologically surveyed and sites 11C152 and 11C212 were identified (McNerney *et al*. 1994).

Site 11C152 was identified within the footprint of Pump Station #3 of the original Swan Lake HREP as an Early Woodland, Late Woodland, and Mississippian habitation site. It was determined eligible to the National Register of Historic Places (NRHP). ARG conducted Phase III mitigation efforts (excavation) of the site in 1995 (McNerney *et al*. 1995). In 2010, Bear Creek Archaeology (BCA) conducted a survey of 11C152 and determined that a Middle Woodland and

Protohistoric component also was present. BCA identified two features eroding from the bank, which were subsequently excavated. The site was determined to be mitigated (Benn 2011).

Site 11C212 was located within Borrow Area D of the original Swan Lake HREP. It was identified as an Early Woodland hunting camp and 19th century farmstead. The historic component was determined to be ineligible to the NRHP; however, the Early Woodland component was determined to be potentially eligible. Avoidance was recommended or, if avoidance was not possible, Phase II testing (strategic excavation units to determine if subsurface cultural resources are intact) should take place. The site was located in the northeastern corner of the borrow area buried under 45 inches (115 centimeters) of PSA deposit (McNerney *et al.* 1994). The site was avoided.

The proposed action would impact 40.78 acres (165,031 square meters) of intact ground surface in an agricultural field for a borrow area and realignment of the northern sediment deflection berm. The ground disturbance within this field will be approximately 18 inches (46 centimeters) deep. This agricultural field had been geomorphologically surveyed by ARG in 1994. That survey revealed that the field had approximately 20 to 75 inches (50 to 190 centimeters) of PSA deposit.

On November 9, 2022, St. Louis District archaeologists conducted a soil survey of the proposed borrow area and directly south of the sediment deflection berm to determine if the PSA deposit exceeded the maximum depth of construction impact (18 inches, 46 centimeters). Eight probes were attempted to at least 20 inches (50 centimeters) below surface and two auger tests were conducted to about 39 inches (100 centimeters) below surface. The probes and augers revealed soil profiles consistent to those observed during the 1994 geomorphological survey, which indicates that the PSA deposit exceeds the maximum depth of ground disturbance.

The St. Louis District determined that the proposed action will have no potential to cause effect on historic properties per 36 CFR 800.3(a)(1). The Illinois State Historic Preservation Office (SHPO) was requested to concur with this determination in a letter dated 8 December 2022 (Appendix B). The SHPO concurred with the St. Louis District's determination on 9 January 2023 (IL SHPO Log # 002121222). In the unlikely event that earthmoving activities associated with the proposed work do impact potentially significant archaeological/historic remains, all construction activities and earthmoving actions in the immediate vicinity of the remains would be held in abeyance until the potential significance of the remains could be determined. The precise nature of such investigations would be developed by the St. Louis District in concert with the SHPO.

Consultation with 25 federally recognized Indian Tribes took place on 8 December 2022. The Quapaw Nation (29 December 2022), Nottwaseppi Huron Band of Potawatomi Indians (3 January 2023), Eastern Shawnee Tribe of Oklahoma (6 January 2023) responded to the consultation letter. None of the Tribes had objected to the undertaking; however, all three requested to be notified if archaeological or human remains are identified during construction.

The Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians (20 January 2023) chose to not provide comments as they do not have information that cultural resources significant to their Tribe is within the project area. They did request to be notified if any archaeological or human remains are identified during construction activity.

Under the No-Action Alternative, there would be no adverse effects on historic properties.

5.3.3 Social and Economic Effects

5.3.3.1 Noise

Noise levels surrounding the study area are varied depending on the time of day and season. The current human activities causing elevated noise levels in the vicinity of the study area include cars, trucks, and large equipment of the ag and river industries. The sound of firearms during hunting season is also commonplace.

A typical vehicle can produce 60-90 decibels (dB) of sound at a distance of 50 feet (USEPA 1974). A public boat ramp, albeit unimproved, exists on the northern end of the project area introducing noise from recreational boat traffic. A pleasure boat's noise range is typically between 65-115 dB (USEPA 1974). Towboats pushing barges upriver produces wayside noise within the range of 71-81 dB when measured at distances ranging from of 50 to 200 feet (Thornton, 1975). Freight is moved up and down the Illinois River frequently along the eastern boundary of the project area. Although the majority of Swan Lake is designated as a refuge, the northern end is open for hunting. Waterfowl hunting is the primary public use at Fuller Lake, and shotguns are used to harvest ducks. The noise from a typical 12-gauge shotgun is 130 dB. All of these sources may contribute to noise levels within the study area.

Under the No-Action Alternative, there would be no adverse effects on local noise.

The proposed action would result in a temporary, minor adverse impact on noise primarily from heavy equipment associated with excavating, transportation, and placement of earthen materials to the repair the flood damage affected areas. The proposed repair alternative would result in an increase in heavy truck traffic immediately prior to project modifications with the transport of rock and dirt materials. Transport of these materials would require dump truck loads traveling to, from, and within the site. The site would be temporarily exposed to increased noise, although the work is anticipated to be completed within a relatively brief construction window, and all activities would comply with applicable federal, state, and local laws regarding noise. Following project repair activities, noise levels would return to normal following completion of the project.

5.3.3.2 Aesthetics

Under the No-Action Alternative, there would be a no effect on aesthetics.

Over the long term, the proposed action would have a negligible effect on the aesthetics of the project. No major changes to the current design and scope of the project are proposed, as it is aimed at repairing existing infrastructure with resiliency. There would be some temporary,

short-term adverse effects to aesthetics associated with construction, but these effects would fade quickly with the reestablishment of vegetation after construction.

5.3.3.3 Recreation

Recreational opportunities are more accessible on Fuller Lake than on Swan Lake, as Swan Lake closes down to the public for waterfowl refuge season in the fall and winter, while Fuller Lake is open for access year-round for hunting and sportfishing.

Under the No-Action Alternative, waterfowl habitat quality and quantity would continue to steadily decline, which would result in reduced amounts of waterfowl use on the Swan and Fuller Lake Complex. This would result in long term adverse effects to recreational opportunities.

The proposed action would likely result in slightly increased recreational hunting opportunities from improved habitat and access improvements by placing the road on top of the newly aligned berm. However, there would be temporary adverse effects as a result of disturbance during construction.

The proposed action would have a negligible effect on recreational opportunities on Swan Lake, as it closes to the public for waterfowl refuge season in the fall and winter, therefore from strictly a recreational opportunity point of view, the effect from the proposed project would be negligible. However, there would be minor and temporary adverse effects as a result of disturbance during construction.

5.3.3.4 Business Activities

Under the No-Action Alternative, there would be a decrease in activity for local businesses as a result of decreased waterfowl use, and subsequent decrease in recreational hunting opportunities.

During construction, the proposed action would likely result in increased ancillary business activities in the region associated with contractor needs. Long-term benefits may also be associated with increased recreational hunting activities.

5.3.3.5 Cumulative Impacts

Cumulative effects result from the proposed action when added to other past, present, and reasonably foreseeable actions or projects. Cumulative effects are not caused by a single project, but they include the effects of a particular project in conjunction with other projects (past, present, and future) on the particular resource. Cumulative effects are studied to enable the public, decisions–makers, and project proponents to consider the “big picture” effects of a project on the community and the environment. In a broad sense, all impacts on affected resources are probably cumulative; however, the role of the environmental analyst is to narrow the focus of the cumulative effects analysis to important issues of national, regional, or local significance (CEQ 1997).

Under the No-Action Alternative, the trend of loss and degradation of available habitat would continue and reduce the overall value of the project area to local wildlife.

The proposed repairs will enhance the rehabilitation of habitat for migratory birds, and other forms of fish and wildlife indigenous to the project area. There are no negative permanent cumulative effects anticipated with the proposed repair.

5.3.3.6 Environmental Justice

Under this Executive Order (EO 12898), a Federal agency "shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States." An Environmental Justice (EJ) analysis focuses on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the federal action. Additionally, if the impact is appreciably more severe or greater in magnitude on minority or low-income populations than the adverse effect suffered by the non-minority or non-low-income populations after taking offsetting benefits into account, then there may be a disproportionate finding. Avoidance and mitigation are then required.

The EJ assessment was performed on the project area boundary with a 1mi buffer area, within Calhoun County, Illinois (total approximate area of 34.13 square miles). For this assessment, the EJSCREEN tool was used (USEPA, 2023b). EJScreen is an environmental justice mapping and screening tool that combines up-to-date economic statistics, U.S. Census Bureau decennial data (2020), and the 2017-2021 American Community Survey (ACS) estimates for a given area. The project area is rural in nature, consisting primarily of riverine and wetland habitat, and the ACS population estimate (2017-2021) was 249 with 1 percent of the residents identifying as being a minority. 16 percent of the population was identified as low-income, which is lower than the state average of 27 percent.

Under the no-action alternative, no change in environmental justice would be expected. Therefore, this alternative would have no effect on environmental justice.

No differential impacts to minority or low-income populations are expected with the proposed repair alternative. Short-term increases in employment could be realized during construction. Therefore, the considered repair alternative would have no disproportionately high and adverse environmental effects on minority or low-income populations.

5.3.4 Summary

The adverse effects on the locally affected environment would be minimal and short lived compared to the benefits gained by the proposed repairs. The repairs would result in a long-term beneficial impact on recreation, aquatic habitat, floodplain forest resources, business activity, wildlife, and surface water quality. However, there would be minor temporary increases in noise levels and air emissions and minor temporary but localized adverse impacts

to air and water quality, wetlands and aquatic habitat, floodplain forest resources, aesthetic appeal, and recreation, associated with project repair activities. The temporary adverse effects would cease when the project is completed, and the disturbed areas revegetate. A summary of effects associated with the no-action and repair alternative is shown in Table 5 .

Table 5: Environmental Assessment Matrix for Swan Lake HREP – FDA Project.

	No Action Alternative							**Repair Alternative**						
	BENEFICIAL				ADVERSE			BENEFICIAL				ADVERSE		
PARAMETER	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR	SUBSTANTIAL	SIGNIFICANT	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR*	SUBSTANTIAL	SIGNIFICANT
A. SOCIAL AND ECONOMIC EFFECTS														
1. Noise Levels				**X**								**T**		
2. Aesthetic Values				**X**							**X**	**T**		
3. Recreation						**X**				**X**		**T**		
4. Business Activities					**X**					**X**				
5. Cumulative Impacts						**X**					**X**			
6. Environmental Justice				**X**							**X**			
C. NATURAL RESOURCE EFFECTS														
1. Air Quality				**X**								**T**		
2. Water Quality					**X**					**X**		**T**		
3. Wetlands/Aquatic Habitat						**X**				**X**		**T**		
4. Floodplain Forest				**X**						**X**		**T**		
5. Wildlife					**X**					**X**		**T**		
6. Threatened or Endangered Species					**X**					**X**		**T**		
D. CULTURAL RESOURCE EFFECTS														

	No Action Alternative							**Repair Alternative**						
	BENEFICIAL				ADVERSE			BENEFICIAL				ADVERSE		
PARAMETER	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR	SUBSTANTIAL	SIGNIFICANT	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR*	SUBSTANTIAL	SIGNIFICANT
1. Historic Architectural Values				**X**							**X**			
2. Prehistoric & Historic Archeological Values				**X**							**X**			

**T - denotes a temporary effect.*

This Environmental Assessment has been prepared in accordance with the National Environmental Policy Act (NEPA); the Council on Environmental Quality - Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508); and the Corps of Engineers - Policy and Procedure for Implementing NEPA (33 CFR Part 230).

References:

Baskett, T.S. et al. 1980. A Handbook for Terrestrial Habitat Evaluation in Central Missouri. U. S. Department of Interior, Fish & Wildlife Service, Resource Publication 133, Washington, D. C.

Benn, D.W. (2011). *Illinois Archaeological Site Recording Form, Site 11C152*. Form on file with the Illinois State Historic Preservation Office, Springfield, Illinois.

Dahl, T. E., & Johnson, C. R. (1991). *Status and trends of wetlands in the conterminous United States, mid-1970s to mid-1980s.* U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 28 pgs.

Devendorf, Randall D. (2013). A Dabbling Duck Migration Model for the Upper Mississippi River. U.S. Army Corps of Engineers, St. Paul District, St. Paul.

Guyon, L., Deutsch, C., Lundh, J., & Urich, R. (2012). *Upper Mississippi River Systemic Forest Stewardship Plan. U.S. Army Corps of Engineers. 124 pgs.*

Guyon, L., Sloan, J., Van Essen, R., & Corcoran, M. (2016). *Floodplain Forests and Water Quality in the Upper Mississippi River System.* Report to the National Audubon Society. 70 pgs.

Havera, S. P., Suloway, L. B., & Hoffman, J. E. (1997). *Wetlands in the Midwest with special reference to Illinois.* Conservation in highly fragmented landscapes. 88-104.

Johnson, B. L., & Hagerty, K. H. (2008). *Status and trends of selected resources of the Upper Mississippi River System.* U.S. Geological Survey, La Crosse, WI. Technical Report LTRMP 2008-T002.

Johnston, C. A. (1994). *Cumulative impacts to wetlands.* Wetlands. *14(1): 49-55.*

McNerney, M. J., Titus, S., Howe, W. G., Neal, W., and Anderson, J. D. (1994). *A Phase I Archaeological Survey for Historic Properties within the Swan Lake Habitat Rehabilitation Enhancement Project (HREP), Environmental Management Program (EMP) Pool 26, Illinois River, Calhoun County, Illinois*. American Resources Group, Ltd., Carbondale, Illinois.

McNerney, M. J., Titus, S., Neal, W., Anderson, J., Howe, G. (1995). *Phase III Data Recovery at the Persimmon Site (11-C-152), Swan Lake Habitat Rehabilitation Enhancement Program (HREP), Environmental Management Program (EMP), Pool 26, Illinois River, Calhoun County, Illinois*. American Resources Group, Ltd., Carbondale, Illinois.

Molano-Flores, B., Cunningham, C. C., Ellis, J. L., Spyreas, G., Bailery, S., Jack, R., . . . Ward, M. (2007). *Critical Trends Assessment Program: Keeping an eye on Illinois habitats.* 28 pgs.

National Audubon Society. (2008). Two Rivers NWR (Calhoun Division) / Mississippi River SFWA. Important Bird Area and biodiversity area digital boundaries. https://www.audubon.org/important-bird-areas/two-rivers-nwr-calhoun-division-mississippi-river-sfwa (accessed October 2022).

O'Neil, L.J. (1985). Habitat Evaluation Methods Notebook. Instruction Report EL-85-3, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Sheehan, R. J., W. M. Lewis, L. R. Bodensteiner, D. E. Logsdon, P. and S. Wills. (1989). *Winter habitat requirements and overwintering of riverine fishes.* Annual Performance Report F-79-R-2, Fisheries Research Laboratory, Southern Illinois University, Carbondale, Illinois.

Thornton, C. (1975). Noise Pollution Aspects of Barge, Railroad, and Truck Transportation. Southern Illinois University, Edwardsville, Illinois. Report to US Army Engineer District, St. Louis. Contract Number LMSSD 75-1654.

U.S. Army Corps of Engineers, St. Louis District. (1991, revised 1993). *Upper Mississippi River System - Environmental Management Program, Definite Project Report (SL-5) with Integrated Environmental Assessment. Swan Lake Habitat Rehabilitation and Enhancement Project (HREP)*. Pool 26, Illinois River, Calhoun County, Illinois.

USEPA. (2023). Nonattainment Areas for Criteria Pollutants (Green Book). Data current as of 18 January 2023. https://www.epa.gov/green-book.

USEPA. (2023b, January 18). *EJSCREEN Tool*. Retrieved from EPA: https://www.epa.gov/ejscreen

Wiener, J. G., Fremling, C. R., Korschgen, C. E., Kenow, K. P., Kirsch, E. M., Rogers, S. J., . . . Sauer, J. S. (1998). *Mississippi River. In Status and Trends of the Nation's Biologist Resources* (M.J. Mac, P.A. Opler, C.E.P Haecker, and P.D. Doran, eds.). U.S. Geological Survey, Biological Resources Division, Reston, VA.

Appendices:

Appendix A: Comprehensive Summary and Prioritization Problems

Appendix B: Cultural

Appendix C: FONSI & Environmental

Appendix D: Coordination

Appendix E: Hydraulics and Hydrology

Appendix F: Civil Engineering

Appendix G: Lessons Learned

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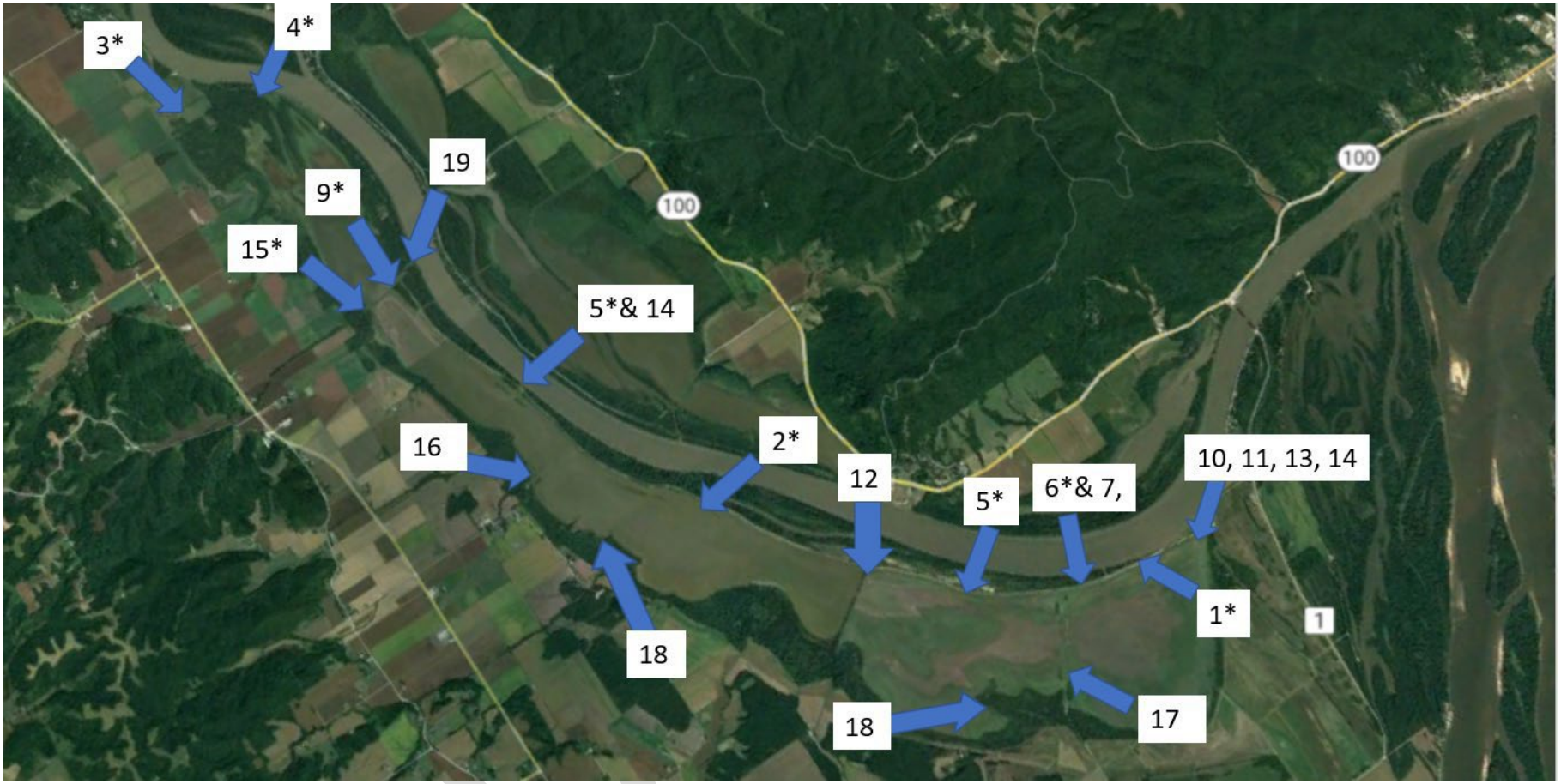
Appendix A: Comprehensive Summary and Prioritization of Problems

Prepared By:
US Army Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103
December 2022

Figure A- 1: Map of Approximate Locations of Problems at Swan Lake (2022)



"" Indicates problem to be addressed in Repair with Resiliency Alternative*

Table A- 1: Comprehensive Summary of Problems at Swan Lake (2022)

# Correlated to Map (* Indicates addressed in Repair with Resiliency Alternative)	Problem Prioritization: Green-High, Yellow-Med, Red-Low	Measure to Address Problem	Ancillary Benefits	POTENTIALLY addressed by: FDA/ Other
1 (*)	Spillways severely erode during floods and effectively reduce the level of protection of the berm system (Lower Swan & Fuller Lake)	Spillway repair	#1- spillway repair, #5- Channel sediment	FDA/Other
2 (*)	Berm slope is too steep in some locations prone to erosion during flood events	Slope modification	#2- Berm slope, #5 - Channel sediment	FDA/Other
3 (*)	Multiple breaches at upper end of Fuller Lake berm due to flood events	Realign berm and/or breach repair		FDA/Other
4 (*)	Excessive sediment deposition on road at Fuller Lake due to flood events	Place service road on top of berm	Facilitates berm maintenance by sponsor by ensuring access to site	FDA/Other
5 (*)	Channels to pumps have filled with sediment in (Lower & Middle) due to flood events	Dredge channels	(If used on berm as beneficial use) #1- berm repair and/or realignment, #1- spillway repair, #2- berm slope, #5 channel sediment, #8- pump performance (reducing excessive wear and tear)	FDA/Other
6 (*)	Lower Swan Pump Station- Forebay sediment deposition due to floodevents	Dredge forebay	(If used on berm as beneficial use) #1- berm repair and/or realignment, #1- spillway repair, #2- berm slope, #8- pump performance (reducing excessive wear and tear)	FDA/ Other
7	Lower Swan Pump station- Mechanical components subject to failure / high maintenance needs due to excessive	Repair OR Replace pump		FDA/ Other

	sedimentation in channels and forebay from flood events		
8	Fish screen on lower swan pump- sill is high and is not allowing feeder ditches to headcut	Replace fish screen	Other
9 (*)	Screw gate between Middle and Fuller Lake damaged due to flood events	Replace water control structure	FDA/Other
10	Lower Swan Fish Passage/ Water control structure is undersized	Increase size of stop log structure	Other
11	Safety railing subject to failure during flood events	Replace or repair safety railing	FDA/Other
12	Gravity Drain between Middle and Lower Swan- Structure is largely silted in due to flood events	Replace gravity drain or Repair gravity drain (ie remove sediment)	FDA/Other
13	Stoplog setup issues with installation and removal of stoplogs during flood events	Repair OR Replace stop log structure	Other
14	Lift box is getting damaged due to flood events	Raise lift box and run hydraulics down between i-beam for access and protection	FDA/Other
15 (*)	Breaches in cross dike between Middle and Fuller due to flood events	Repair cross dike between Fuller/Middle Swan to as built conditions and remove spillway to separate management	FDA/Other
16	Middle Swan Islands severely eroded and are non-functional due to flood events	Repair Islands	FDA/Other
17	Lower Swan Islands eroded but had rock protection so still exist. Floods continue to erode.	Repair Islands	FDA/ Other
18	Significant upload flow contributing to water volume and sedimentation	Reduce upland flow entering lake	Other

19	Fuller Lake Pump- Mechanical components subject to failure / high maintenance needs due to excessive sedimentation in channels and forebay from flood events	Repair OR Replace pump & dredge channels	Other

Figure A- 2: Lower Swan Lake Repair Measures

Figure A- 3: Middle Swan Lake Repair Measures

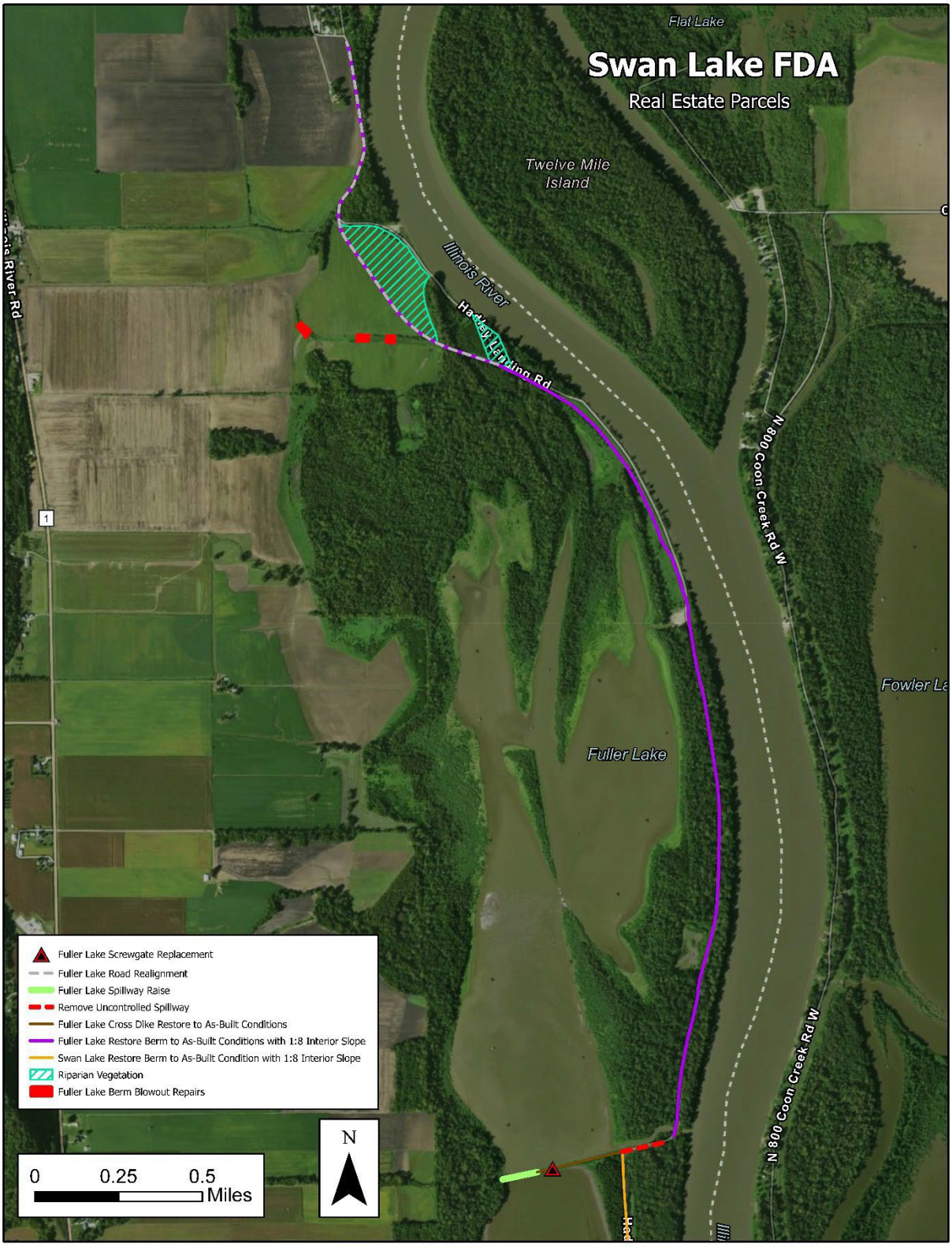


Figure A- 4: Fuller Lake Repair Measures

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Appendix B: Cultural

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St. Louis, MO 63103
December 2022

State Historic Preservation Officer Letter

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103

December 8, 2022

Engineering and Construction Division
Curation and Archives Analysis Branch (ECZ)

SUBJECT: Swan Lake Habitat Rehabilitation and Enhancement Project (HREP), Calhoun County, Illinois

Jeffrey D. Kruchten
State Historic Preservation Office – IDNR
Attn: Review & Compliance
1 Old State Capitol Plaza
Springfield, IL 62701

Dear Mr. Kruchten:

The U.S. Army Corps of Engineers, St. Louis District (District), is analyzing damages caused by the flood of 2019 to the Swan Lake Habitat Rehabilitation and Enhancement Project (HREP) and determine the next steps. The Swan Lake HREP is located along the Illinois River just north of its confluence with the Mississippi River in Calhoun County, Illinois (Figure 1). The District is contacting your office to initiate consultation for the above designated project under Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations (36 CFR 800).

The goal of the original Swan Lake HREP was to improve and enhance wetland habitat quality for both waterfowl and fish. In 1994, American Resources Group, Ltd (ARG) conducted a geomorphological and archaeological survey of 95 acres of the original Swan Lake HREP (Survey C-6731). The purpose of the geomorphological investigation was to determine the depth of the post-settlement alluvium (PSA) deposit. The survey concluded that the PSA deposit exceeded the maximum depth of construction in the majority of the project area. In eight areas, the construction limits were lower than the PSA deposit and archaeological surveys were performed. Construction of the original project was completed in 2003.

Since the completion of the Swan Lake HREP, multiple flood events have occurred in the area, including in 2019 which was the second highest recorded flood event. In 2021, a site visit to the Swan Lake project area was conducted to identify impacts caused by the multiple flood events. The site visit noted that the sediment deflection berm was holding sediment within the lake after overtopping, breaches within the sedimentation berm, excessive island erosion, cross dike damages and breaches, sedimentation in pumps leading to failures, and sedimentation of channels leading to pumps.

The District is reviewing two alternatives for the repair of the Swan Lake HREP: no action alternative and the repair with resiliency alternative. The no action alternative would result in no correctional repairs at the Swan Lake HREP. The repair with resiliency alternative is the recommended plan and it includes (Figure 2):

- Realign the northern sediment deflection berm tie-in at Fuller Lake.
- Place a road on top of the berm along Fuller Lake.
- Mechanical excavation of channel and inlets to pumpstation and pump bays.
- Eliminate the cross-dike spillway between Fuller Lake and Middle Swan Lake and the uncontrolled spillway by the Fuller Lake pumpstation.
- Elevate the Lower Swan Lake spillway to an elevation that allows sufficient back flooding capability, approximately one foot below berm height.
- Remove and replace the screw gate in cross-dike between Fuller Lake and Middle Swan Lake.
- Restore the cross-dike between Fuller Lake and Middle Swan Lake to as built conditions.
- Restore exterior sediment deflection berm to as built conditions with an interior 1:8 slope for added resiliency.
- Repair breaches in exterior sediment deflection berm.
- Riparian vegetative plantings for added resiliency of the exterior sediment deflection berm.

The repair with resiliency alternative is focused on repairing the damage while making slight alterations to the original design to ensure stability over the life of the project. Under this alternative, impacts to the intact ground surface will be limited to a 165,031 square meter (40.78 acre) agricultural field north of the northern sediment deflection berm (Figure 3). This field is a proposed borrow area and location of the realigned sediment deflection berm. The maximum depth of ground disturbance within this field will be approximately 46 centimeters (18 inches).

Before a cultural resource survey was to take place, the District wanted to determine if the maximum depth of ground disturbance would go below the PSA deposit. In 1994, ARG conducted seven soil cores within the current proposed borrow area (Figure 3). The survey revealed that the PSA deposit ranged between 50 and 190 centimeters (approximately 20 to 75 inches) below surface within the agricultural field (Table 1). No archaeological investigations were conducted because the PSA deposit was deeper than the proposed construction limit of 60 centimeters below surface. The final implementation of the original Swan Lake HREP did not utilize the field for borrow, as originally planned. Instead, the northern sediment deflection berm was constructed on top of the field.

On November 9, 2022, District archaeologists conducted a soil survey of the proposed borrow area and the area directly south of the sediment deflection berm. Eight soil probes were attempted to at least 50 centimeters (approximately 20 inches) below surface and two auger tests were conducted to 100 centimeters (about 39 inches) below surface (Figure 3; Table 2). The probes and augers revealed soil profiles consistent to those observed during the 1994 geomorphological survey, which indicates that the PSA deposit within the proposed borrow exceeds the maximum depth of ground disturbance (46 centimeters, 18 inches) for this proposed project.

Based upon the 1994 geomorphological survey and the current soil survey, it is the District's opinion that the proposed project will have no potential to cause effect on historic properties per 36 CFR 800.3(a)(1). If the proposed project plans are modified to include ground disturbing activities below 46 centimeters (18 inches), the District will reevaluate its determination. If human remains or unrecorded archaeological sites are found during ground disturbing activities, all work will be stopped, and the Illinois State Historic Preservation Office and consulting tribes will be notified prior to any further ground disturbance activities.

If you have any questions or comments, please contact Meredith Hawkins Trautt (Archaeologist and Tribal Liaison) at (314) 925-5031 or email Meredith.M.Trautt@usace.army.mil.

Respectfully,

Jennifer L. Riordan
Chief, Curation and Archives
Analysis Branch

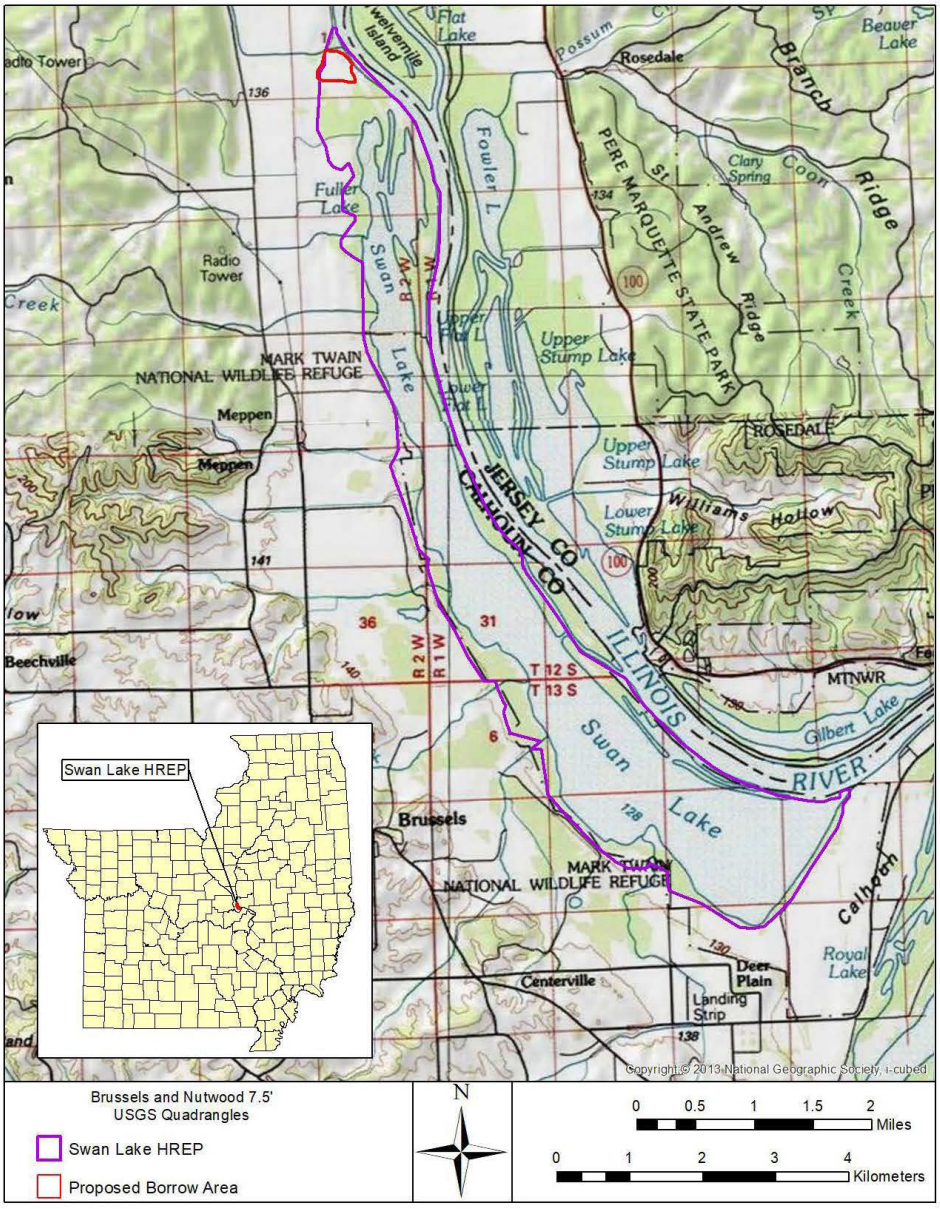

Figure 1: Location Map of Swan Lake Project Area

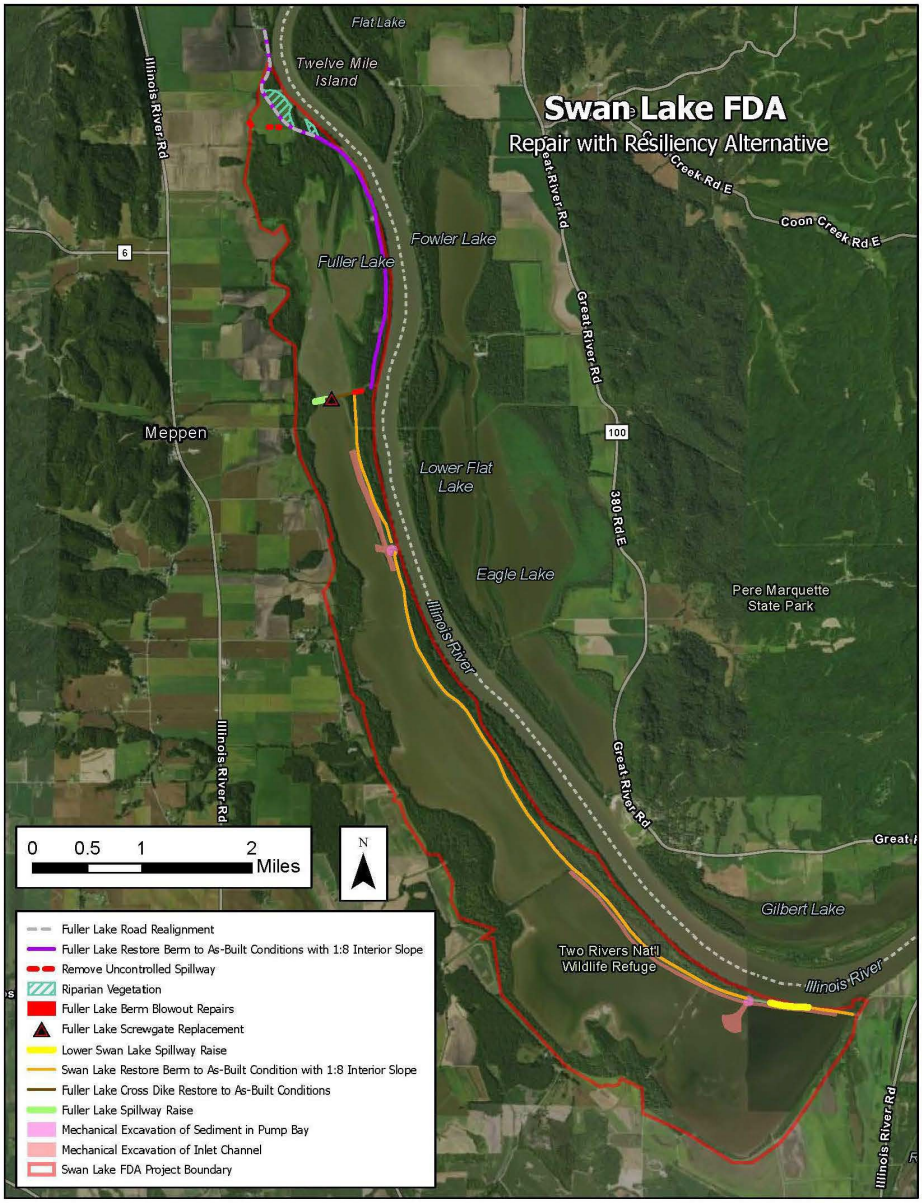

Figure 2: Map showing Repair with Resiliency Alternative

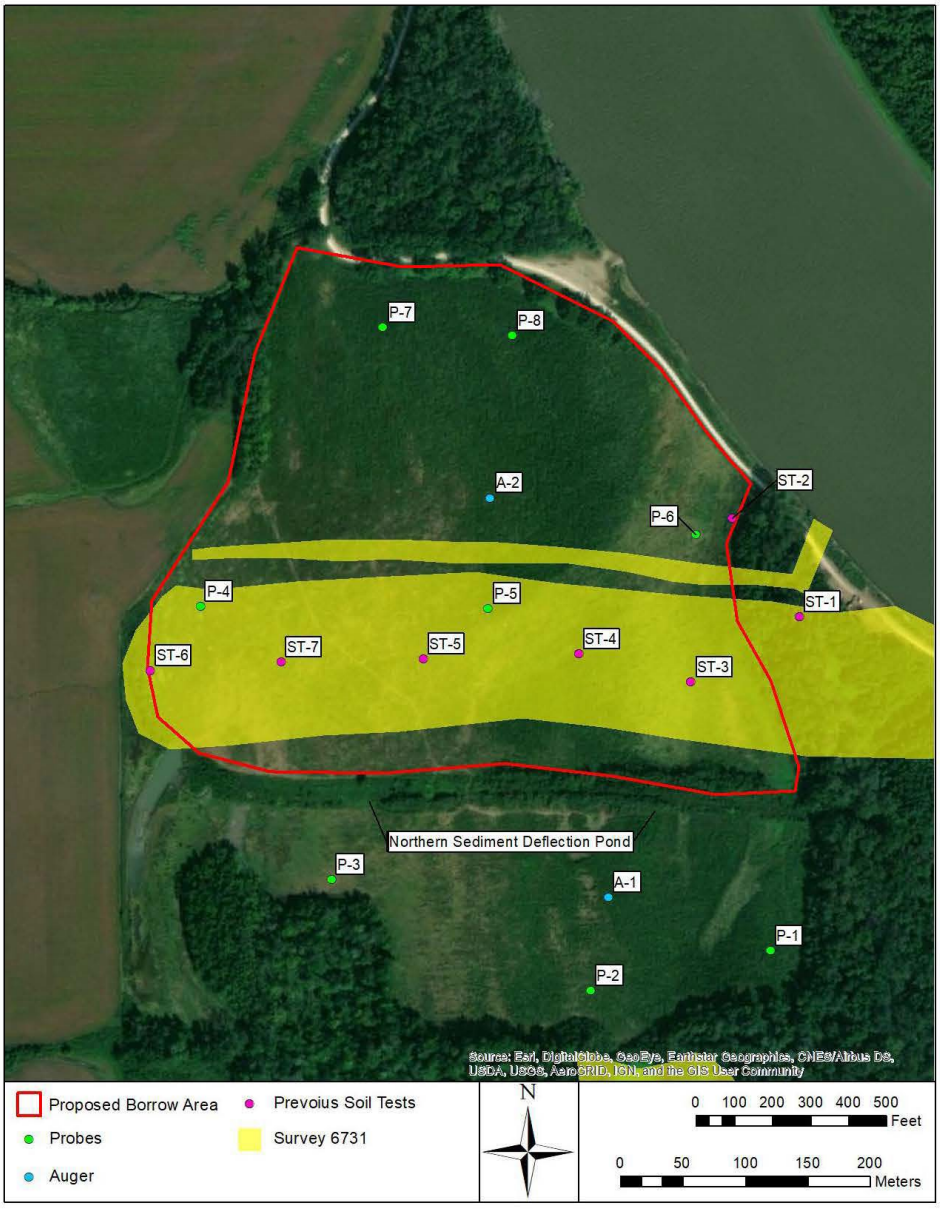

Figure 3: Sketch Map

Table 1: ARG's 1994 Soil Cores within the Proposed Borrow Area*
(McNerney et al. 1995, Appendix B)

Probe	Depth of Construction Impact (cm)	Depth of PSA Deposit (cm)	Soil Description
ST-1	60	190	10YR 4/4-3/3; silt loam and loam; massive; friable, PSA flood laminae; few fine faint mottles below 50cm; some units leached others unleached; abrupt smooth
ST-2	60	90	10YR4/4-3/3-3/2; silt loam and loam; weak medium platy to massive; friable; PSA flood laminae; few to common fine roots; some units leached others unleached; abrupt smooth
ST-3	60	100	10YR 4/4-3/3-2/2; silt loam; weak medium granular and weak medium subangular blocky, friable; PSA flood laminate; many fine roots and root holes; both leached and unleached laminae; abrupt smooth
ST-4	60	85	10YR 4/4-3/3-2/2 silt loam; weak medium platy to massive friable; PSA flood laminae; many fine roots and root holes; both leached and unleached laminea; abrupt smooth
ST-5	60	70	10YR 4/4-3/3-2/2 silt loam; weak medium granular to massive friable; PSA flood laminae; many fine roots and root holes; both leached and unleached laminae; abrupt smooth
ST-6	60	50	10YR 2/2; silt loam to silty clay loam; weak medium granular to massive; friable; both leached and unleached units; abrupt smooth
ST-7	60	80	10YR 4/4-2/2; silt loam; weak medium granular to massive, friable; PSA flood laminae; many fine roots and root holes; both leached and unleached laminae; abrupt smooth

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Illinois Department of
Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

JB Pritzker, Governor
Colleen Callahan, Director

Calhoun County PLEASE REFER TO: SHPO LOG #002121222
Meppen
East of Illinois River Road
COESTL
Habitat rehabilitation & enhancement - Swan Lake

January 9, 2023

Meredith Hawkins Trautt
Dept. of the Army-U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, MO 63103

Dear Ms. Trautt:

We have reviewed the documentation submitted for the referenced project(s) in accordance with 36 CFR Part 800.4. Based upon the information provided, no historic properties are affected. We, therefore, have no objection to the undertaking proceeding as planned.

Please retain this letter in your files as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended. This clearance remains in effect for two (2) years from date of issuance. It does not pertain to any discovery during construction, nor is it a clearance for purposes of the Illinois Human Skeletal Remains Protection Act (20 ILCS 3440).

If you are an applicant, please submit a copy of this letter to the state or federal agency from which you obtain any permit, license, grant, or other assistance. If further assistance is needed contact Jeff Kruchten, Chief Archaeologist at 217/785-1279 or Jeffery.kruchten@illinois.gov.

Sincerely,

Carey L. Mayer

Carey L. Mayer , AIA
Deputy State Historic
Preservation Officer

Tribal Letter

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

December 8, 2022

Engineering and Construction Division
Curation and Archives Analysis Branch (ECZ)

SUBJECT: Swan Lake Habitat Rehabilitation and Enhancement Project (HREP), Calhoun County, Illinois

Ms. Devon Frazier Smith
Tribal Historic Preservation Officer
Absentee-Shawnee Tribe of Indians of Oklahoma
2025 S. Gordon Cooper Drive
Shawnee, OK 74801

Dear Ms. Frazier Smith,

The U.S. Army Corps of Engineers, St. Louis District (District), is analyzing damages caused by the flood of 2019 to the Swan Lake Habitat Rehabilitation and Enhancement Project (HREP) and determine the next steps. The Swan Lake HREP is located along the Illinois River just north of its confluence with the Mississippi River in Calhoun County, Illinois (Figure 1). The District is contacting your tribe to initiate consultation for the above designated project under Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations (36 CFR 800).

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Based upon the 1994 geomorphological survey and the current soil survey, it is the District's opinion that the proposed project will have no potential to cause effect on historic properties per 36 CFR 800.3(a)(1). If the proposed project plans are modified to include ground disturbing activities below 46 centimeters (18 inches), the District will reevaluate its determination. If human remains or unrecorded archaeological sites are found during ground disturbing activities, all work will be stopped, and the Illinois State Historic Preservation Office and consulting tribes will be notified prior to any further ground disturbance activities.

If your tribe has any questions, comments, or areas of tribal concern please contact me at (314) 331-8855 or Meredith Hawkins Trautt (Archaeologist and Tribal Liaison) at (314) 925-5031 or Meredith.M.Trautt@usace.army.mil.

Respectfully,

SIGNED

Jennifer L. Riordan
Chief, Curation and Archives
Analysis Branch

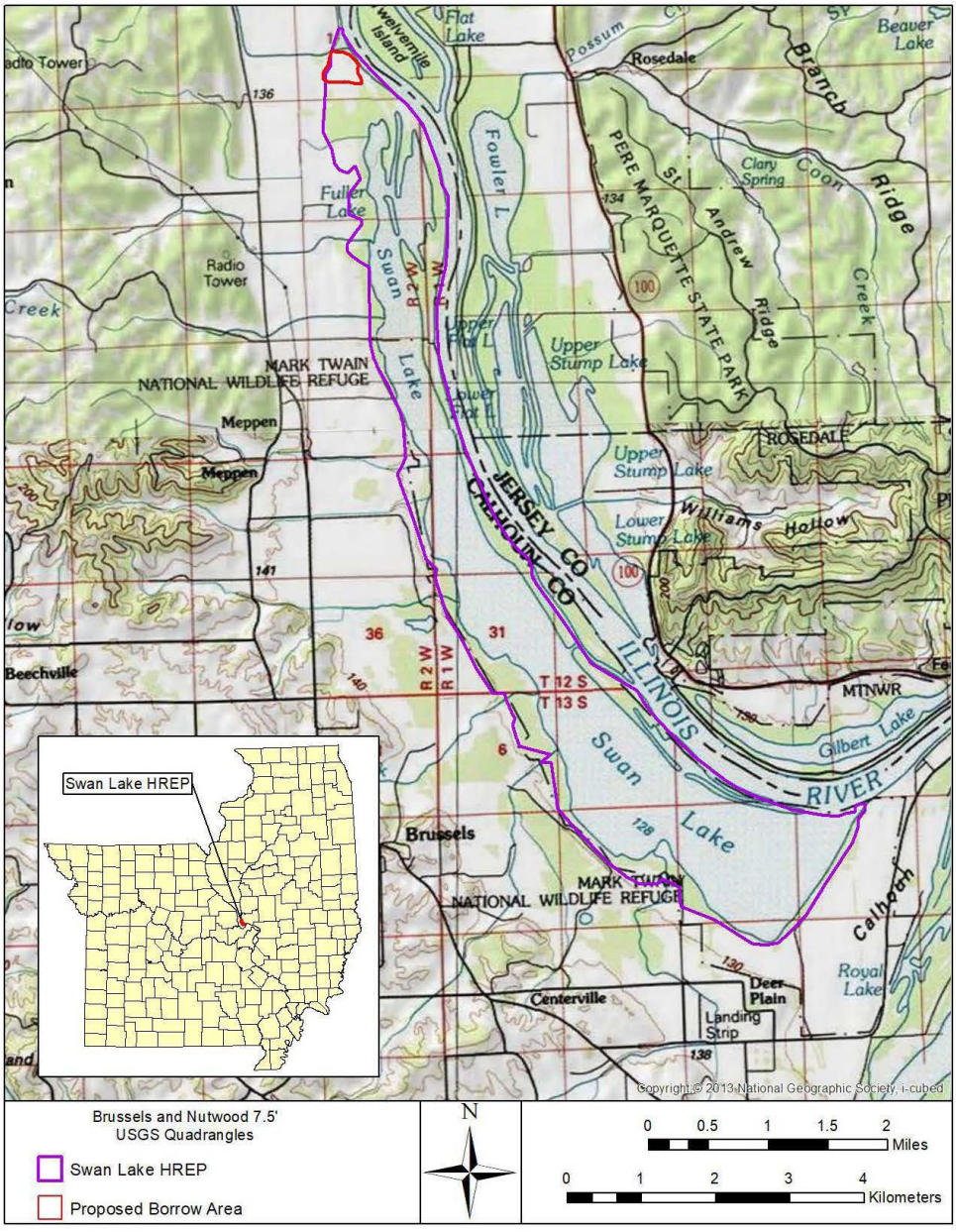


Figure 1: Location Map of Swan Lake Project Area

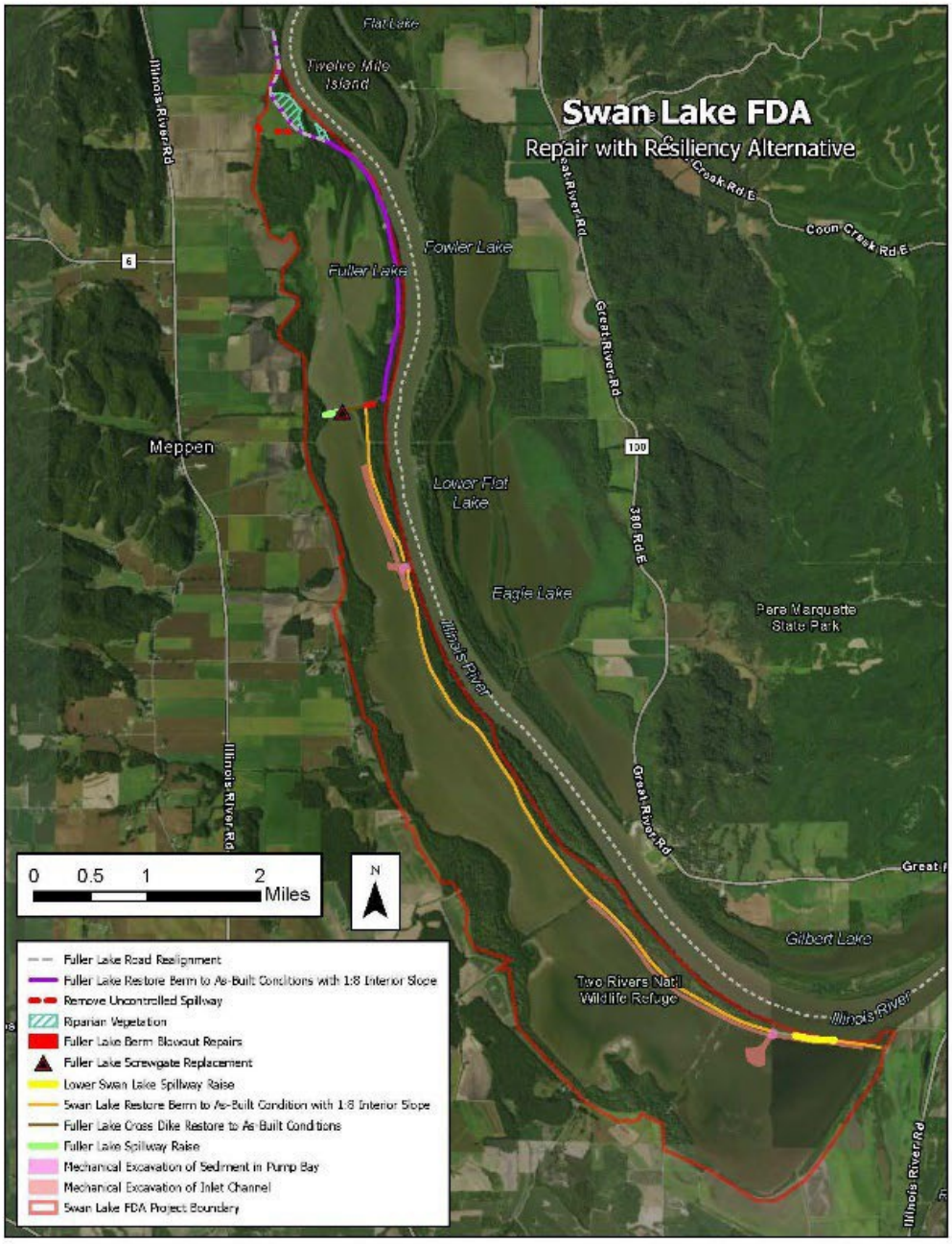


Figure 2: Map showing Repair with Resiliency Alternative

Table B- 1: MVS Leaders

Name (First, Middle, Last)	Last Name	Street Address	Street Address 2	City	State	Zipcode	Furnished Copy
John Raymond Johnson c/o Representative Alicia Miller	Johnson	2025 S. Gordon Cooper Drive		Shawnee	OK	74801	Ms. Carol Butler and Ms. Devon Frazier Smith
Bobby Gonzalez	Gonzalez	P.O. Box 487		Binger	OK	73009	Mr. Jonathan M. Rohrer
John Barrett	Barrett	1601 S. Gordon Cooper Drive		Shawnee	OK	74801	Ms. Tracy Wind
Deborah Dotson	Dotson	P.O. Box 825		Anadarko	OK	73005	Ms. Carissa Speck
Brad KillsCrow	KillsCrow	5100 Tuxedo Boulevard		Bartlesville	OK	74006	Mr. Larry Heady
Glenna J. Wallace	Wallace	12755 S. 705 Road		Wyandotte	OK	74370	Mr. Paul Barton
Ned Daniels, Jr.	Daniels	P.O. Box 340		Crandon	WI	54520	Mr. Benjamin Rhodd
Kenneth Meshigaud	Meshigaud	N 14911 Hannahville B-1 Road		Wilson	MI	49896	Mr. Earl Meshigaud
Marlon White Eagle	White Eagle	P.O. Box 667		Black River Falls	WI	54615	Mr. William Quackenbush
Tim Rhodd	Rhodd	3345 Thrasher Road, #8		White Cloud	KS	66094	Mr. Lance Foster and Mr. Alan Kelley
Edgar B. Kent, Jr.	Kent	335588 E. 750 Rd		Perkins	OK	74059	Ms. Candace Pershall
Lester Randall	Randall	824 111th Drive		Horton	KS	66439	Ms. Johanna Thomas
Darwin Kaskaske	Kaskaske	105365 S. Hwy 102		McCloud	OK	74851	Ms. Kay Rhoads
Bob Peters	Peters	2872 Mission Dr.		Shelbyville	MI	49344	Ms. Lakota Hobia
Gunnar Peters	Peters	W2908 Tribal Office Loop Road	P.O. Box 910	Keshena	WI	54135	Mr. David Grignon
Douglas Lankford	Lankford	P.O. Box 1326		Miami	OK	74355	Ms. Diane Hunter
Jamie Stuck	Stuck	2221—1 & 1/2 Mile Road		Fulton	MI	49052	Mr. Douglas R. Taylor
Craig Harper	Harper	P.O. Box 1527		Miami	OK	74355	Ms. Charla EchoHawk
Rebecca J. Richards	Richards	P.O. Box 180		Dowagiac	MI	49047	Mr. Matthew Bussler
Joseph Rupnick	Rupnick	Government Center	16281 Q Road	Mayetta	KS	66509	Ms. Tara Mitchell
Tiauna Carnes	Carnes	305 N. Main Street		Reserve	KS	66434	Mr. Gary Bahr
Justin F. Woods	Woods	920963 S Highway 99	Building A	Stroud	OK	74079	Mr. Chris Boyd
Vern Jefferson	Jefferson	349 Meskwaki Road		Tama	IA	52339	Mr. Johnathan Buffalo
Benjamin Barnes	Barnes	29 S Hwy 69A		Miami	OK	74354	Ms. Tonya Tipton
Geoffrey Standing Bear	Standing Bear	P.O. Box 779		Pawhuska	OK	74056	Dr. Andrea Hunter
Joseph Byrd	Byrd	P.O. Box 765		Quapaw	OK	74363	Mr. Everett Bandy
Joe Bunch	Bunch	P.O. Box 746		Tahlequah	OK	74464	Mr. Acee Watt

Table B- 2: MVS Reps

Tribe	Name (First, Middle, Last)	Position	Street Address	Street Address 2	City	State	Zipcode	Email
Absentee-Shawnee Tribe of Indians of Oklahoma	Devon Frazier Smith	Tribal Historic Preservation Officer	2025 S. Gordon Cooper Drive		Shawnee	OK	74801	dfrazier@astribe.com
Absentee-Shawnee Tribe of Indians of Oklahoma	Carol Butler	Cultural Preservation Director	2025 S. Gordon Cooper Drive		Shawnee	OK	74801	cbutler@astribe.com
Caddo Nation of Oklahoma	Jonathan M. Rohrer	Tribal Historic Preservation Officer	P.O. Box 487		Binger	OK	73009	jrohrer@mycaddonation.com
Citizen Potawatomi Nation, Oklahoma	Tracy Wind	Assistant Tribal Historic Preservation Officer	Cultural Heritage Center	1601 S. Gordon Cooper Drive	Shawnee	OK	74801	tracy.wind@potawatomi.org; cpnthpo@potawatomi.org
Eastern Shawnee Tribe of Oklahoma	Paul Barton	Tribal Historic Preservation Officer	70500 E. 128 Road		Wyandotte	OK	74370	pbarton@estoo.net
Forest County Potawatomi Community, Wisconsin	Benjamin Rhodd	Tribal Historic Preservation Officer	8130 Mish ko Swen Dr.	P.O. Box 340	Crandon	WI	54520	Benjamin.Rhodd@fcp-nsn.gov
Hannahville Indian Community, Michigan	Earl Meshigaud	Historic Preservation Office	P.O. Box 351, Highway 2 & 41		Harris	MI	49845	earlmeshigaud@hannahville.org
Ho-Chunk Nation of Wisconsin	William Quackenbush	Tribal Historic Preservation Officer	P.O. Box 667		Black River Falls	WI	54615	bill.quackenbush@ho-chunk.com
Iowa Tribe of Kansas and Nebraska	Lance Foster	Tribal Historic Preservation Officer	3345B Thrasher Road		White Cloud	KS	66094	lfoster@iowas.org
Iowa Tribe of Kansas and Nebraska	Alan Kelley	Deputy Tribal Historic Preservaiton Officer	3345 Thrasher Road		White Cloud	KS	66094	akelley@iowas.org
Iowa Tribe of Oklahoma	Candace Pershall	Cultural Preservation	335588 E. 750 Rd		Perkins	OK	74875	cpershall@iowanation.org
Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas	Johanna Thomas	Vice Chairman	824 111th Drive		Horton	KS	66439	johannathomas83@yahoo.com
Kickapoo Tribe of Oklahoma	Kay Rhoads	OSG Director/NAGPRA Representatives	P.O. Box 70	105365 S. Hwy 102	McCloud	OK	74851	kay.rhoads@okkt.net; cc pamwesley@okkt.net
Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians	Lakota Hobia	Tribal Historic Preservation Officer	2872 Mission Drive		Shelbyville	MI	49344	Lakota.Hobia@glt-nsn.gov; mbpi_thpo@glt-nsn.gov
Menominee Indian Tribe of Wisconsin	David Grignon	Tribal Historic Preservation Officer	P.O. Box 910		Keshena	WI	54135	dgrignon@mitw.org
Miami Tribe of Oklahoma	Diane Hunter	Tribal Historic Preservation Officer	202 S. Eight Tribes Trail	P.O. Box 1326	Miami	OK	74355	dhunter@miamination.com
Nottawaseppi Huron Band of the Potawatomi, Michigan	Douglas R. Taylor	Tribal Historic Preservation Officer	1485 MNO--Bmadzen Way		Fulton	MI	49052	Douglas.Taylor@nhbp-nsn.gov
Peoria Tribe of Indians of Oklahoma	Charla EchoHawk	Director of Cultural Preservation	118 S. Eight Tribes Trail		Miami	OK	74354	cechohawk@peoriatribe.com
Pokagon Band of Potawatomi Indians, Michigan and Indiana	Matthew Bussler	Tribal Historic Preservation Officer	P.O. Box 180		Dowagiac	MI	49047	matthew.bussler@pokagonband-nsn.gov
Prairie Band Potawatomi Nation	Tara Mitchell	Deputy Tribal Historic Preservation Officer	Government Center	16281 Q Road	Mayetta	KS	66509	taramitchell@pbpnation.org
Sac & Fox Nation of Missouri in Kansas and Nebraska	Gary Bahr	Vice Chairperson	305 N. Main Street		Reserve	KS	66434	gary.bahr@sacfoxks.com
Sac & Fox Nation, Oklahoma	Chris Boyd	NAGPRA/Historic Preservation Office	920963 S Highway 99	Building A	Stroud	OK	74079	chris.boyd@sacandfoxnation-nsn.gov
Sac & Fox Tribe of the Mississippi in Iowa	Johnathan Buffalo	Historic Preservation Office	349 Meskwaki Road		Tama	IA	52339	sp.historical@meskwaki-nsn.gov
Shawnee Tribe	Tonya Tipton	Historic Preservation Office	P.O. Box 189		Miami	OK	74355	Correspondence to: Section106@shawnee-tribe.com; tonya@shawnee-tribe.com
The Osage Nation	Andrea Hunter	Historic Preservation Office	627 Grandview Avenue		Pawhuska	OK	74056	s106@osagenation-nsn.gov
Quapaw Nation	Everett Bandy	Tribal Historic Preservation Officer	ATTN: QNHPP	P.O. Box 765	Quapaw	OK	74363	ebandy@quapawnation.com
United Keetoowah Band of Cherokee of	Acee Watt	Tribal Historic Preservation Officer	P.O. Box 746		Tahlequah	OK	74464	awatt@ukb-nsn.gov; ukbthpo@ukb-nsn.gov

US Army Corps of Engineers®

Appendix C: FONSI & Environmental

Prepared By:
US Army Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103
December 2022

FONSI

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
1222 SPRUCE STREET
SAINT LOUIS, MO 63103

Regional Planning and Environmental Division - North

FINDING OF NO SIGNIFICANT IMPACT

Swan Lake Flood Damage Assessment
Upper Mississippi River Restoration Program

The U.S. Army Corps of Engineers, St. Louis District (Corps) has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The final integrated Letter Report and Environmental Assessment (LR/EA), dated December 2022, for the Swan Lake Flood Damage Assessment (FDA) addresses repairs needed to meet project objectives, opportunities, and feasibility in the Alton Pool, Upper Mississippi River, Calhoun County, Illinois.

The Final LR/EA, incorporated herein by reference, evaluated various alternatives that would make the necessary repairs to the Swan Lake HREP to maintain and improve resting and feeding habitat for migratory birds in the study area. The recommended plan is the Repair with Resiliency Alternative and includes:

- Realign the northern sediment deflection berm tie-in at Fuller Lake
- Place road on top of berm along Fuller Lake
- Excavation of channel and inlets to pump stations and pump bays
- Eliminate the cross dike spillway between Fuller Lake and Middle Swan Lake and the uncontrolled spillway by the Fuller Lake pumpstation
- Elevate the Lower Swan Lake spillway to an elevation that allows sufficient back flooding capability, approximately one foot below berm height
- Remove and replace screw gate in cross dike between Fuller Lake and Middle Swan Lake
- Restore the cross dike between Fuller Lake and Middle Swan Lake to as-built conditions
- Restore exterior sediment deflection berm to as-built conditions with an interior 1:8 slope for added resiliency
- Repair breaches in exterior sediment deflection berm
- Add riparian vegetative plantings for additional resiliency of the exterior sediment

deflection berm

In addition to a "no action" plan, one alternative was evaluated in detail. Other repair options, with varying project features and alignments were initially identified, but were dismissed for critical deficiencies as described in Section 3 of the LR/EA. A limited repair would not be cost effective and result in an incomplete system.

For all alternatives evaluated in detail, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan are listed in Table 1:

Table 1: Summary of Potential Effects of the Recommended Plan.

*denotes a temporary effect.

	No Action Alternative							**Repair Alternative**						
	BENEFICIAL				ADVERSE			BENEFICIAL				ADVERSE		
PARAMETER	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR	SUBSTANTIAL	SIGNIFICANT	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR*	SUBSTANTIAL	SIGNIFICANT
A. SOCIAL AND ECONOMIC EFFECTS														
1. Noise Levels				**X**								**T**		
2. Aesthetic Values				**X**							**X**	**T**		
3. Recreation						**X**				**X**		**T**		
4. Business Activities					**X**					**X**				
5. Cumulative Impacts						**X**					**X**			
6. Environmental Justice				**X**							**X**			
C. NATURAL RESOURCE EFFECTS														
1. Air Quality				**X**								**T**		
2. Water Quality					**X**					**X**		**T**		
3. Wetlands/Aquatic Habitat						**X**				**X**		**T**		
4. Floodplain Forest				**X**						**X**		**T**		
5. Wildlife					**X**					**X**		**T**		

	No Action Alternative							**Repair Alternative**						
	BENEFICIAL				ADVERSE			BENEFICIAL				ADVERSE		
PARAMETER	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR	SUBSTANTIAL	SIGNIFICANT	SIGNIFICANT	SUBSTANTIAL	MINOR	NO EFFECT	MINOR*	SUBSTANTIAL	SIGNIFICANT
6. Threatened or Endangered Species					**X**					**X**		**T**		
D. CULTURAL RESOURCE EFFECTS														
1. Historic Architectural Values				**X**							**X**			
2. Prehistoric & Historic Archeological Values				**X**							**X**			

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the LR/EA will be implemented, if appropriate, to minimize impacts.

No compensatory mitigation is required as part of the recommended plan.

Public review of the draft LR/EA and FONSI was completed on January XX, 2023. There were no public comments submitted during the public review period. A 30-day state and agency review of the draft IFR/EA was also completed on February XX, 2023. The _____ provided comments which have been addressed in the final LR/EA.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, USACE has determined that the recommended plan may affect, but is not likely to adversely affect federally listed species or their designated critical habitat. USFWS concurred with this determination and provided their comments in a letter dated January XX, 2023.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, USACE has determined that the recommended plan has no potential to cause adverse effects on historic properties.

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) guidelines evaluation

has been completed as part of Nationwide Permit 27 (NWP 27) for which the proposed project qualifies.

A water quality certification pursuant to section 401 of the Clean Water Act was issued as part of NWP 27. All conditions of the water quality certification shall be implemented in order to minimize adverse impacts to water quality.

All applicable environmental laws have been considered and coordination with appropriate agencies and officials has been completed.

Technical, environmental, and cost effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the recommended plan would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date:_____

Jonathan J. Sobiech
Deputy Chief
Regional Planning and Environmental
Division - North

Compliance with Applicable Environmental Laws and Regulations:

This section provides documentation of how the proposed action complies with applicable federal environmental laws, statutes, and executive orders. Major environmental compliance regulations and status of compliance are described below followed by a table (Table C- 1) showing the status of a compliance review with the applicable environmental regulations and guidelines.

National Environmental Policy Act of 1969

The National Environmental Policy Act of 1969 as amended (NEPA) (42 U.S.C. § 4321 *et seq*.) commits federal agencies to considering, documenting, and publicly disclosing the environmental effects of their actions. This letter report has been prepared in compliance with NEPA, the Council on Environmental Quality (CEQ) regulations, and USACE planning regulations. All agency and public comments have been considered and evaluated. A signed Finding of No Significant Impact (FONSI) concludes no significant impacts from this proposed action. The signed FONSI is provided at the beginning of this appendix (Appendix C). The project is in compliance with NEPA.

Endangered Species Act of 1973

The Endangered Species Act as amended (ESA) of 1973 (16 U.S.C. § 1531–1544), Section 7(a) requires that federal agencies consult with National Marine Fisheries Service (NMFS) and USFWS, as appropriate, to ensure proposed actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their critical habitats.

USACE has determined that the proposed action may affect but is not likely to adversely affect two listed bat species, one proposed bat species, and one listed plant species. Upon completion of the public review period, USFWS and USACE will coordinate to complete consultation under Section 7 of the ESA, therefore the project is currently in compliance with the ESA.

Clean Water Act of 1972

The Clean Water Act of 1972 (33 U.S.C. § 1251 *et seq.;* CWA) requires federal agencies to protect waters of the United States. The regulation implementing the Act disallows the placement of dredged or fill material into water unless it can be demonstrated there are no practical alternatives that are less environmentally damaging. CWA Sections 404 (discharges of dredged and fill material in waters of the US) and 401 (discharges to waterways) apply to the proposed action. USACE has determined that the proposed action is in compliance with the CWA. Additional details on the two applicable sections of the CWA follow.

Section 404

To comply with Section 404, it is necessary to avoid negative effects to waters of the United States wherever practicable, minimize effects where they are unavoidable, and compensate for effects in some cases.

USACE has determined that the proposed action would have no more than minor adverse effects to jurisdictional waters of the U.S. The proposed action is in compliance with work authorized under CWA Section 404 of the 2021 Nationwide Permits (NWP), specifically NWP 27, Aquatic Habitat Restoration, Establishment, and Enhancement Activities. NWP 27 authorizes the restoration, enhancement, and establishment of tidal and non-tidal wetlands and riparian areas, the restoration and enhancement of non- tidal streams and other non-tidal open waters, and the rehabilitation or enhancement of tidal streams, tidal wetlands, and tidal open waters, provided those activities result in net increases in aquatic resource functions and services. A copy of this will be provided in the project specifications.

Section 401
Any project that involves placing dredged or fill material in waters of the United States requires a water quality certification from the state or tribal agency, as delegated by EPA. IDNR issued a 401 Certification for work authorized by NWP 27 on 21 December 2021, and it remains valid through the expiration of the 2021 NWPs (14 March 2026), unless revoked or extended. A copy of this will be provided in the project specifications.

Clean Air Act of 1972

The Clean Air Act of 1963 (CAA), as amended (42 U.S.C. § 7401, *et seq*.) prohibits federal agencies from approving any action that does not conform to an approved state, tribal, or federal implementation plan. Under the CAA General Conformity Rule (Section 176(c)(4)), federal agencies are prohibited from approving any action that causes or contributes to a violation of the National Ambient Air Quality Standards (NAAQS) in a nonattainment area.

USACE has determined that the proposed action would have minor, but temporary effects on air and therefore, is in compliance with the CAA.

National Historic Preservation Act of 1966

Section 106 of the National Historic Preservation Act of 1966 as amended (NHPA; 54 U.S.C. § 306108) requires federal agencies to account for the indirect, direct, and cumulative effects of their undertakings on historic properties (i.e., archaeological sites, traditional cultural properties, buildings, structures, objects, districts, and landscapes listed in or eligible for listing in the National Register of Historic Places). Section 106 and its implementing regulations at 36 CFR Part 800 establish procedures for federal agencies to follow in identifying historic properties and assessing and resolving effects of their undertaking on them in consultation with State Historic Preservation Office, Indian tribes, Native Hawaiians, and the Advisory Council for Historic Preservation, as appropriate.

USACE has determined that the proposed action would have no effect on historic properties and therefore, is compliant with the NHPA.

Fish and Wildlife Coordination Act of 1934

The Fish and Wildlife Coordination Act of 1934 as amended (16 U.S.C. §§ 661–667e) (FWCA) ensures fish and wildlife conservation receives equal consideration and be coordinated with other features of water-resource development programs. This law provides that whenever any water body is proposed to be impounded, diverted, deepened or otherwise controlled or modified, USACE shall consult with the USFWS and NMFS as appropriate, and the agency administering the wildlife resources of the state. Any reports and recommendations of the wildlife agencies shall be included in authorization documents for construction or modification of projects. Recommendations provided by the USFWS in Coordination Act Reports must be specifically addressed in USACE feasibility reports.

USACE has completed coordination with the USFWS and other agencies on the proposed action (Appendix D). No substantive issues were identified. USACE is compliance with the FWCA.

Bald and Golden Eagle Protection Act of 1940

The Bald and Golden Eagle Protection Act of 1940, as amended (BGEPA) (16 U.S.C. §§ 668–668c) applies to USACE Civil Works projects through the protection of bald and golden eagles from disturbance. The plans and specifications for the repairs include provisions for maintaining a 660-foot buffer of known nests in the project area during the nesting season. USACE has determined that the proposed action would have no effect on bald or golden eagles and therefore, is in compliance with the BGEPA.

Migratory Bird Treaty Act of 1918 and Executive Order 13186 Migratory Bird Habitat Protection

The Migratory Bird Treaty Act of 1918 (16 U.S.C. § 703–712), as amended (MBTA) protects over 800 bird species and their habitats and commits that the U.S. will take measures to protect identified ecosystems of special importance to migratory birds against pollution, detrimental alterations, and other environmental degradations. Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds (January 10, 2001) directs federal agencies to evaluate the effects of their actions on migratory birds, with emphasis on species of concern, and inform the USFWS of potential negative effects to migratory birds.

USACE has determined that the proposed action would have overall beneficial effects on migratory birds and therefore, is in compliance with the MBTA.

Watershed Protection and Flood Prevention Act of 1954

The Watershed Protection and Flood Prevention Act of 1954 (WPFPA) protects watersheds from erosion, sedimentation, and flooding. Under WPFPA, federal agencies work with local organizations to develop and implement flood control and watershed runoff plans.

USACE has determined that the proposed action would lessen the effects on erosion and sedimentation within the project area and would have a minimal effect on flooding. Therefore, it is in compliance with the WPFPA.

Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175 (November 6, 2000) reaffirmed the federal government's commitment to a government-to-government relationship with Indian tribes and directed federal agencies to establish procedures to consult and collaborate with tribal governments when new agency regulations would have tribal implications.

USACE consulted with 25 federally recognized Indian tribes that have an interest within this portion of USACE's area of responsibility. Therefore, the proposed action is in compliance with EO 13175.

Executive Order 12898: Environmental Justice

Environmental justice is defined as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The EPA further defines fair treatment to mean that no group of people should bear a disproportionate share of the negative environmental consequences of industrial, governmental, or commercial operations or policies.

Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 16, 1994) provides that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Environmental justice concerns may arise from impacts on the natural and physical environment, such as human health or ecological impacts on minority populations, low-income populations, and Indian tribes or from related social or economic impacts.

The proposed action is not anticipated to affect environmental justice. The proposed action is in compliance with Executive Order 12898.

Executive Order 11988: Floodplain Management

Executive Order 11988 (May 24, 1977) directs all federal agencies to avoid development and other activities in the floodplain. USACE has determined that the proposed action would have no effect on development in the floodplain and therefore, is in compliance with EO 11988.

Executive Order 11990: Protection of Wetlands

Executive Order 11990 (May 24, 1977) requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this EO.

USACE has determined that the proposed action would have no net adverse effect on wetlands. Overall, the project would improve wetland habitat. Therefore, the project is in compliance with EO 11990.

Executive Order 11593: Protection and Enhancement of the Cultural Environment

Executive Order 11593 (May 13, 1971) states the federal government shall provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation.

Federal agencies shall administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural, or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people, and, in consultation with the Advisory Council on Historic Preservation , institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural, or archaeological significance.

The recommended alternative will not adversely affect cultural resources as compared to the current condition. The recommended alternative is in full compliance with EO 11593.

Table C- 1: Compliance Review with Applicable Environmental Regulations and Guidelines

Environmental Requirement	**Compliance[1]**
Federal Statutes	
National Historic Preservation Act of 1966, as amended	Full
Bald and Golden Eagle Protection Act of 1940, as amended	Full
Clean Air Act of 1972, as amended	Full
Clean Water Act of 1972, as amended	Full
Coastal Zone Management Act, as amended	N/A
Endangered Species Act of 1973, as amended	Full
Farmland Protection Policy Act of 1981	N/A
Federal Water Project Recreation Act, as amended	Full
Fish and Wildlife Coordination Act of 1934, as amended	Full
Land and Water Conservation Fund Act of 1965, as amended	Full
Migratory Bird Treaty Act of 1918, as amended	Full
National Environmental Policy Act of 1969, as amended	Full
National Historic Preservation Act of 1966, as amended	Full
National Wildlife Refuge Administration Act of 1966	Full
Noise Pollution and Abatement Act of 1972	Full
Watershed Protection and Flood Prevention Act of 1954	Full
Wild and Scenic Rivers Act of 1968, as amended	N/A
Executive Orders, Memoranda	
Floodplain Management (EO 11988)	Full
Safeguarding the Nation from the Impacts of Invasive Species (EO	Full
Protection and Enhancement of Environmental Quality (EO 11514)	Full
Protection and Enhancement of the Cultural Environment (EO 11593)	Full

Protection of Wetlands (EO 11990)	Full
Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 30 Aug 1976)	Full
Environmental Justice (EO 12898)	Full

1 The compliance categories used in this table were assigned according to the following definitions:

a. Full – All requirements of the statute, EO.
b. Partial – Additional processes are needed to gain full compliance.
c. N/A – Not applicable.

Evaluation of Habitat Benefits

Background:

The Swan Lake FDA analysis of habitat benefits used USFWS's Habitat Evaluation Procedure (HEP) across the project area (Table C- 2). The original HREP utilized the Aquatic Habitat Appraisal Guide (AHAG) (O'Neil, 1985) and the Missouri Wildlife Habitat Appraisal Guide (WHAG) (Baskett et al., 1980) habitat models for assessment of habitat quality in a comparison of Swan Lake with project features against Swan Lake in the future without project conditions.

Presently, the AHAG and WHAG models are no longer approved for use in the USACE planning process and would need to undergo a one-time use approval to be utilized in this FDA effort. Also, as previously mentioned, Swan Lake has shifted management focus from fisheries and waterfowl to a more dominant focus on waterfowl; therefore, rather than seeking approval to use the same models as the original project for this effort, the Dabbling Duck Migration Model (Devendorf, 2013) was utilized, which was developed using the basic tenets of the WHAG model and is currently certified for use by USACE. With that shift in management focus and modeling effort, the comparison of benefits in this effort will also be restricted to waterfowl habitat units.

Table C- 2: Comparison of AAHUs from Original Project to 2022 Recommended Plan

1991 DPR	**No Action Alternative (Baseline)**	**Selected Plan**
	Waterfowl	Waterfowl
AAHU	690	1,711

2022 FDA	**No Action Alternative (FWOP)**			**Recommended Plan (Repair Alt)**		
	Fuller Lake	Middle Swan	Lower Swan	Fuller Lake	Middle Swan	Lower Swan
AAHU	122	293	397	201	459	623
Total AAHU	812			1,283		

Model Application:

Season:
This model was developed to evaluate fall migration habitat for dabbling ducks.

Project Lifespan and Target Years:
The HSI models were used to generate suitability index values for the two alternatives at target years over a total, 50-year project lifespan of the project. With the project completed in 2003, the target years (TYs) of 0, and 30 were used to extend out to the original project life in the year 2053.

HSI:
HSIs under FWOP, and Repair Alternative conditions are shown in comparison with the original HEP analysis for waterfowl (Table C- 3).

Acreages:
Acreage of the management units was calculated by H&H from gauge data of peak water levels in the fall. Boundary polygons were extracted at corresponding water levels to determine total acreage.

Average Annualized Habitat Units:
Habitat units were calculated using HSIs and acreages across target years for the model under both alternatives. Habitat units were annualized across the project lifespan following standard HEP protocol.

Assumptions:

- Distance to bottomland hardwoods, species composition and water availability (Parameter 1) and Distance to cropland and cropland practices (Parameter 2) were assumed to stay static across alternatives and time. No major shift in ag practices or hard mast tree composition is expected to change in abundance or distance to the project over the course of the project lifespan.
- Water depth of 4-18 inches in the fall (Parameter 3) was calculated using the same methodology for calculating acreage above. Polygons were constructed at ½ foot increments below expected peak pool levels. The acreages from the polygon at 18" below pool was subtracted from the polygon at 6" below pool to get an acreage that was divided over total pool acreage for a percentage of area that fell in the 4" to 18" range of water depth. It was assumed that the difference in the 4" band would be negligible from the 6" band, and resolution below the ½ foot increment level would have taken considerable extra effort from H&H.

- Water depth of <4inches in the fall (Parameter 4), was developed similarly to Parameter 3; such as the polygon constructed at 6" below pool was subtracted from full pool polygon acreage, then divided to estimate percentage of the area that fell within that water depth.
- Percent of open water (Parameter 5) relates to interspersion of open water and vegetation. This parameter input relied heavily on experience and knowledge of the area managers for Swan Lake (USFWS) and Fuller Lake (IDNR).
- Plant Community Diversity (Parameter 6) specifies number of plant communities present. This parameter input relied heavily on experience and knowledge of the area managers for Swan Lake (USFWS) and Fuller Lake (IDNR).
- Important food plant coverage (Variable 7) relates to vegetation that is considered important food sources to migrating waterfowl. This parameter input relied heavily on experience and knowledge of the area managers for Swan Lake (USFWS) and Fuller Lake (IDNR).
- Percent of area containing loafing structures (Parameter 8) relates to woody debris or vegetation that would provide loafing and resting areas to migrating waterfowl. This parameter input relied heavily on experience and knowledge of the area managers for Swan Lake (USFWS) and Fuller Lake (IDNR).
- Structure to provide thermal protection (Parameter 9), similar to parameter 8, relates to woody debris or vegetation that would provide wind barriers for resting areas to migrating waterfowl. This parameter input relied heavily on experience and knowledge of the area managers for Swan Lake (USFWS) and Fuller Lake (IDNR).
- Disturbance in the Fall (Parameter 10) relates to recreational use and management of the specific management areas. Fuller Lake allows for waterfowl hunting, which equates to a value of 1 in the model; whereas Swan Lake is managed as a refuge and only allows for minimal disturbance by refuge staff which equates to a value of 8 in the model. Neither of these values are expected to change over the life of the project.
- Visual barriers (Parameter 11), similar to parameters 8 and 9, relates to woody debris or vegetation that would provide visual barriers against disturbance for resting waterfowl. This parameter input relied heavily on experience and knowledge of the area managers for Swan Lake (USFWS) and Fuller Lake (IDNR).

Table C- 3: Summary Table from the Dabbling Duck Migration Model

Fuller Lake FWOP				
TY	Acres	x HSI	Cumulative HUs	Total HUs
0	461	0.28		
30	461	0.25	3660.882353	3660.882353
			AAHU's	122.0294118

Fuller Lake FWP-REPAIR ALT.				
TY	Acres	x HSI	Total HUs	Cumulative HUs
0	461	0.41		
30	461	0.46	6020.117647	6020.117647
			AAHU's	200.6705882

Middle Swan FWOP				
TY	Acres	x HSI	Total HUs	Cumulative HUs
0	976	0.33		
30	976	0.27	8784	8784
			AAHU's	292.8

Middle Swan FWP-REPAIR ALT.				
TY	Acres	x HSI	Total HUs	Cumulative HUs
0	976	0.45		
30	976	0.49	13778.82353	13778.82353
			AAHU's	459.2941176

Lower Swan FWOP				
TY	Acres	x HSI	Total HUs	Cumulative HUs
0	1325	0.33		
30	1325	0.27	11925	11925
			AAHU's	397.5
			Total AAHU	812.3294118

Lower Swan FWP-REPAIR ALT.				
TY	Acres	x HSI	Total HUs	Cumulative HUs
0	1325	0.45		
30	1325	0.49	18705.88235	18705.88235
			AAHU's	623.5294118
			Total AAHU	1283.494118

Federally Listed Species

Official Species List obtained through coordination with USFWS IPaC System

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Southern Illinois Sub-Office
Southern Illinois Sub-office
8588 Route 148
Marion, IL 62959-5822
Phone: (618) 998-5945
Email Address: Marion@fws.gov
https://www.fws.gov/office/illinois-iowa-ecological-services

In Reply Refer To:
Project Code: 2022-0085197
Project Name: Swan Lake HREP - Flood Damage Assessment

December 16, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat, if present, within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Under 50 CFR 402.12(e) (the regulations that implement Section 7 of the Endangered Species Act) **the accuracy of this species list should be verified after 90 days.** This verification can be completed formally or informally. You may verify the list by visiting the ECOSPHERE Information for Planning and Consultation (IPaC) website https://ipac.ecosphere.fws.gov at regular intervals during project planning and implementation and completing the same process you used to receive the attached list.

Section 7 Consultation

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the U.S. Fish and Wildlife Service (Service) if they determine their project "may affect" listed species or designated critical habitat. Under the ESA, it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action may affect endangered, threatened, or

proposed species, or designated critical habitat, and if so, to consult with the Service further. Similarly, it is the responsibility of the Federal action agency or project proponent, not the Service to make "no effect" determinations. If you determine that your proposed action will have no effect on threatened or endangered species or their respective designated critical habitat, you do not need to seek concurrence with the Service.

Note: For some species or projects, IPaC will present you with *Determination Keys*. You may be able to use one or more Determination Keys to conclude consultation on your action.

Technical Assistance for Listed Species

1. For assistance in determining if suitable habitat for listed, candidate, or proposed species occurs within your project area or if species may be affected by project activities, you can obtain information on the species life history, species status, current range, and other documents by selecting the species from the thumbnails or list view and visiting the species profile page.

No Effect Determinations for Listed Species

1. If there are *no* species or designated critical habitats on the Endangered Species portion of the species list: conclude "no species and no critical habitat present" and document your finding in your project records. No consultation under ESA section 7(a)(2) is required if the action would result in no effects to listed species or critical habitat. Maintain a copy of this letter and IPaC official species list for your records.

2. If any species or designated critical habitat are listed as potentially present in the **action area** of the proposed project the project proponents are responsible for determining if the proposed action will have "no effect" on any federally listed species or critical habitat. No effect, with respect to species, means that no individuals of a species will be exposed to any consequence of a federal action or that they will not respond to such exposure.

3. If the species habitat is not present within the action area or current data (surveys) for the species in the action area are negative: conclude "no species habitat or species present" and document your finding in your project records. For example, if the project area is located entirely within a "developed area" (an area that is already graveled/paved or supports structures and the only vegetation is limited to frequently mowed grass or conventional landscaping, is located within an existing maintained facility yard, or is in cultivated cropland conclude no species habitat present. Be careful when assessing actions that affect: 1) rights-of-ways that contains natural or semi-natural vegetation despite periodic mowing or other management; structures that have been known to support listed species (example: bridges), and 2) surface water or groundwater. Several species inhabit rights-of-ways, and you should carefully consider effects to surface water or groundwater, which often extend outside of a project's immediate footprint.

4. Adequacy of Information & Surveys - Agencies may base their determinations on the best evidence that is available or can be developed during consultation. Agencies must give the benefit of any doubt to the species when there are any inadequacies in the information. Inadequacies may include uncertainty in any step of the analysis. To provide adequate information on which to base a determination, it may be appropriate to conduct surveys to determine whether listed species or their habitats are present in the action area. Please contact our office for more information or see the survey guidelines that the Service has made available in IPaC.

May Effect Determinations for Listed Species

1. If the species habitat is present within the action area and survey data is unavailable or inconclusive: assume the species is present or plan and implement surveys and interpret results in coordination with our office. If assuming species present or surveys for the species are positive continue with the may affect determination process. May affect, with respect to a species, is the appropriate conclusion when a species might be exposed to a consequence of a federal action and could respond to that exposure. For critical habitat,

'may affect' is the appropriate conclusion if the action area overlaps with mapped areas of critical habitat and an essential physical or biological feature may be exposed to a consequence of a federal action and could change in response to that exposure.

2. Identify stressors or effects to the species and to the essential physical and biological features of critical habitat that overlaps with the action area. Consider all consequences of the action and assess the potential for each life stage of the species that occurs in the action area to be exposed to the stressors. Deconstruct the action into its component parts to be sure that you do not miss any part of the action that could cause effects to the species or physical and biological features of critical habitat. Stressors that affect species' resources may have consequences even if the species is not present when the project is implemented.

3. If no listed or proposed species will be exposed to stressors caused by the action, a 'no effect' determination may be appropriate – be sure to separately assess effects to critical habitat, if any overlaps with the action area. If you determined that the proposed action or other activities that are caused by the proposed action may affect a species or critical habitat, the next step is to describe the manner in which they will respond or be altered. Specifically, to assess whether the species/critical habitat is "not likely to be adversely affected" or "likely to be adversely affected."

4. Determine how the habitat or the resource will respond to the proposed action (for example, changes in habitat quality, quantity, availability, or distribution), and assess how the species is expected to respond to the effects to its habitat or other resources. Critical habitat analyses focus on how the proposed action will affect the physical and biological features of the critical habitat in the action area. If there will be only beneficial effects or the effects of the action are expected to be insignificant or discountable, conclude "may affect, not likely to adversely affect" and submit your finding and supporting rationale to our office and request concurrence.

5. If you cannot conclude that the effects of the action will be wholly beneficial, insignificant, or discountable, check IPaC for species-specific Section 7 guidance and conservation measures to determine whether there are any measures that may be implemented to avoid or minimize the negative effects. If you modify your proposed action to include conservation measures, assess how inclusion of those measures will likely change the effects of the action. If you cannot conclude that the effects of the action will be wholly beneficial, insignificant, or discountable, contact our office for assistance.

6. Letters with requests for consultation or correspondence about your project should include the Consultation Tracking Number in the header. Electronic submission is preferred.

For additional information on completing Section 7 Consultation including a Glossary of Terms

used in the Section 7 Process, information requirements for completing Section 7, and example letters visit the Midwest Region Section 7 Consultations website at: https://www.fws.gov/library/collections/midwest-region-section-7-consultations.
You may find more specific information on completing Section 7 on communication towers and transmission lines on the following websites:

- Incidental Take Beneficial Practices: Power Lines - https://www.fws.gov/story/incidental-take-beneficial-practices-power-lines
- Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning. - https://www.fws.gov/media/recommended-best-practices-communication-tower-design-siting-construction-operation

Northern Long-eared Bat Update

Please note that on March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat (NLEB) as endangered under the Endangered Species Act. The U.S. District Court for the District of Columbia has ordered the Service to complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021). The bat, currently listed as threatened, faces extinction due to the range-wide impacts of white-nose syndrome (WNS), a deadly fungal disease affecting cave-dwelling bats across the continent. The proposed reclassification, if finalized, would remove the current 4(d) rule for the NLEB, as these rules may be applied only to threatened species. Depending on the type of effects a project has on NLEB, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective (anticipated to occur by December 30, 2022). If your project may result in incidental take of NLEB after the new listing goes into effect this will first need to addressed in an updated consultation that includes an Incidental Take Statement. If your project may require re-initiation of consultation, please contact our office for additional guidance.
Other Trust Resources and Activities

Bald and Golden Eagles

Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act, as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, please contact our office for further coordination. For more information on permits and other eagle information visit our website https://www.fws.gov/library/collections/bald-and-golden-eagle-management.

We appreciate your concern for threatened and endangered species. Please feel free to contact our office with questions or for additional information.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Southern Illinois Sub-Office
Southern Illinois Sub-office
8588 Route 148
Marion, IL 62959-5822
(618) 998-5945

Project Summary

Project Code: 2022-0085197
Project Name: Swan Lake HREP - Flood Damage Assessment
Project Type: Management Plans Land Management/Restoration
Project Description: Repair completed HREP project with resiliency to restore function from flood damages.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.99291555,-90.57758177488628,14z

Counties: Calhoun County, Illinois

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Decurrent False Aster *Boltonia decurrens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7705	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

The following FWS National Wildlife Refuge Lands and Fish Hatcheries lie fully or partially within your project area:

FACILITY NAME	ACRES
TWO RIVERS NATIONAL WILDLIFE REFUGE https://www.fws.gov/refuges/profiles/index.cfm?id=33621	6,577.567

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Oct 15 to Aug 31
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31

NAME	BREEDING SEASON
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds elsewhere
Hudsonian Godwit *Limosa haemastica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Ruddy Turnstone *Arenaria interpres morinella* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (▪)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

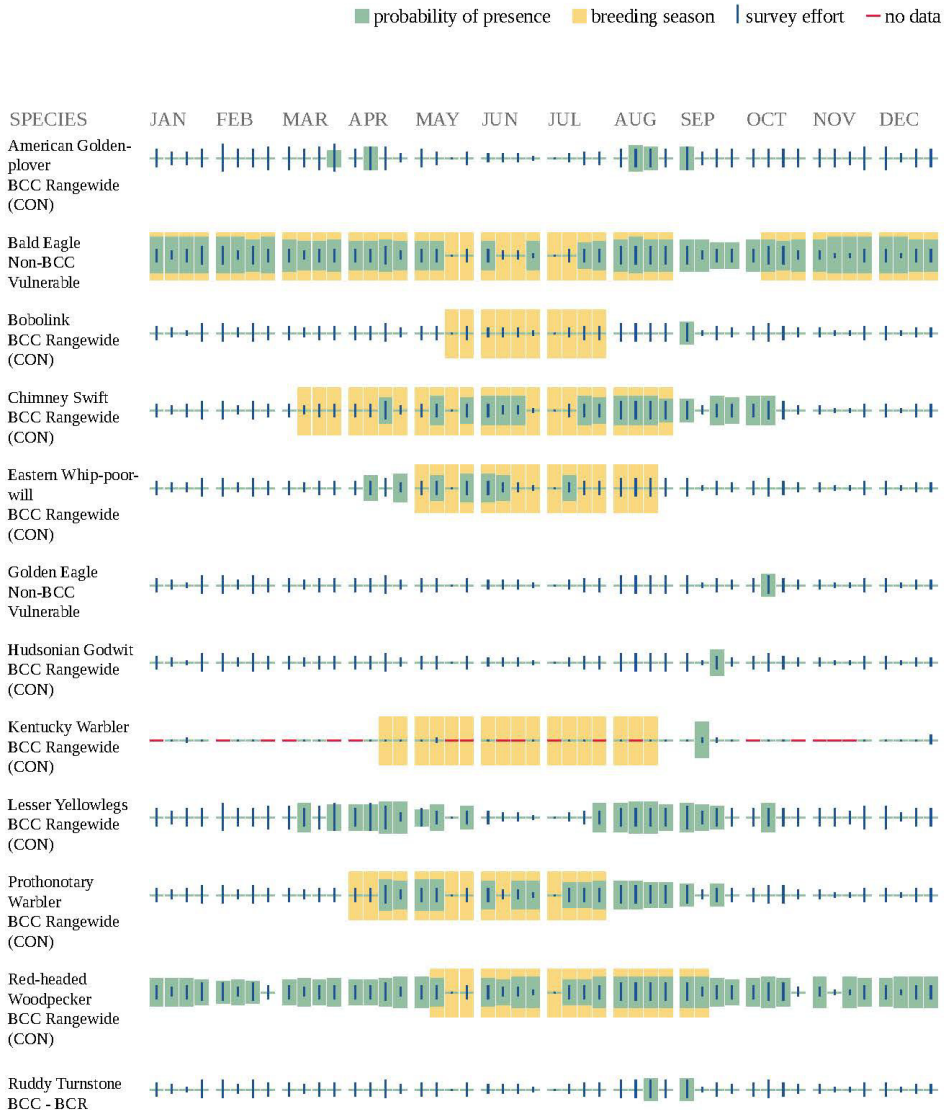
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

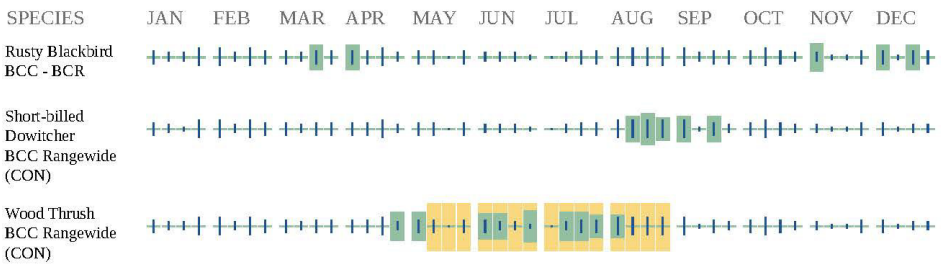
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides

birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

IPaC User Contact Information

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Phone:	6367446554

Illinois State Species of Concern

Coordination through Illinois State EcoCAT system.

EcoCAT
Ecological Compliance Assessment Tool

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Applicant:	US Army Corps of Engineers	*IDNR Project Number:*	2304749
Contact:	Justin Garrett	*Date:*	09/22/2022
Address:	1222 Spruce St St. Louis, MO 63103		
Project:	Swan Lake FDA - HREP Repair		
Address:	121 Main Street, Brussels		

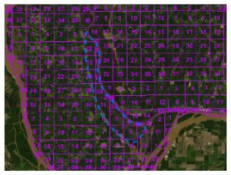
Description: Repair flood damaged project features from an original HREP Project at Swan Lake and Fuller Lake in Calhoun County IL

Natural Resource Review Results

The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

Mcadams Peak Hill Prairie INAI Site
Monterey School Geological Area INAI Site
Mcadams Peak Land And Water Reserve
Indiana Bat *(Myotis sodalis)*
Indiana Bat *(Myotis sodalis)*
Indiana Bat *(Myotis sodalis)*
Longnose Sucker *(Catostomus catostomus)*
Northern Long-Eared Myotis *(Myotis septentrionalis)*
Smooth Softshell *(Apalone mutica)*
Western Sand Darter *(Ammocrypta clarum)*

An IDNR staff member will evaluate this information and contact you to request additional information or to terminate consultation if adverse effects are unlikely.



Location
The applicant is responsible for the accuracy of the location submitted for the project.

County: Calhoun	*County:* Jersey
Township, Range, Section:	*Township, Range, Section:*
12S, 1W, 7	, ,
12S, 1W, 18	, ,
12S, 1W, 19	, ,
12S, 1W, 30	, ,
12S, 1W, 31	, ,
12S, 1W, 32	, ,
12S, 2W, 1	, ,
12S, 2W, 12	, ,
12S, 2W, 13	, ,
12S, 2W, 24	, ,
12S, 2W, 25	, ,
12S, 2W, 36	, ,
13S, 1W, 3	, ,
13S, 1W, 4	, ,

IDNR Project Number: 2304749

IDNR Project Number: 2304749

13S, 1W, 5
13S, 1W, 6
13S, 1W, 7
13S, 1W, 8
13S, 1W, 9
13S, 1W, 10
13S, 1W, 15
13S, 1W, 16
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12S, 1W, 6
6N, 13W, 15
6N, 13W, 16
6N, 13W, 22
6N, 13W, 23
7N, 13W, 18
7N, 13W, 32

IL Department of Natural Resources Contact
Bradley Hayes
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction
U.S. Army Corps of Engineers

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

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2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

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Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

US Army Corps of Engineers®

Appendix D: Coordination

Prepared By:
US Army Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103
December 2022

Coordination

*This Appendix will be updated at the closure of the public comment period.

Coordination between USACE and agencies on the proposed alternative has been completed. This has consisted of site visits, conference calls, and emails involving USFWS, and the IDNR. Input from agencies has been considered as part of project design and incorporated into the latest plan set. Agencies were provided the opportunity to comment on the draft Letter Report/Integrated EA in accordance with the Fish and Wildlife Coordination Act.

The discharge of dredged or fill material into waters of the US proposed under the repair alternative would have no more than minimal impacts to waters of the US. The activities for the work described under the repair alternative are authorized by the 2021 Nationwide Permit (NWP)27 - Aquatic Habitat Restoration, Establishment, and Enhancement Activities. The IDNR issued 401 Water Quality Certification for NWP 27 in 2021. In addition, USACE St. Louis District Regulatory Branch completed a 404(b)(1) analysis for all issued 2021 NWPs in their region. The 404(b)(1) analysis for NWP 27 remains valid.

USACE also coordinated the proposed project with the public in accordance with NEPA. A Public Notice was sent to all adjacent landowners and coordinating agencies (name them), as well as published on USACE - St. Louis District's website, with a 30-day comment period allotted for the public to express any potential concerns with the proposed project.

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Appendix E: Hydraulics and Hydrology

Prepared By:
US Army Corps of Engineers
1222 Spruce St.
St. Louis, MO 63103
December 2022

Hydraulic modeling was performed for the Swan Lake Habitat Rehabilitation and Enhancement Project (HREP) in order to evaluate alternatives from a hydraulics perspective and to identify potential locations of elevated velocities. Modeling was completed using the computer program HEC-RAS. All elevations given are in feet, referenced to the National Geodetic Vertical Datum of 1988 (NAVD88). The flood frequency for the existing and recommended conditions was also examined.

Flood Frequency

The frequency of overtopping was evaluated by plotting the Swan Lake / Fuller Lake berm elevation against the flood elevation. Figure E - 1 shows the existing berm elevation taken from survey data collected by the St. Louis District's survey team against various Illinois River frequency flood event elevations. The Illinois River frequency flood water-surface elevations were taken from a UNET model developed by USACE Rock Island District. This computer model is based upon the results of the report entitled "Upper Mississippi River System Flow Frequency Study" (January 2004). This report was developed by several agencies and stakeholders. Elevations were reported in NGVD29 and converted to NAVD88 when creating the profiles. The plot shows that the breach on the northwestern section of the berm and the uncontrolled spillway on the southern section of the berm are both below the 50% annual exceedance probability (AEP) flood event. Much of the rest of the berm lies between the 50% AEP and 20% AEP events.

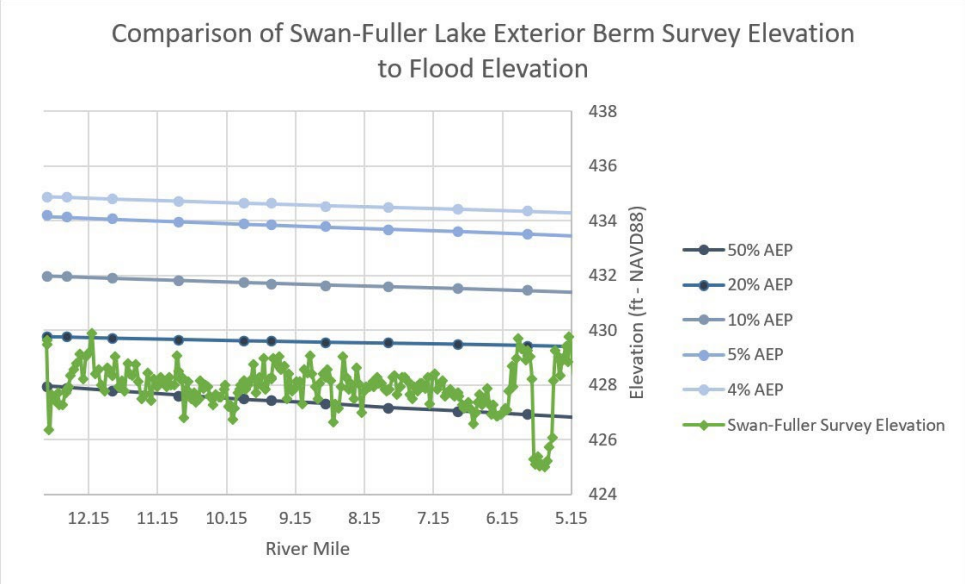

Figure E - 1: Comparison of Swan -Fuller Lake Survey to Flood Elevation Data

The frequency of overtopping for the recommended berm configuration was also evaluated. Figure E - 2 shows the elevation of the recommended realignment and recommended

restoration to as-built conditions plotted against flood elevations. The recommended berm configuration would bring the entire system above the 50% AEP flood event. Additionally, the Fuller Lake portion of the system would be above the 20% AEP flood event, while the southern portion of Swan Lake would be between the 50% AEP and 20% AEP flood events. Restoring the level of protection from the current degraded state would reduce the frequency of sediment laden water entering the area, reducing the amount of sedimentation interior to the berm.

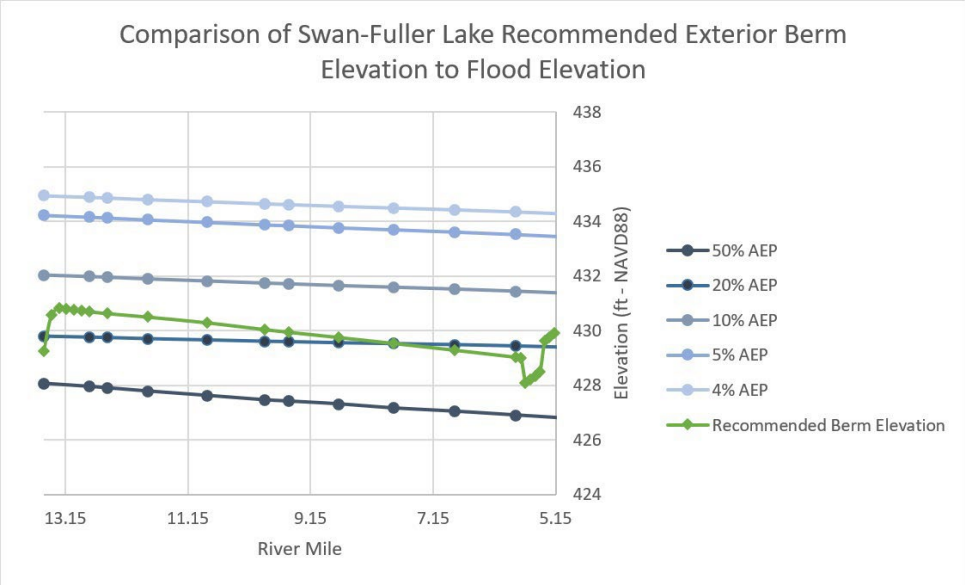

Figure E - 2: Comparison of Recommended Berm Configuration Elevation to Flood Elevation

Hydraulic Modeling

Three hydraulic models were created using the HEC-RAS software, with each exploring different aspects of the project. The three models include a 1-dimensional model used for the no-rise analysis, a 2-dimensional model of the entire Swan Lake and Fuller Lake system, and a 2-dimensional model of the recommended berm realignment north of Fuller Lake.

No-Rise Analysis

Model Development

The no-rise analysis was performed using a 1D model created with the HEC-RAS version 6.2 software. The existing Upper Mississippi River Phase III HEC-RAS model was used as a starting point and was modified to meet the needs of this project. The extent of the existing model was trimmed to include the Illinois River from river mile 61.4 to the mouth, the Mississippi River from river mile 236.39 to 180.01, and the Missouri River from river mile 47.47 to the mouth. Additional cross sections were added and were based upon the terrain in the vicinity of the recommended berm realignment.

Model Results

The no-rise analysis indicated that there was no rise in water surface elevation for the 1% AEP flood event. Table E-1 shows the water surface elevations in the vicinity of the project area for the 1% AEP flood event. The project area runs from Illinois River mile 13.5 to river mile 5.1.

Table E - 1: Water Surface Elevations for the 1% AEP Flood Event

River Mile	Existing Conditions W.S. Elev (feet)	Recommended Conditions W.S. Elev (feet)	Difference in W.S. Elev (feet)
19.1	440.08	440.08	0.00
18.64	440.05	440.05	0.00
18.25	440.00	440.00	0.00
17.96	439.99	439.99	0.00
17.7	439.92	439.92	0.00
17.3	439.84	439.84	0.00
16.7	439.80	439.80	0.00
16.31	439.77	439.77	0.00
15.9	439.74	439.74	0.00
15.54	439.71	439.71	0.00
15.17	439.70	439.70	0.00
14.6	439.68	439.68	0.00
14	439.68	439.68	0.00
13.5	439.66	439.66	0.00
13.377	439.67	439.67	0.00
13.253	439.65	439.65	0.00
13.13	439.65	439.65	0.00
13.007	439.65	439.65	0.00
12.883	439.63	439.63	0.00
12.76	439.62	439.63	0.00
12.47	439.59	439.59	0.00

River Mile	Existing Conditions W.S. Elev (feet)	Recommended Conditions W.S. Elev (feet)	Difference in W.S. Elev (feet)
11.8	439.57	439.57	0.00
10.84	439.52	439.52	0.00
9.9	439.49	439.49	0.00
9.5	439.48	439.48	0.00
8.7	439.45	439.45	0.00
7.8	439.40	439.40	0.00
6.8	439.37	439.37	0.00
5.8	439.34	439.34	0.00
5.1	439.31	439.31	0.00
4.8	439.28	439.28	0.00
3.8	439.11	439.11	0.00
2.8	439.02	439.02	0.00
1.9	439.01	439.01	0.00
1.4	438.92	438.92	0.00
0.8	438.92	438.92	0.00
0	438.97	438.97	0.00

In addition to the 1% AEP event, various other AEP flood events were also modeled. The 20% AEP flood event was of note as there was a rise of about 0.01 foot in the water surface elevation near the recommended berm realignment at the northern end of the project. This rise was caused because the existing conditions allow water to easily pass by the berm alignment at the northern end of the project during a 20% AEP flood event due to the existing breach prior to eventual overtopping of the berm. The recommended conditions repair the breach and restore the 20% AEP level of protection to Fuller Lake, thus allowing more water to accumulate near the realignment before overtopping occurs. This very small change in water surface elevation is not expected to negatively impact the surrounding area.

Model of Entire System

A two-dimensional (2D) model of the entire system was created that included Swan Lake, Fuller Lake, the management units and the moist-soil units (MSUs) southwest of Swan Lake , and the field north of Fuller Lake. The extent of the model and Illinois River miles are shown in Figure E - 1. The purpose of the model was to investigate various elevations and drainage structure location options for the cross dike between Fuller and Swan Lake, as well as to better understand how the system operates as a whole.

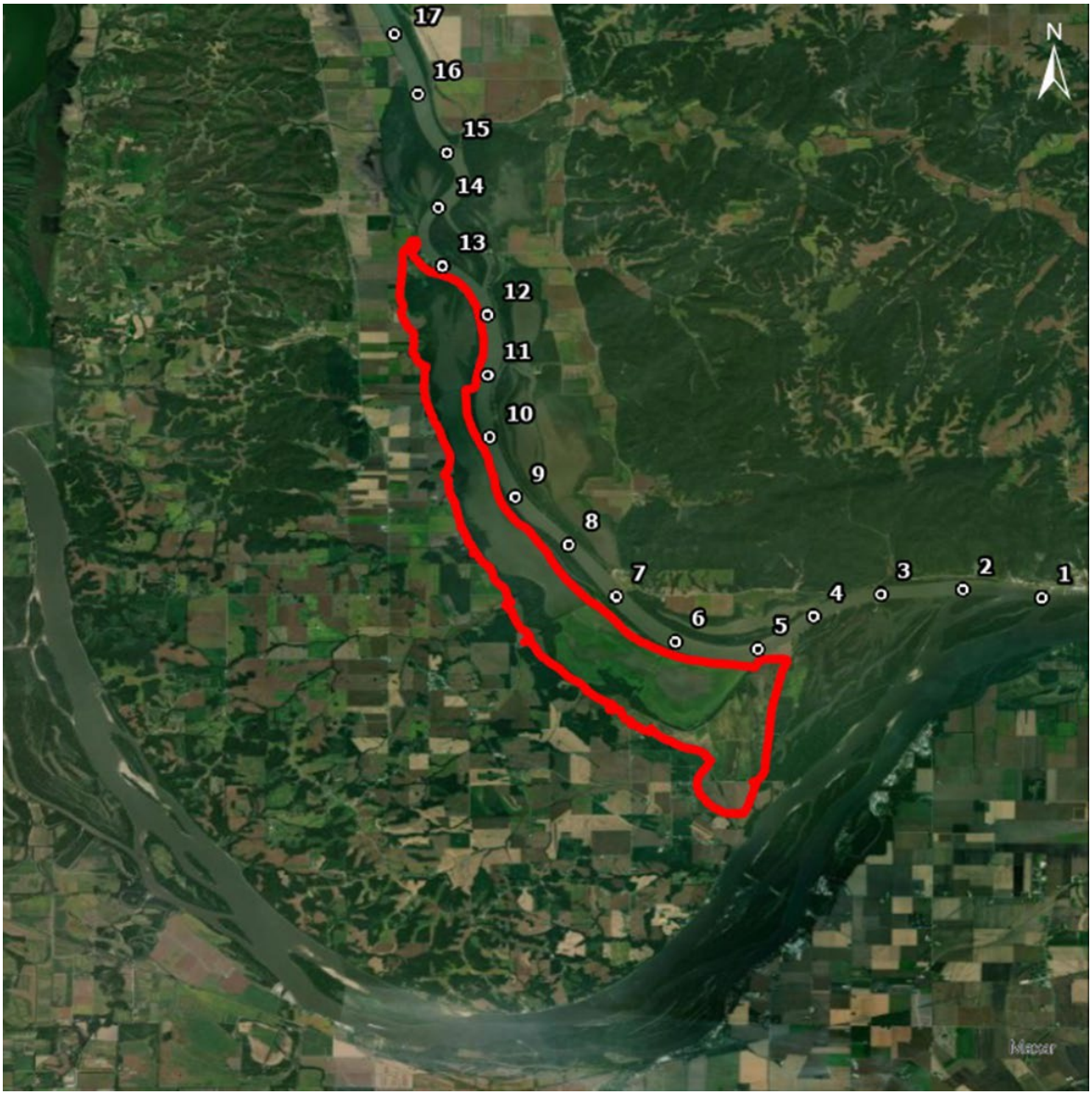

Figure E - 3: Extent of 2D Model of Entire Swan Lake System

Model Development

An analysis of the entire Fuller Lake and Swan Lake system was conducted utilizing a 2D model created with the HEC-RAS version 6.2 software. The model is a modification of a 2D HEC-RAS

model previously created. The original purpose of the model was to evaluate drainage for various precipitation events that could fall on areas that are two-dimensionally modeled (the management units, the MSUs and Swan Lake) and on upland tributary watersheds of the two-dimensionally modeled areas. An initial water surface elevation is set for each area. Upland runoff enters the system through boundary conditions that utilize the output from a separately developed HEC-HMS model. Precipitation that falls directly on the two-dimensionally modeled areas is also modeled with boundary conditions. National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation data with a 6-hour duration was used for 10%, 4%, 2%, and 1% AEP precipitation events. Water is able to leave the system through the stoplog water control structure located at the southeastern end of Swan Lake. The model only accounts for precipitation events and assumes that water enters the Illinois River though the stoplog water control structure with no backwater effects from the river.

Multiple modifications were made to the previous model in order to meet the needs of the Swan Lake FDA. A new 2D flow area was created north of Fuller Lake to include the area protected by the recommended realignment. The terrain modification tools within HEC-RAS were used to add some of the recommended features. Features include the berm realignment north of Fuller Lake, patching the low spots in the northern most section of the existing berm, restoring the remaining existing berm and cross dike to as built conditions, and removing the spillway between the Fuller Lake pump station and the cross dike. A new boundary condition was created for the added 2D flow area and the upland runoff was determined by the original modeler of the previous HEC-HMS model by adding a watershed at the desired location. The existing culverts under Hadley Landing Road were also added to the new 2D flow area to allow for water to leave the system. Figure E - 4 shows the newly added 2D flow area north of Fuller Lake.

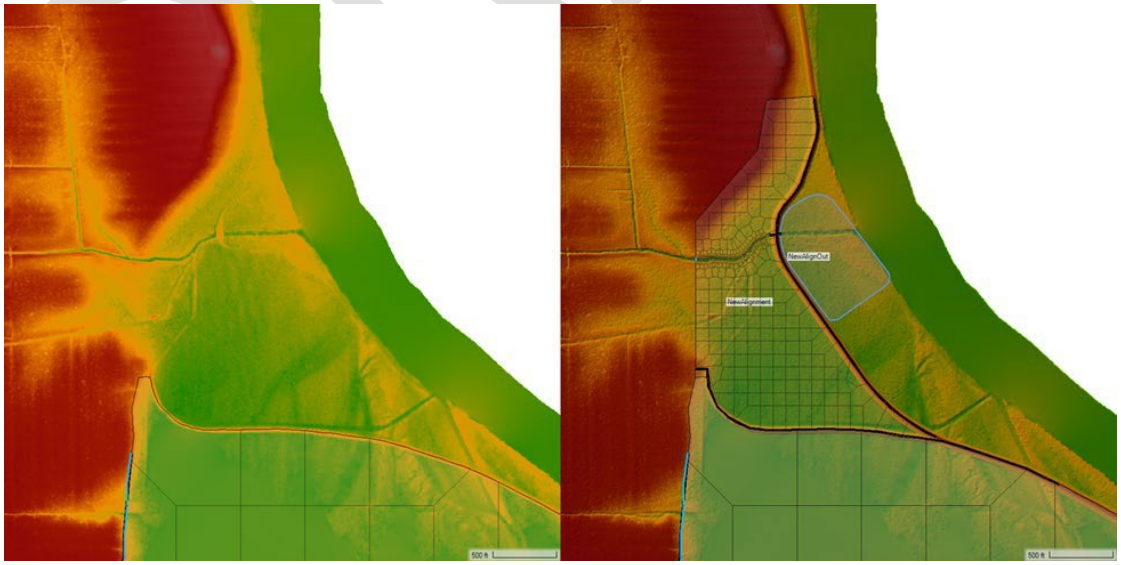

Figure E - 4: Original Model (left) vs Added 2D Flow Area (right)

The terrain of the model uses Calhoun County Light Detection and Ranging (LiDAR) data with bathymetry data incorporated for the entirety of Swan Lake. Bathymetry data for Fuller Lake was not available. Additionally, the LiDAR data was collected during a high-water event, resulting in a flat elevation of around 422.8 feet NAVD88 for Fuller Lake. Artificial bathymetry was created for Fuller Lake utilizing the terrain modification tools within HEC-RAS. Geometric characteristics of Swan Lake bathymetry were used to create a bowl shape for Fuller Lake with similar slopes to Swan Lake. Figure E - 5 shows the original LiDAR compared to the artificial bathymetry. The color gradations demonstrate the flat LiDAR versus the changing elevation of the artificial bathymetry.

Figure E - 5: Original LiDAR Terrain (left) vs Artificial Bathymetry (right) of Fuller Lake

One purpose of the model was to investigate different drainage options for Fuller Lake. Current conditions consist of an inoperable 36-inch diameter stoplog structure through the cross dike between Fuller Lake and Swan Lake, and a pump station located at the southeastern edge of Fuller Lake. Three drainage conditions were modeled: drainage from Fuller Lake to Swan Lake via a 36-inch diameter pipe, drainage from Fuller Lake to the Illinois River via a 36-inch diameter pipe, and no drainage from Fuller Lake. Figure E - 6 shows a comparison of the two different drainage features. The drainage structure from Fuller Lake to Swan Lake is located near the center of the cross dike, while the drainage structure from Fuller Lake to the Illinois River is located at the southwest corner of Fuller Lake.

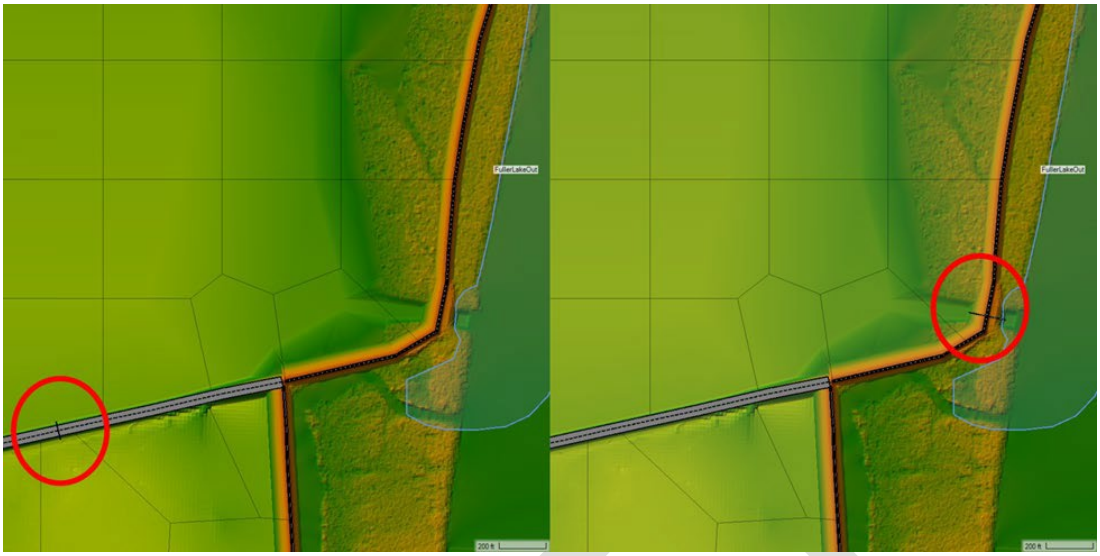

Figure E - 6: Drainage to Swan Lake (left) vs Drainage to Illinois River

In addition to different drainage scenarios, two different cross dike elevations were explored. The terrain modification tools with HEC-RAS were used to restore the cross dike to as-built conditions as well as to raise the cross dike to the same elevation as the berm. These elevations are roughly 425 feet and 430 feet, respectively.

Model Results

Runs were conducted for all combinations of geometry and events: high cross dike, low cross dike, Fuller Lake drainage to Swan Lake, Fuller Lake drainage to the Illinois River, and no Fuller Lake drainage, and 10%, 4%, 2%, and 1% AEP precipitation events. At first the initial water elevation for Swan Lake and Fuller Lake were set to 419 feet and 420 feet, respectively. A rough target water elevation for Swan Lake was provided while the target water elevation for Fuller Lake was unknown and a value was assumed that was slightly higher than that for Swan Lake. The water elevations of 419 feet and 420 feet proved to be too low to cause the cross dike to overtop, thus the initial water elevations were raised to 422 feet and 422.5 feet for Swan Lake and Fuller Lake, respectively. This raising of the initial elevations was done to investigate the interaction between the lakes in the event of the cross dike overtopping. Table E - 2 shows the water surface elevation for Swan Lake and Fuller Lake for each scenario. The elevations shown do not represent the true values due to needing to raise the initial lake elevations and the artificial bathymetry created for Fuller Lake. However, the elevations give an idea of the interaction between the two lakes and how the cross dike elevation and Fuller Lake drainage impact Swan Lake.

Table E - 2: Peak Water- Surface Elevations for Swan and Fuller Lakes

Cross Dike Elevation	Precipitation Event	Peak Water-Surface Elevation (feet)		
		No Fuller Drainage	Fuller Drainage to River	Fuller Drainage to Swan
As Built Conditions	10% AEP	Fuller: 424.64 Swan: 423.80	Fuller: 424.29 Swan: 423.80	Fuller: 424.39 Swan: 423.83
	4% AEP	Fuller: 425.07 Swan: 424.40	Fuller: 424.84 Swan: 424.39	Fuller: 424.98 Swan: 424.42
	2% AEP	Fuller: 425.19 Swan: 425.12	Fuller: 425.14 Swan: 425.08	Fuller: 425.19 Swan: 425.12
	1% AEP	Fuller: 425.44 Swan: 425.44	Fuller: 425.42 Swan: 425.42	Fuller: 425.44 Swan: 425.44
Sediment Deflection Berm Height	10% AEP	Fuller: 424.67 Swan: 423.80	Fuller: 424.31 Swan: 423.80	Fuller: 424.39 Swan: 423.83
	4% AEP	Fuller: 425.25 Swan: 424.40	Fuller: 424.84 Swan: 424.39	Fuller: 424.99 Swan: 424.42
	2% AEP	Fuller: 425.73 Swan: 425.05	Fuller: 425.32 Swan: 425.05	Fuller: 425.19 Swan: 425.12
	1% AEP	Fuller: 426.21 Swan: 425.38	Fuller: 425.84 Swan: 425.38	Fuller: 426.06 Swan: 425.39

The results of the modeling showed that a drainage structure from Fuller Lake to the Illinois River allows for better control of the water levels in Fuller Lake, while also minimizing the impact to Swan Lake. These results align with the desire to manage the lakes independently from one another.

The modeling also indicated that raising the cross dike to the same height as the sediment deflection berm is not necessary. The 1% AEP precipitation event combined with a rather high estimate for the Fuller Lake initial water elevation did not produce a water elevation near the sediment deflection berm height of roughly 430 feet NAVD88. Additionally, it was determined that water in Fuller Lake begins to encroach on private property at around elevation 422 feet NAVD88.

The effects of various precipitation events on the area north of Fuller Lake where the berm realignment is were also examined. It was determined that the field between the northern end of the existing berm and the realigned berm becomes inundated as a result of heavy precipitation. The peak of inundation increases as the amount of precipitation increases. However, all precipitation events result in one to two feet of water being trapped in the field after water is given time to drain through the culverts. This occurs because of the terrain

sloping slightly downwards moving south from the culverts. Sloping the terrain north towards the culverts would allow for the water to drain to the Illinois River. Figure E - 7 shows the extent of the trapped water north of Fuller Lake.

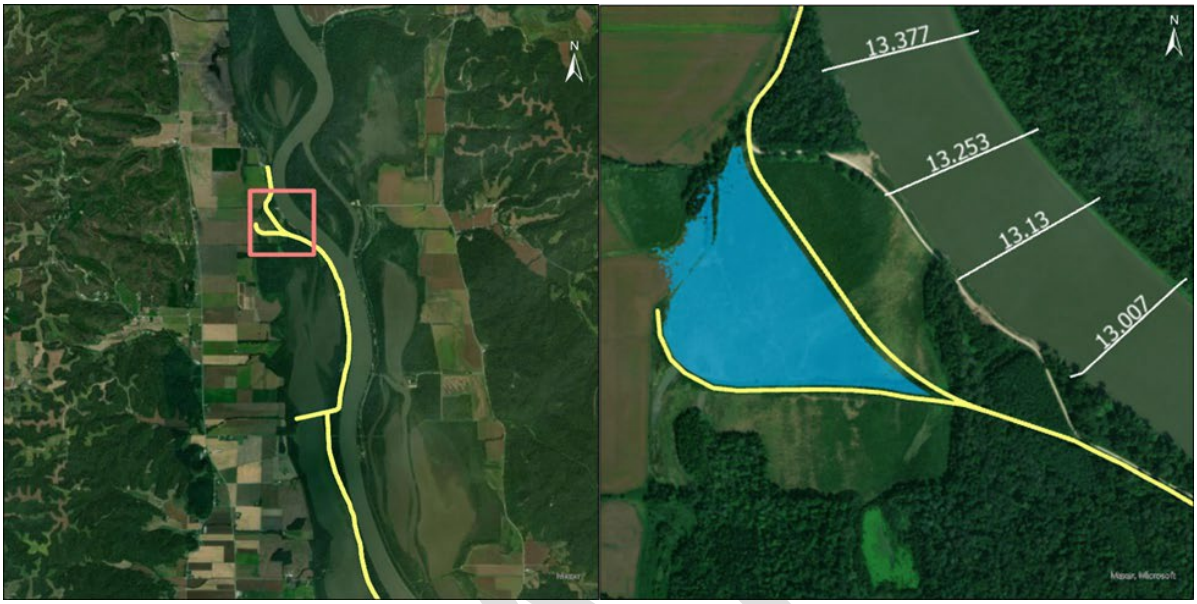

Figure E - 7: Extent of Trapped Water North of Fuller Lake

Model of Berm Realignment

A model of the recommended berm realignment was created in order to evaluate water velocities and identify any potential locations along the berm that may require additional measures such a shallower side slope or armoring. The model encompasses all of Fuller Lake and recommended berm realignment north of Fuller Lake. The extent of the model and Illinois River miles are shown in Figure E - 8.

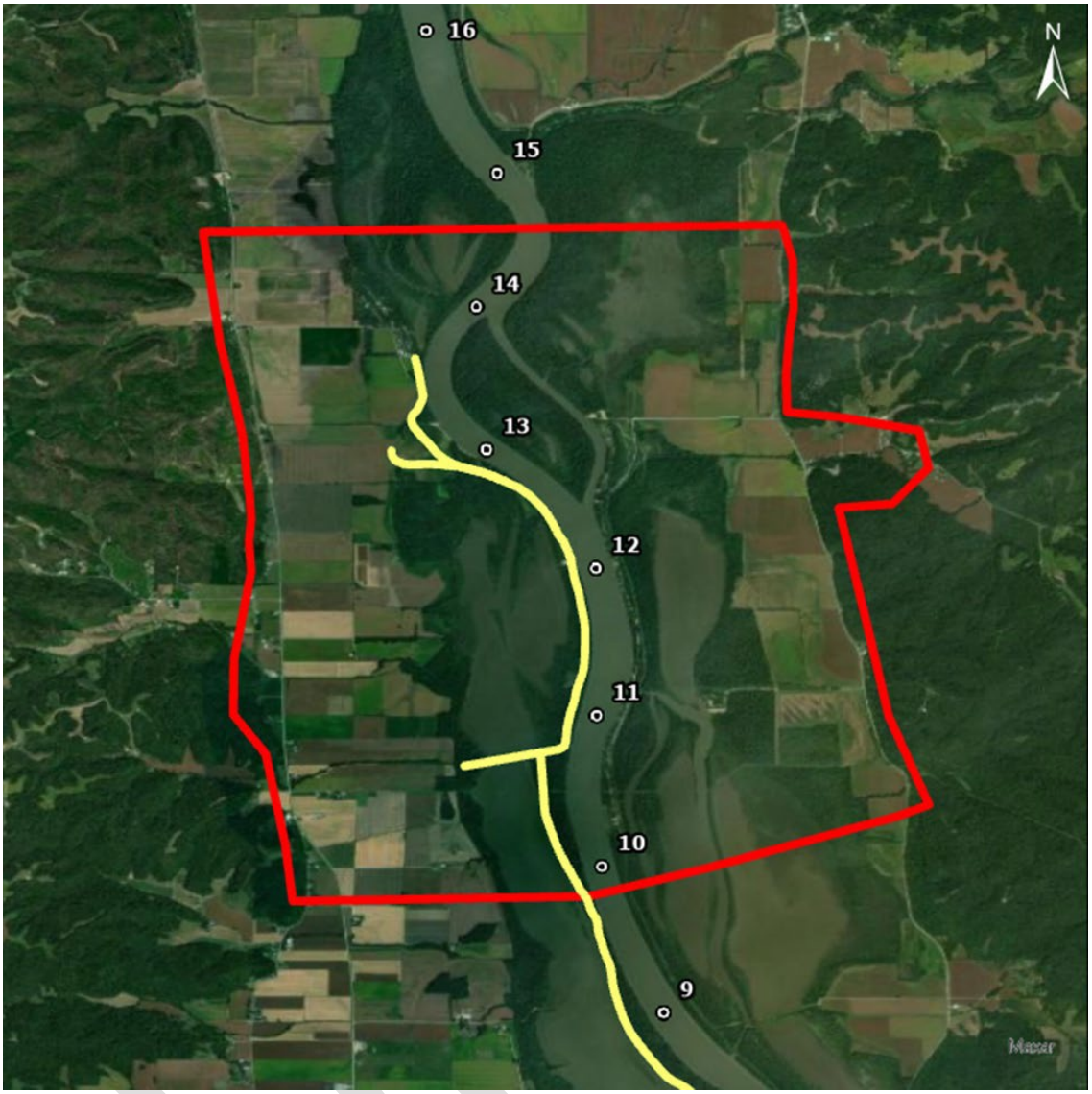

Figure E - 8: Extent of Berm Realignment Model

Model Development

An analysis of the recommended berm realignment was conducted utilizing a 2D model created with the HEC-RAS version 6.2 software. The model uses a flood event to evaluate the velocities that occur when the berm is overtopped. The model does not include precipitation events.

The terrain of the model is the Calhoun County LiDAR data. The terrain modification tools within HEC-RAS were used to add the recommended realignment portion of the berm, as well as to patch the low spots in the northern most section of the existing berm and restore the remaining portions of existing berm and cross dike to as built conditions. The berm in the LiDAR data did not line up exactly with the survey that was conducted. As a result, the existing berm in the LiDAR data was removed using terrain modification tools before adding the berm back in

with the recommended conditions. The existing culverts under Hadley Landing Road were also added to the realigned portion of the berm. Figure E - 9 shows the terrain modification adding the recommended berm realignment compared to the original LiDAR, while Figure E - 10 shows the terrain modification restoring the cross dike to as built conditions.

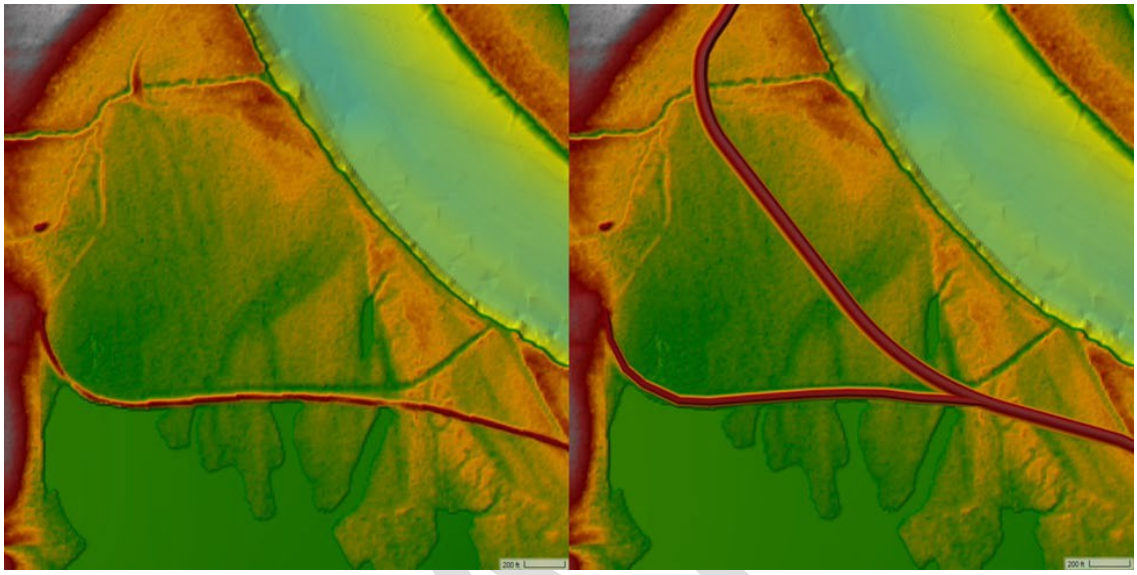

Figure E - 9: Original LiDAR (left) vs Recommended Berm Realignment Terrain Modification (right)

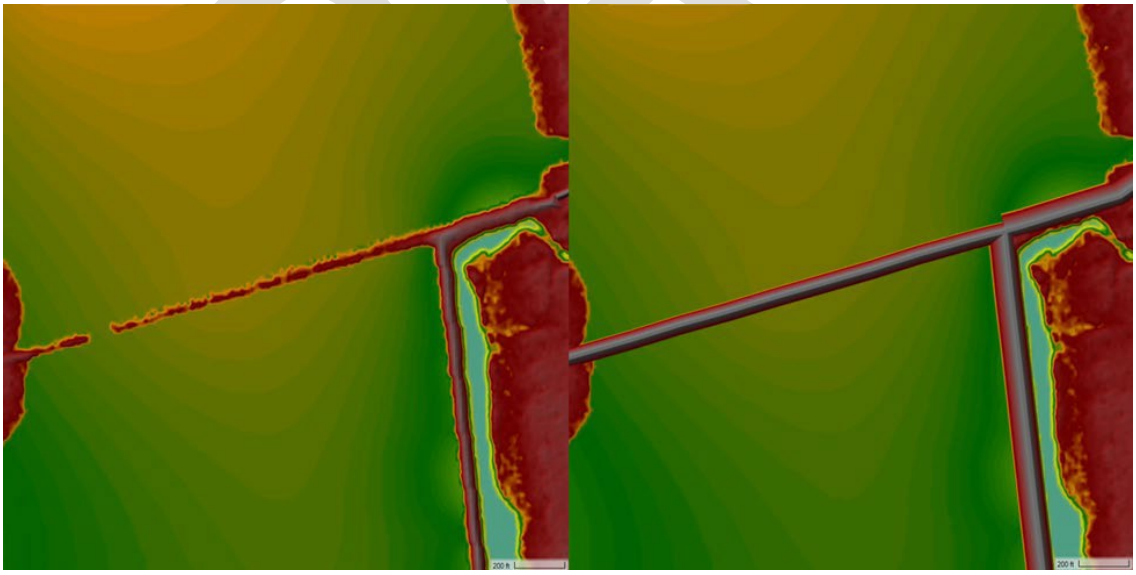

Figure E - 10: Original LiDAR (left) vs Restored Cross Dike Terrain Modification (right)

The United States Geological Survey (USGS) 2016 National Land Cover Database (NLCD) was used for land cover. Manning's *n* calibration regions, a utility within HEC-RAS, were used to refine the roughness values along the berm. The road located on top of the berm was

designated “developed, open space” (*n* = 0.035), while the area of the current roadway was designated “woody wetlands” (*n* = 0.08).

The upstream boundary condition (northern boundary) is a flow hydrograph, while the downstream boundary condition (southern boundary) is normal depth. The flow hydrograph used is a modification of the Spring 2019 flood event. Modifications to the Spring 2019 hydrograph include adding a two-day long linear ramp up to the initial flow, adding a two-day linear ramp down to low flow followed by four days of constant low flow, and scaling the entire event to 70%. The scaling and ramp up were added to better capture the overtopping event because the unaltered 2019 event caused immediate overtopping since its initial flow rates were very large. The ramp down and constant low flow were added to allow for the field south of the culverts to drain through the culverts under Hadley Landing Road.

Model Results

The model was run to identify areas of elevated velocities that may require additional attention. Based on the results of the model, two areas of interest were identified. The first area is located where the existing road meets the existing berm, as shown in Figure E - 11. Modeling indicated that this portion of the berm could experience elevated velocities due to water funneling down the clearing between the trees that is created by the road, as well as because of the direction of flow relative to the road. The risk of elevated velocities can be mitigated by reforesting the current roadway once the road is relocated on top of the berm. Further modeling with the current roadway simulated as being reforested resulted in the berm no longer experiencing elevated velocities at this location. The simulation of reforestation was achieved by altering the roughness value utilizing Manning’s *n* calibration regions. Figure E - 12 shows the velocities at this location for the existing conditions without reforestation compared to the velocities of the recommended with reforestation, with arrows indicating the direction of flow.

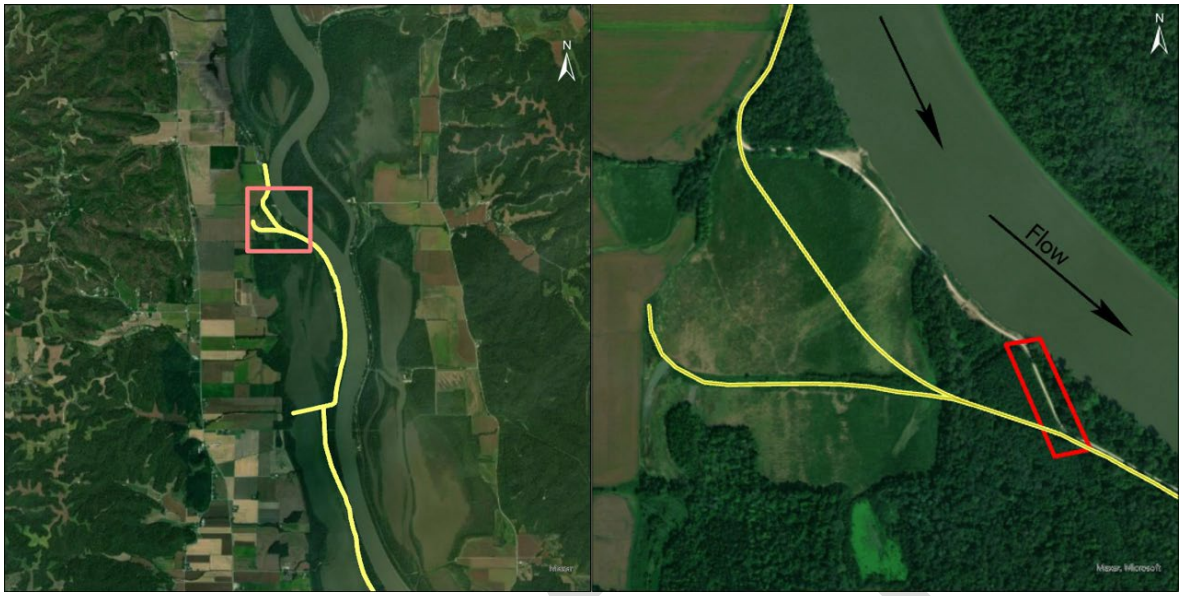

Figure E - 11: Location of Existing Road Creating Elevated Velocities

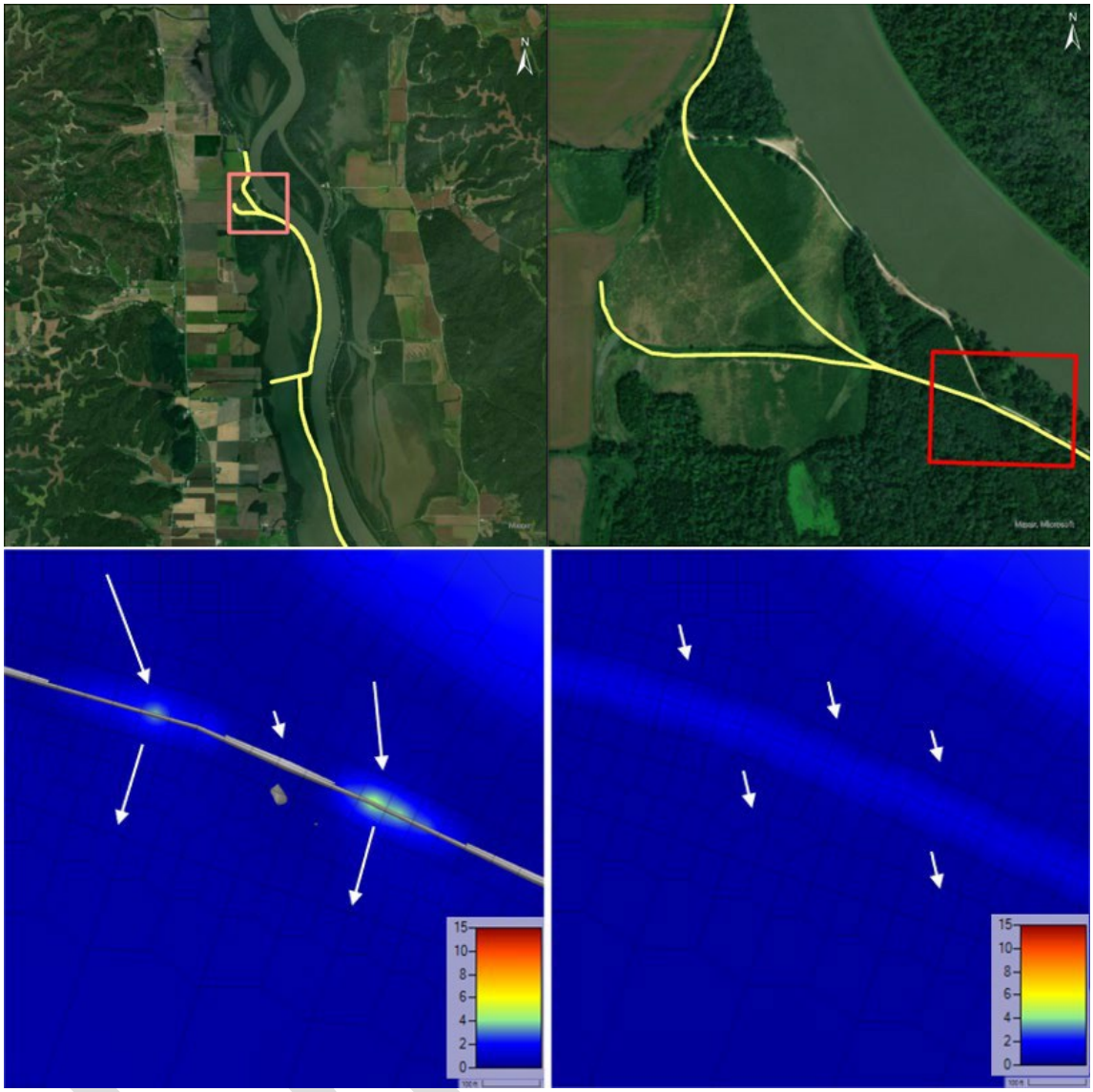

Figure E - 12: Velocities With and Without Reforestation

The second area of interest is located at the northwestern end of the existing berm alignment. Figure E - 7 shows the location as well as the velocities (in feet/second), with arrows indicating the direction of flow. Elevated velocities at this location are caused from water that overtops the berm being channeled between the backside of the berm and the relative high ground to the west.

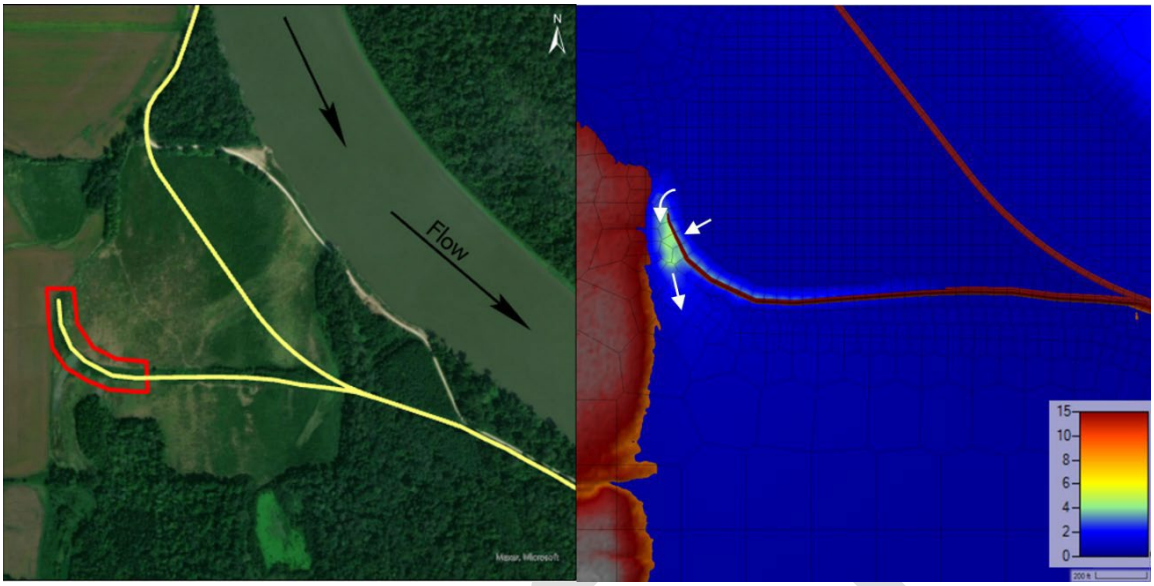

Figure E - 13: Second Location and Velocity Results

In the event of rising flood waters, the field between the existing alignment and recommended new alignment begins to fill with water that backflows through the existing culverts under Hadley Landing Road. The rising water is then pooled in the field until eventually overtopping the existing berm and entering Fuller Lake. The portion of the berm restored to as-built elevations along with the new alignment overtop shortly thereafter. Once flood waters recede the field drains to the Illinois River through the culverts leaving behind one to two feet of trapped water (as occurred with the model of the full system).

References / Computer Software

ArcGIS Pro, Version 2.9 ESRI

HEC-HMS Version 4.8 USACE

HEC-RAS Version 6.2 USACE

National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Point Precipitation Frequency Estimates, 2022. (Online resource): https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

United States Geological Survey (USGS), National Land Cover Database (NLCD) (Online resource): https://www.usgs.gov/centers/eros/science/national-land-cover-database

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Appendix F: Civil Engineering

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December 2022

Civil design for this project will include improvements to the sediment berm and cross dike as described in the "Repair with Resiliency Alternative" in Section 3.2, including but not limited to returning to as-built conditions, regrading for removals and establishing a route for the realignment of the Hadley Landing Road. It also includes excavating materials, and infrastructure protection and replacement. This appendix summarizes the layout by area, assumptions made for the conceptual design, conceptual design quantities used to establish the cost estimate, and needs for further design.

Project Location

The proposed layout includes four major areas. From the north tie-in point to the south most one, they are: Realignment, Fuller Lake, Cross Dike, and Swan Lake (Figure F- 1). Additionally, there are multiple breach areas recommended for repair if the existing sediment berm remains in place. These areas can be used to delineate changes in design efforts and summarize the quantity computations.

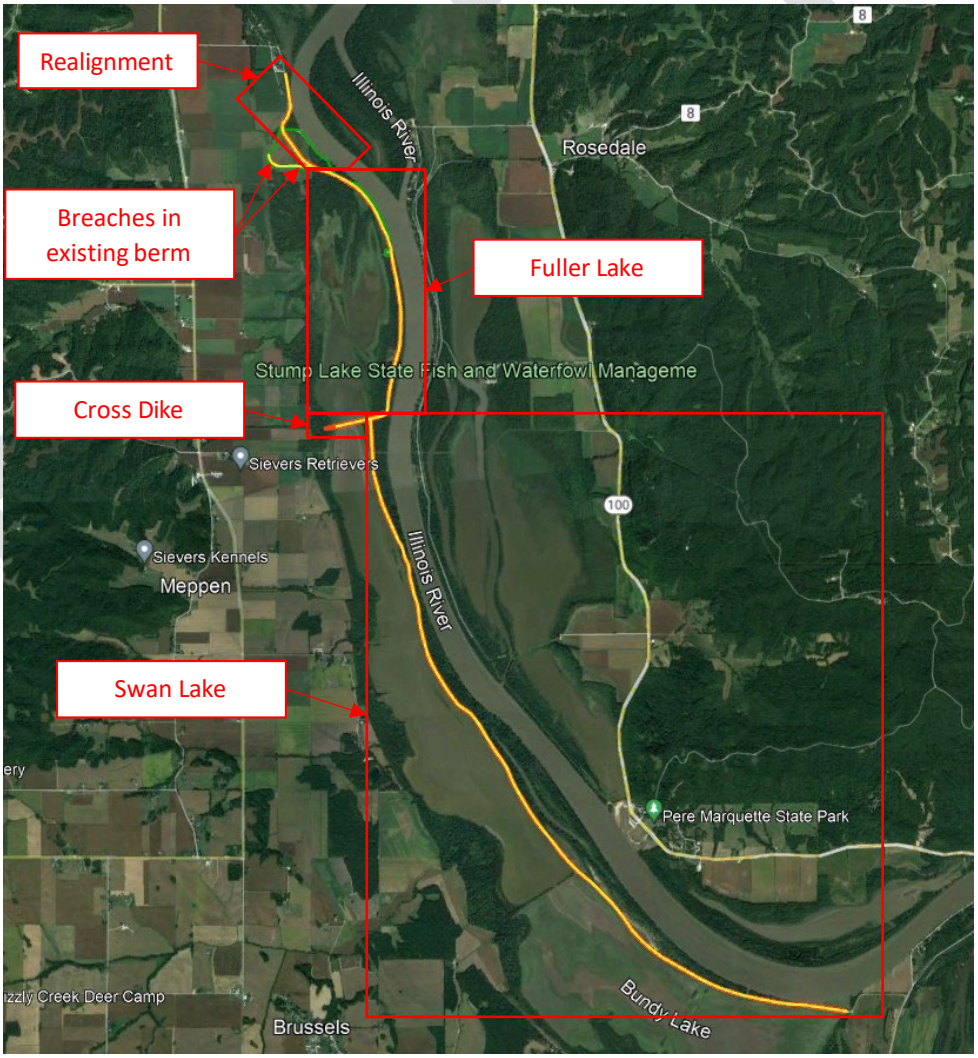

Figure F- 1: Civil Design Project Location Map

Realignment

The Realignment is north of the existing sediment berm from just east of the first breach across the existing open field tying in along the curve at the existing culverts; it includes the transition back to existing ground along Hadley Landing Road just south of Gallinipper Road.

Fuller Lake

Fuller Lake is the portion of the berm adjacent to the Fuller Lake. Within Fuller Lake, there is a parking lot used for lake access where the berm shifts from a shared path with the road to adjacent to the existing access road along the western side. There is also a pump station at the southern end of the berm just for it bends into the existing spillway.

Cross Dike

The Cross Dike routes between Fuller Lake spillways on the western edge of project limits to the Fuller Lake spillway just south of the pump station into the Swan Lake berm.

Swan Lake

Swan Lake is the portion of the berm adjacent to Middle and Lower Swan Lake (shown as Bundy Lake in the image). It ties into the Fuller Lake spillway and cross dike. There are two stoplog water control structures and two pump station within the Swan Lake design limits that should be protected in place and the design transition may be necessary to meet existing elevations. The proposed improvements begin at the southmost water control structure.

Data Collection

As-built plans were developed after construction of the original project. Vertical slopes and feature elevations were obtained from these plans. LiDAR information gathered in 2011 was used to produce a surface which was used as existing conditions to develop the proposed design and calculate design quantities for the majority of features in the FDA. The LiDAR data was collected during a high water event causing the data to mimic the water levels instead of existing ground conditions. In addition, due to various changes over time, such as sediment deposits and removal, occurrences of berm/cross dike overtopping and the 2019 flood instance since the LiDAR data was collected, additionally surveys were needed. Two surveys for the FDA were obtained in Summer 2022. After processing the surveys, it should be noted the sediment deflection berm in the LiDAR data was offset at a variable distant from the survey data collected. The surveys contained cross sections every 200’ of the berm, including points along the centerline, edge of the road, top of crown, and berm slopes, as well as points across the open field anticipated for the berm realignment. The survey data collected did not include points at the limits of each water control structure, changes in material types, or tree/vegetation data. The limited number/frequency of points available within the available scope/budget of surveys for this effort provide an incomplete picture of what the existing

conditions are within the proposed design limits. A comprehensive survey collection is recommended to support PED efforts and reduce risk to the project.

Conceptual Design Overview

The design was completed using Bentley's OpenRoads Designer (2021 Release 1). Three templates were created for the design—one template has a 1:8 interior side slope with 1:6 exterior side slopes and two have 1:6 side slopes on both sides (one with the road on the berm top and one without it for the cross dike) with the alignment used as the insertion point. The steepest slope recommended along the sediment berm is 1:6 in order to meet requirements from a hydraulic analysis in order to prevent potential erosion deficiencies in the future. Template drops created a corridor that runs the entire stretch of the berm. Feasibility of designs are dependent on geotechnical analysis.

Conceptual Design Considerations

The design concept considered all the data collected or already available, as well as further analyses as described throughout the report. This includes applying the as-built height and slope information to the exterior sediment deflection berm. Varying interior side slopes, ranging from 1V:6H to match the minimum recommendation to 1V:8H to provide resiliency due to lessons learned throughout the duration of the project, were considered for the Swan Lake Berm and the Cross Dike design concepts. Slopes steeper than 1V:8H were not found acceptable within the limits of Fuller Lake to the north end of the project where the culverts cross under Hadley Landing Road to help reduce future flood damages. The recommended design for each area is as follows, including repairs to the sediment berm with added resiliency in areas:

- Realignment – East of the first breach in the existing berm, the proposed alignment curves north connecting the existing road along two curves with a tangent in between then transitions back to existing ground at an acceptable slope. The road along the river is to be relocated on the top of the berm for accessibility during flood event to prevent buildup of sediment. The side slopes are designed as 1:8 on the interior side of the berm and 1:6 on the exterior, or river side, of the berm. The longitudinal slope begins as 0.0043% until the culvert crossing where it transitions back to existing ground.
- Fuller Lake – The Fuller Lake 1:8 interior slope design stretches from Swan Lake berm and the Fuller Lake Cross Dike to the Realignment. The pump station should remain in place. A new installation of a screw gate; no design has been done for the water control structure. The longitudinal slope continues from Swan Lake as 0.0043% into the berm realignment.
- Cross dike – The cross dike between Fuller Lake and Swan Lake was designed to maintain an elevation of 425 before transitioning to the elevation of the sediment berm. The cross dike previously armored with riprap should be

maintained as 12” minimum thickness on the slopes with an earthen berm top. The side slopes for the cross dike are 1:6.

- Swan Lake – Side slopes should vary, between 1:8 and 1:6, by need determined during the design phase. The Swan Lake water control structures control the elevations and slopes throughout the Swan Lake stretch. The longitudinal slopes determined from the as built plans vary between 0.0025% and 0.0043%.
- Infrastructure Improvements – Culvert Replacement and Removal of control structure within the cross dike and installation of a new screw gate within Fuller Lake limits. All other utilities, including water control structures, within the project limits should be protected in place and remain undisturbed, unless determined otherwise during engineering and design phase.

Conceptual Design Quantities

Design quantities were calculated using a combination of aerial images, LiDAR information, and the template placement along the horizontal and vertical alignments. All assumptions are described below. The difference from the proposed design, created in OpenRoads Designer, to the surface created from the 2011 LiDAR information was used to compute the volumetric quantities. Quantities measured by area were gathered using 2D shapes from the top mesh of the proposed design extents by material. A summary of these conceptual design quantities can be found below in Table F-1.

Assumptions

Various assumptions were made to provide quantities for the conceptual design with limited information. All assumptions made for quantity calculations are as follows:

- Existing surface: The 2011 LiDAR data was used as the existing surface to design on with the knowledge that it does not match existing conditions in all locations.
- Soil: The soil quantity is the total soil needed, whether reusable or hauled from offsite. While 1V:8H interior side slope is recommended across the entire area, there will likely be variability during design. Quantities for both 1:8 and 1:6 have been provided below (Table F-1) as a reference.
- Trees: Areas for Tree Removals were estimated from aerial images, as such the density of trees removed varies. With environmental coordination, foresters from the RPO estimated that new tree plantings should be placed at a 20’ by 20’ spacing, yielding 109 trees per acre. These spacing of these trees can vary between cottonwood and willow saplings, making stand maintenance and mowing easier.
- Screw Gate: Specific screw gate feature will be decided upon during the design phase.
- Removals: Material removals may not be accurately identified for regrading the existing road and berm as there are plans to dispose within the project vicinity. Gravel road to be removed and regraded is 6" depth as defined in as-built plans.

- Reusable Materials: All values are estimated by field measurement of by aerial image, and sources should be determined during the design phase.
- Riprap: Any area currently armored with stone will remain armored, as such, additional riprap may be needed to keep the armoring. All riprap has a 20” layer thickness applied.
- Clearing and grubbing area was not able to be estimated with the available data and should be estimated in PED.

Table F- 1: Quantities for Recommended Repairs

Item	Units	Swan Lake	Cross Dike	Fuller Lake Berm	Realignment	**Project Total**
Soil (recommended 1V:8H slope)	CY	345512.6	16640.1	123664	52720.9	**538538**
Soil - (Alt. 1V:6H slopes)*	CY	293686.4	15945	N/A	N/A	**486016**
Gravel, Roadway 6"	CY	8341.2	0.00	2530.2	1076.8	**11948**
Seeding	ACRE	60.4	2.9	21.6	31.2	**116**
Trees (109 stems/acre)	EACH	0	0	327	2452.5	2780.00
Tree Removal	ACRE	7.10	0	5.00	1.1	13.20
Culvert Pipes	FOOT	0	5	0	225	230.00
Screw Gate	EACH	0	0	1	0	1.00
Removals	CY	8341.2	0	0	0	8341.27
Reusable Material	CY	366100.9	0	100290.8	52231.8	518623.56
Rip Rap - 20" layer thickness	CY	5354.0	10429.7	0	0	15784
Clearing and Grubbing	JOB					1.00
Removal - Gravel				898.3		898.3

*Project Total includes Fuller Lake Berm and Realignment as recommended 1V:8H slopes since no 1V:6H interior slopes are recommended within the boundaries of those areas.

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Appendix G: Lessons Learned

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The purpose of the UMRR Construction Lessons Learned – Swan Lake Report is to document the physical performance and construction considerations, including cost and schedule risk, for each of the features originally constructed at the Swan Lake HREP. The report is intended to serve as one component of a larger body of work that will document lessons learned from all past and present HREP project features. Future HREP design engineers can and should utilize this work as a resource to help guide future HREP feature designs and lead to more efficient HREP execution.

ORIGINAL PROJECT FEATURES:

The following features were constructed for the Swan Lake HREP to provide the most habitat benefits and cost efficiencies to achieve the goals and objectives of the project (Figure G - 1):

1. Island Building (Middle / Lower Swan Lake) – Excavate Lake sediments to construct groups of barrier islands that would reduce wind-generated wave action and reduce turbidity levels within Swan Lake
2. Channels (Middle/Lower Swan Lake) – Channels were constructed to subdivide the Swan Lake into independently managed, but complimentary habitat compartments and to help convey water from water control structures.
3. Overwintering Habitat - Mechanical Excavation (Middle / Lower Swan Lake) to provide deep water fish habitat was accomplished in conjunction with the construction of the riverside berm. Borrow material for berm construction was taken from the lake bottom immediately adjacent to the berm. This created 5.9 miles of deep-water habitat that was approximately 30 feet wide by 10 feet deep.
4. Riverside berm to reduce the deposition of river borne sediment. The riverside berm is an 8.8-mile earthen sediment deflection berm that parallels the Illinois River shoreline and the perimeter of the Refuge. The berm was necessary to reduce siltation that occurs from frequent floods from the Illinois River and to improve water control capabilities. Two spillways were created on the berm by lowering the elevation in certain locations and adding stone protection. These spillways allow for overtopping to happen in a controlled manner without causing damage to the berm.
5. Water and sediment control basins and ponds to trap hillside sediments - Erosion control practices were implemented at more than forty sites in the Swan Lake Watershed by the end of 1998. This included 25 water and sediment control basins (WASCOB) in upland watersheds to reduce sediment transported by tributaries flowing into the lake.

6. Water level control features (including gravity drains, interior closure structures, and pump stations) to provide for interior water level control. Basic data on water level control features follows:

    A. Lower Swan Lake to Illinois River: A gravity structure has been utilized to separate Lower Swan Lake from the Illinois River at approximately RM 5.0, constructed with 20 foot concrete channel openings with four 52-inch stoplog slots to facilitate fish passage when the stoplogs are out. An angle mounted pump is installed in the unit for dewatering. The pumping capacity is 48,000 GPM at a total dynamic head of 16.2 feet and 50,000 GPM at a total dynamic head of 7.63 feet. The pump is driven by a diesel engine, rated for 301 hp at 1800 rpm, through a universal drive shaft, belt drive and a right-angle gear reducer. The diesel engine is trailer mounted so it can be stored off-site when not in use, the diesel fuel tank is also trailer mounted. There is a water control structure at the inlet to the Lower Swan Lake pumping station with five sluice gates and 5 fish screens. The structure helps keep silt out of the pump sump area when the pump is not being operated. A portable diesel engine driven pump is also provided to dewater the forebay area of the larger pump for maintenance. This pump would utilize the concrete ramp constructed alongside the western side of the forebay. The pumping capacity of the portable pump is 3,100 GPM at a total dynamic head of 40 feet.

    B. Middle Swan Lake to Lower Swan Lake: Through the interior lake closure between Lower Swan and Middle Swan Lake is a 42-inch gated CMP to release water from Middle Swan into Lower Swan. The drainage structure consists of a 42-inch diameter Waterman Industries, Inc. C-20-SB-Y canal gate mounted on the 42-inch CMP inside a 72-inch diameter riser pipe.

    C. Middle Swan Lake to Illinois River: A gravity structure has been utilized to separate Middle Swan Lake from the Illinois River at approximately RM 9.8, constructed with 20 foot concrete channel openings with four 52-inch stoplog slots to facilitate fish passage when the stoplogs are out. A 42-inch gated CMP drains this unit to the Illinois River and a 30,000 GPM reversible pump station facilitates watering and dewatering. It is located near the upper end of the compartment at river mile 9.8. The pump station consists of a precast concrete vault with two bays. One bay is the sump for the 30,000 GPM vertical, line-shaft pump. The pump discharges through a flap gate into the other bay which serves as the pump discharge chamber. Corrugated steel pipes extend from the sump and discharge chamber, through the berm to Middle Swan Lake and to the Illinois River. The pump station can pump from Middle Swan Lake into the Illinois River or from the Illinois River into Middle

Swan Lake. Pumping direction is controlled by opening or closing the two pump sump intake gates and the two discharge chamber outflow gates. The pump is driven by a diesel engine, rated for 118 hp at 1800 rpm, through a universal drive shaft and a right-angle gear reducer. The diesel engine is trailer mounted so it can be stored off-site when not in use. The diesel fuel tank is also trailer mounted. The pump intake sluice gates are two 84-inch x 84- inch self-contained Hydro Gate sluice gates. The discharge chamber gates are two 72-inch x 72-inch self-contained Hydro Gate sluice gates. The sluice gates are manually operated using the hand crank or using a portable hydraulic operator. The 42-inch gated CMP at the pump station discharge chamber can serve as a gravity drain when the pumping station is not in operation. Upper Swan Lake to Middle Swan Lake: A 36" gravity drain at the Upper Swan Lake site has been utilized for the compartmentalized control of interior water levels between Upper and Middle Swan Lake.

Upper Swan Lake to Illinois River: A 48-inch and 60-inch gated CMP drains this unit to the Illinois River and a 16,000 GPM reversible pump station facilitates watering and dewatering. The pump station consists of a precast concrete vault with two bays. One bay is the sump for the 16,000 GPM vertical, line-shaft pumps. The pump discharges through a flap gate into the other bay which serves as the pump discharge chamber. Corrugated steel pipes extend from the sump and discharge chamber, through the berm to Fuller Lake and to the Illinois River. The pump station can pump from Fuller Lake into the Illinois River or from the Illinois River into Fuller Lake. Pumping direction is controlled by opening or closing the two pump sump intake gates and the two discharge chamber outflow gates. The pump is driven by a diesel engine through a universal drive shaft, belt drive and a right-angle gear reducer. The diesel engine is trailer mounted so it can be stored off-site when not in use. The diesel fuel tank is also trailer mounted. The pump intake sluice gates are two 60-inch x 60-inch self-contained Hydro Gate sluice gates. The discharge chamber gates are two 48-inch x 48-inch self-contained Hydro Gate sluice gates. The sluice gates are manually operated using the hand crank or using a portable hydraulic operator. A 24" CMP with a sluice gate drains water near the north end of Upper Swan Lake into the Illinois River.

D. Boat Ramps were constructed to provide service access to constructed features to better facilitate operation and maintenance of the constructed features.

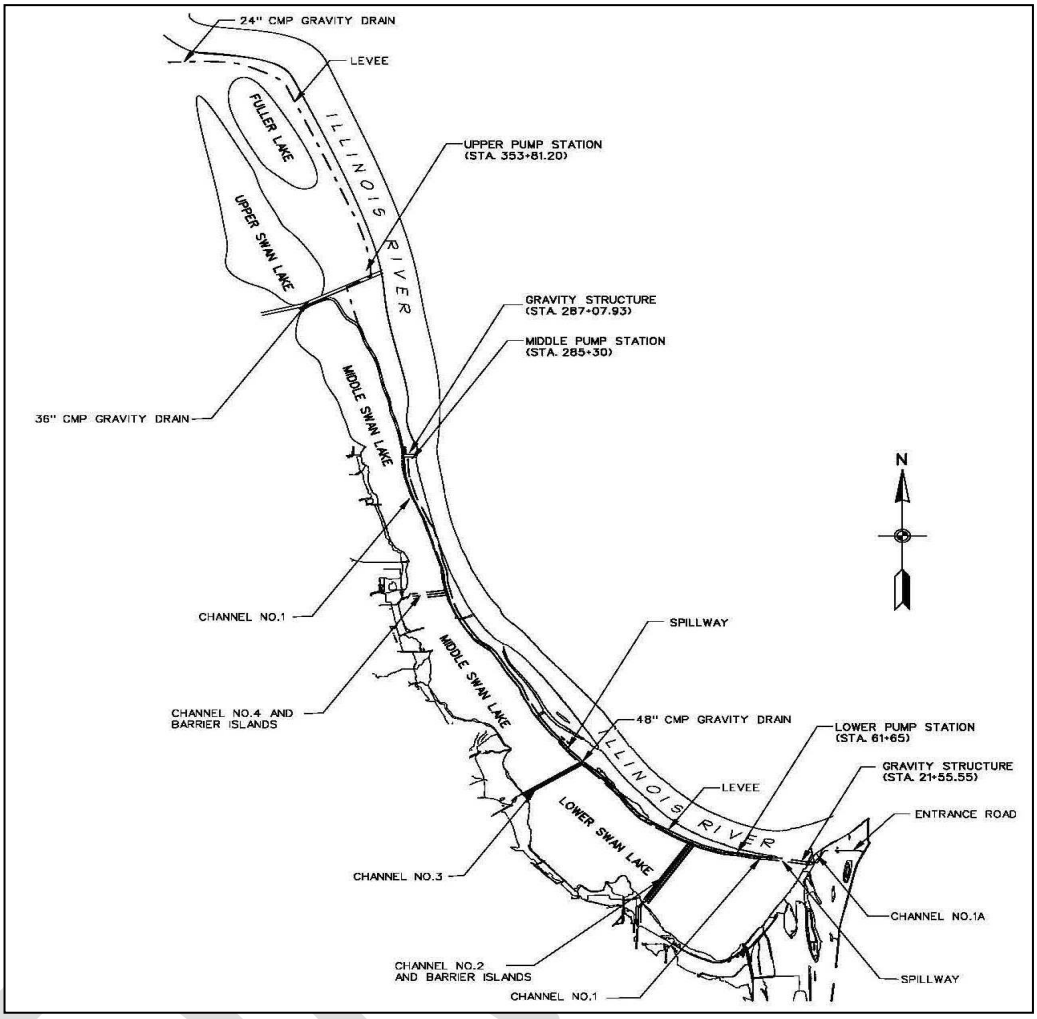

Figure G - 1: Project Features

Lessons Learned Analysis

While all features constructed at the Swan Lake HREP have been discussed as part of the UMRR Construction Lessons Learned analysis, only the key elements relevant to the Repair with Resiliency design are included in this appendix. Information from recent OMRR&R Inspections as well as a general discussion of the recommendations and considerations, based on lessons learned, with input from USACE and sponsor personnel, associated with each project feature is discussed.

1. Channels (Middle/Lower Swan Lake) – Initially Channels 1, 1A, 2, 3, and 4 (Figure G - 2, G - 3, G - 4,and G - 5) were constructed to subdivide the Swan Lake into independently managed,

but complimentary habitat compartments and to help convey water from water control structures (watering/dewatering). Material from these channel excavations was utilized in the creation of other project features including island, exterior berm, and over wintering habitat construction.

2013 Inspection Results: All of the channels were experiencing some degree of siltation. This situation was restricting the USFWS ability to draw down the two units.

2020 Inspection Results: Wave action/wind fetch and flooding was observed to have caused severe sedimentation in channels. 3-4 inches of sediment were removed from the top of the Middle Swan berm after the 2019 flood; estimates of sedimentation deposition in the lake channels were likely greater.

Fall 2021 Site Visit Results: Sedimentation observed in previous inspections remained unchanged or potentially increased as a result of continued wave action and wind fetch.

Recommendations / Considerations: Siltation will always be an issue with the backwaters on the Illinois River. The life expectancy of these channel cuts could be relatively short, depending on the exposure to sedimentation. Movement of flocculent material in the lake bottom via wave action occurs nearly continuously and flood events can bring in a substantial amount of sediment in a very short period of time. Care should be taken in the design process to consider all sources of sediment and limit the exposure of the excavated channels. Routing of upland sediment to alternate locations for deposition and appropriate berm protection from adjacent river flows are critical design decisions. Additional consideration of the quality of the dredge material should also be considered for use of the dredged material for other project features.

Figure G - 2: Channel Cuts 1, 1A, 2 and 3 Completed to Facilitate Watering and Dewatering

Figure G - 3: Channel Cuts 1 and 4

Figure G - 4: Channel Cut 1 Near the Lower Swan Spillway

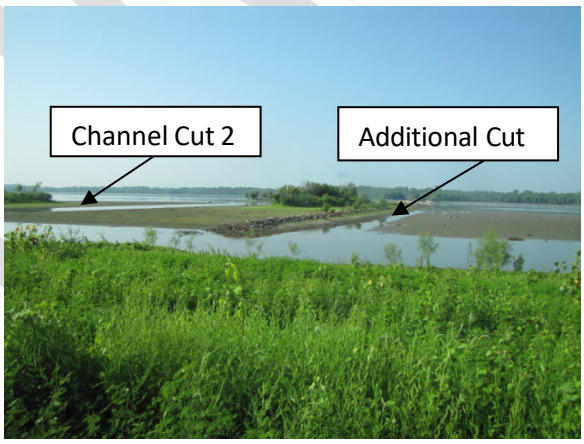

Figure G - 5: Channel Cut 2 and Additional Cut

2. Overwintering Habitat Dredge Cut (Middle/Lower Swan Lake)/Dredging – Dredging / Mechanical Excavation to provide deep water fish habitat was accomplished in conjunction with the construction of the riverside berm (Figure G - 4). This dredge cut is labeled Channel Cut 1 above. Borrow material for berm construction was taken from the lake bottom immediately adjacent to the berm. This created 5.9 miles of deep-water habitat that was approximately 30 feet wide by 10 feet deep plus the channels dredged from each boat ramp to the dredge cut for boat access.

2013 Inspection Results: Channel 1 is was observed to be failing to act as overwintering habitat for fish. Siltation, loss of depth, and current management were all contributing factors to the failure of channel 1 to act as an overwintering habitat for fish. Originally, Lower Swan was to be managed for fishery habitats and Middle Swan for emergent vegetation and waterfowl habitats, but because of dewatering capability, the management of these two units has been switched. This made river connectivity for winter habitat an issue.

2020 Inspection Results: In the DPR, Lower Swan was to be managed for fishery and Middle Swan for emergent vegetation and waterfowl. Research found Lower Swan to be very shallow (3 feet deep average), no deep-water overwintering fish habitat, no submergent aquatic vegetation, and the water became super cooled with wave action during cold weather.

Research indicated that Swan Lake is not a suitable habitat for overwintering fish but is highly desirable as a feeding, resting and roosting habitat for migrating waterfowl, shorebirds, wading birds, pelicans, and bald eagles.

Fall 2021 Site Visit Results: It was noted during the site visit that the performance of this project feature had degraded significantly due to siltation / loss of depth of the dredge cut. Water control structures connecting segments of the dredge cut were observed to have silted in completely and Site Manager workarounds (construction and removal of earthen dam material adjacent to the water control structures) were discussed.

Recommendations / Considerations: The construction of the exterior berm utilizing material from a dredge cut immediately adjacent to the dredge cut was an efficient operation. It also allowed for practical, land-based maintenance. A long-reach excavator operating from the berm could be used to dig sediment out and cast it along the landside slope; however, the rate of sedimentation has outpaced the Site Manager's ability to keep this channel open. This situation has degraded the ability of this dredge cut to function as a connection between the different units of Swan Lake. A risk analysis focusing on long term functionality of the systems / features designed for future HREPs could inform on project designs both during the planning and pre-construction, engineering, and design (PED) phases of HREPs. The analysis should recognize that Site Manager decisions based on degrading performance of individual project features will likely have a significant impact on the functionality of all other system components.

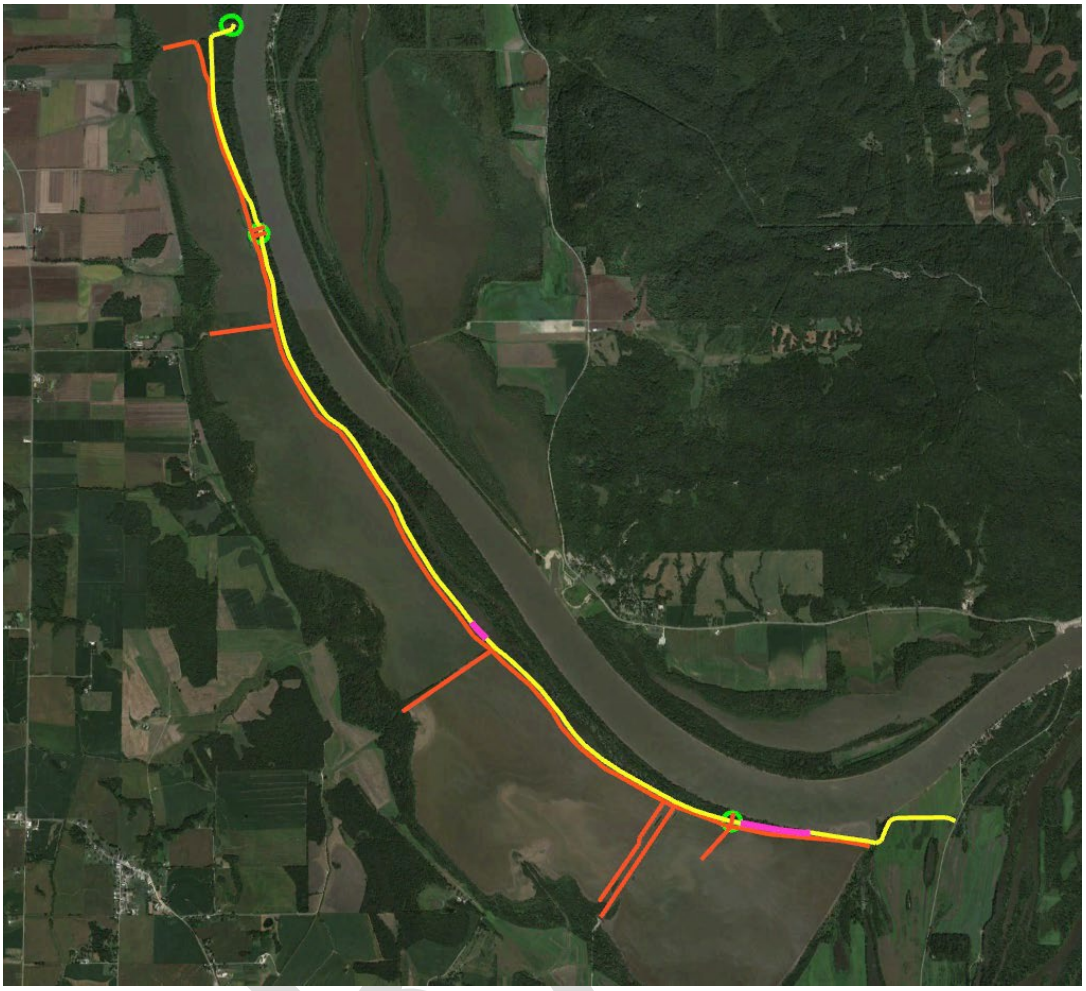

Figure G - 6: Exterior Sediment Deflection Berm and Channels Used for Material

(The Exterior Berm (in yellow) of the Swan Lake HREP was constructed with dredge material from Cut 1 (orange line immediately adjacent to the Exterior Berm). Two spillways (magenta) were also constructed.)

3. The Exterior Berm was constructed to reduce the deposition of river borne sediment. This feature is an 8.8-mile earthen berm that parallels the Illinois River shoreline and the perimeter of the Refuge (Figures G - 6, G - 7, G - 8, G - 9, G - 10, and G - 11). The Exterior Berm was necessary to reduce siltation that occurs from frequent floods from the Illinois River and to improve water control capabilities. Two spillways were created on the berm by lowering the elevation in certain locations and adding stone protection. These spillways allow for overtopping to happen in a controlled manner while minimizing damage to the berm.

2013 Inspection Results: Site Manager indicated that there is a repetitive problem with the riprap being eroded from the roadway and spillway and recommended that a larger riprap be used and that the spillways be replaced with concrete. The wider spillway in Lower Swan was

observed to have been working well and had reduced some of the issues with rock being carried away during flood events. The Middle Swan spillway had some of the riprap removed during the 2013 flood event. The steepness of the slope of the exterior berm is contributing to the instability of the riprap (according to Site Manager). Some erosion of the exterior berm from wave action was also observed.

2020 Inspection Results: Site Manager indicated that there is a repetitive problem with the riprap being eroded from the roadway and spillway. Site Manager found that building a mound of large riprap immediately adjacent to and higher than the access road has greatly reduced loss of gravel from the road when the spillway overtops. The Lower Swan berm was observed to be holding up better than Middle Swan; at the time it was believed that the gentler slope and wider base of the Lower Swan berm is largely part of this reason. It has also been noted that the current condition of the berm at the time of the inspection, based on observations of previous flood events, there was very little elevation change between the upper end of Middle Swan to the lower end of Lower Swan. Since the Illinois River falls about two inches every mile, if this observation was correct, the berm would naturally more susceptible to over-topping floods on the upper end of the project.

Fall 2021 Site Visit Results: Site Manager communicated issues associated with the spillways and erosion associated with the exterior berm during this site visit. The site visit was primarily conducted from the exterior berm. The team stopped at the Lower Swan spillway to discuss the measures the Site Manager implemented to prevent the erosion of surface stone from the berm. The Site Manager also mentioned on numerous occasions that it was his belief, based on observations of multiple flood events, that the minimal slope along the berm profile was causing significant scour and sedimentation on the upstream end of the Swan Lake project area.

Recommendations / Considerations: Observation of the performance of the exterior berm has led to several lessons learned. First, the slopes on the interior (Swan Lake) side of the berm are relatively gentle at 1V to 6H. However, some scour during overtopping events could be alleviated with an even more gentle, more natural slope of up to 1V to 10H, where practical. Lesser slopes of 1V to 8H in areas shown to be more at risk of scour would also likely be more resilient than as-built.

Additionally, the functionality of the spillways in Middle and Lower Swan have effectively reduced the level of protection that the exterior berm provides. Often enough, events that would not have otherwise overtopped the exterior berm flows through the spillways and leads to reduced refuge performance and unnecessary OMRR&R costs for the Site Manager. Scour at these spillway locations, particularly the loss of the smaller surface stone on the road at the top of the berm, has been a concern for the Site Manager. Early efforts by the Site Manager involved embedding Articulated Concrete Bock Mattress into the spillway to prevent erosion during overtopping events. However, due to the continued loss of surface stone, the Site

Manager has placed riprap protection on the interior (Swan Lake) side of the exterior berm at an elevation a foot or so above the elevation of the road surface, which has greatly reduced this issue.

The current condition of the exterior berm profile with minimal slope along key sections of the berm has also shown to be an issue for the Site Manager. In his opinion, this has led to uneven overtopping with a lot of energy focused into locations along the upstream end of Swan Lake and scour along the exterior berm in these locations. Additionally, planting / promoting woody vegetation along the exterior berm could help to reduce scour risk.

Finally, the upper end of this berm is oriented perpendicular to the flow of the Illinois River. While this may have been the right design choice to avoid sedimentation from upland flows or real estate issues, the orientation does lead to an increase in the scouring energy and a higher risk of berm failure. Whenever possible, exterior berms should be aligned with the flows of the adjacent river channel. If this is not possible, a wider cross section and gentle slopes (suggest a slope greater than the as-built slope of 1V:6H) on the protected side of the berm will help reduce the risk of a scour failure.

Figure G - 7: Exterior Sediment Deflection Berm at Lower Swan Lake (South of the Pump Station)

(Note woody vegetation starting to emerge on berm and steepness of slope of berm on the left.)

Figure G - 8: Exterior Sediment Deflection Berm at Lower Swan Lake (North of the Pump Station)

Figure G - 9: Exterior Sediment Deflection Berm and Spillway at Middle Swan Lake (South of the Pump Station)

(Note erosion and rock movement from 2013 flood event.)

Figure G - 10: Spillway of Middle Swan Lake

Figure G - 11: Lower Swan Lake Spillway (Notice riprap elevated above road grade to prevent gravels from washing during overtopping events. Photo taken March 2020)

4. Gravity structures were constructed to separate Swan Lake from the Illinois River while also allowing for fish passage (Figure G - 12 and G - 13). Gravity structures were constructed at the southern end of Lower Swan Lake (river mile 5.0) and at the upper end of Middle Swan Lake (river mile 9.8). The structures consist of a 20-foot-wide open concrete channel containing four 52-inch wide stoplog slots.

    a. Lower Swan Water Control Structure.

2013 Inspection Results: Site Manager was pleased with the general operation of this stoplog structure. The aluminum stoplogs operated well, but the trolly hoist required a brake along the I-beam to keep it from moving when lowering or raising the gates with the lifting beam. They did have to replace the lifting cable with a thicker cable (the lifting beam is gravity engaged and lanyard released). The lifting beam did not effectively hook into the lifting lugs on the stop logs when there was flow over the gates (Figure G - 13). The USFWS manufactured a device that allows them grab ahold of the stoplogs when there is flow (Figure G - 16), but use of the device was cumbersome because the lifting lugs would get ripped off the stop log periodically (Figure G - 15) and the rubber seals along the stoplog would separate from the stoplog if they were glued on (Figure G - 20). The bolted seals have greater longevity. The widening of the control structure was sufficient to facilitate the passage of USFWS machinery. The slope leading up to the control structure and tops of cofferdams has had issues with gravel being eroded away during flood events.

2020 Inspection Results: Refer to 2013 description of Lower Swan Control Structure. No changes were noted.

Fall 2021 Site Visit Results: The team observed this structure at the outset of the site visit. Several issues were noted, including a hydraulic control box that was damaged and safety rails

around the perimeter of the structure had been loosened by damage during a recent flood event. The installation of the stoplogs was discussed as being sometimes cumbersome and usually a two-man operation.

Recommendations / Considerations: Future lifting beam designs should include the development of a hand braking system that holds trolly in place. Additionally, hydraulic controls, the lifting beams, cabling, and aluminum stoplogs (including lifting lugs) should be designed to be sufficiently strong to meet the need of Site Managers during all river flow conditions. Bolted on seals were much more resilient on the stoplogs than the seals that were glued on.

Placement of the concrete caps on each cofferdam has worked well to reduce maintenance and gravel erosion during overtopping events. Safety railings around the cofferdams should also either be designed to withstand overtopping events or to allow for efficient re-tightening of the cables after an event.

Figure G - 12: Gravity Control and Fish Passage Structures for the Lower (left) and Middle (right) Swan Lake

Figure G - 13: Stoplog Structure and Trolley Hoist for Lower Swan Lake. (The lifting beam and hooks do not work well when there is flow.)

Figure G - 14: Lower Swan Lake Gravity Control Structure

(The site was made wider to facilitate passage of farm machinery. Photo- March 2020)

Figure G - 15: Lower Swan Lake Gravity Control Structure and Trolley Beam

(Aluminum stoplogs had some problems with the lifting lugs being ripped off during lifting.)

Figure G - 16: USFWS Designed Apparatus to Lift Trolly Beam

(Hooking onto the stoplogs when flow was present proved to be difficult with the trolley beam lift. USFWS designed an apparatus that worked, with some difficulty (left). The rubber seals that were glued to the stoplogs have the tendency to separate from the stoplog (right). Bolted on seals work better.)

b. Middle Swan Control Structure.

2013 Inspection Results: Site Manager was pleased with the general operation of this stoplog structure. The aluminum stoplogs worked well, but the trolly hoist needed a brake along the i-beam to keep it from moving when lowering or raising the gates with the lifting beam. The lifting cable was replaced with a thicker cable. The lifting beam is gravity engaged and lanyard released. The lifting beam did not effectively hook into the lifting lugs on the stop logs when there is flow over the gates (Figure G - 13). The USFWS manufactured a device that allows the stoplogs to be grabbed when flow is present (Figure G - 16), but the device was cumbersome. The lifting lugs would become separated from the stoplog periodically (Figure G - 15), and the rubber seals along the stoplog separated from the stoplog if they were glued on (Figure G - 20).The bolted-on seals have longer longevity . The gravel slope leading up to the control structure and tops of cofferdams has eroded away during flood events. The channel on the river side of the control structure has been filling with sediment and making it difficult to pump water.

2020 Inspection Results: Refer to 2013 description of Middle Swan Control Structure. No changes.

Fall 2021 Site Visit Results: The team observed this structure near the end of the site visit. Several issues were noted, including a hydraulic control box that was damaged and safety rails around the perimeter of the structure that had been loosened by damage during a recent flood event. The installation of the stoplogs was discussed as being sometimes cumbersome and usually a two-man operation.

Recommendations / Considerations: Future lifting beam designs should include the development of a hand braking system that holds the trolly in place. Additionally, hydraulic controls, the lifting beams, cabling, and aluminum stoplogs (including lifting lugs) should be designed to be sufficiently strong to meet the needs of Site Managers during all river flow conditions. Bolted-on seals were much more resilient on the stoplogs than the seals that were glued on.

Placement of the concrete caps on each cofferdam has worked well to reduce maintenance and gravel erosion during overtopping events. Safety railings around the cofferdams should also be either be designed to withstand overtopping events or be designed to allow for efficient re-tightening of the cables after an event.

Figure G - 17: Middle Swan Stoplog Structure and Trolly Hoist

Figure G - 18: Middle Swan Stoplog Structure and Trolly Hoist

Figure G - 19: Middle Swan Stoplog Structure and Trolly Hoist

Figure G - 20: The Bolted Seals (left) Work Better than the Glues Seals (right)

(The bolted gaskets on the stoplogs worked better than the glued ones.)

Figure G - 211: Middle Swan Stoplog Structure.

5. 36-inch gravity drain was constructed prior to project authorization at the Upper Swan Lake site for the compartmentalized control of interior water levels between Upper and Middle Swan Lake (Figure G - 22 and G - 23).

2013 Inspection Results: The screw gate was not being used to control water in the two units at the time of inspection.

2020 Inspection Results: The screw gate was not being used to control water in the Fuller Lake or Middle Swan at the time of inspection.

Fall 2021 Site Visit Results: This feature was not visited during the Fall 2021 Site Visit.

Recommendations / Considerations: The functionality of this structure was a key component of the Swan Lake HREP design. Future designs should consider a higher factor of safety for flowrates and sediment passage for key infrastructure such as this one. Locating this structure closer to the pump station inlet channel could also potentially lead to dual benefits of cleaning out this channel to serve the structure as well as the pump station.

Figure G - 22: Cross Dike between Fuller Lake and Middle Swan

(A 36-inch screw gate exists between the two units.)

Figure G - 23: The Cross Dike Between the Fuller Lake and Middle Swan Lake.

(A 36-inch screw gate exists between the two units.)

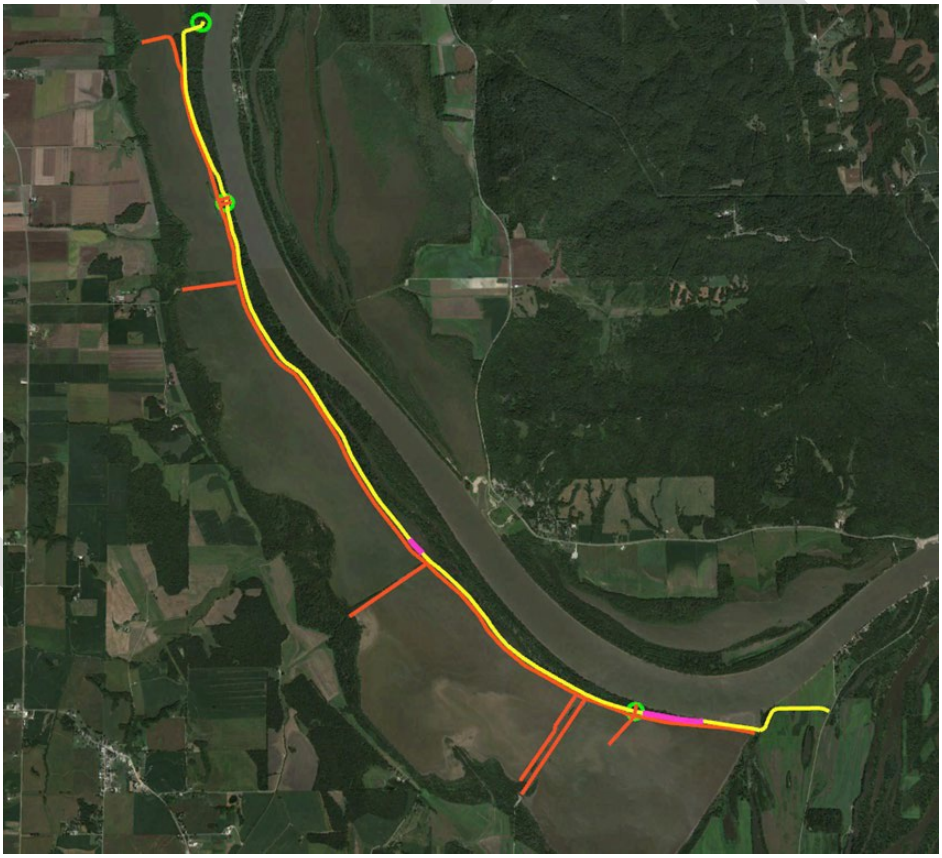

Figure G - 24: Pump Stations are Located (green circles) in Lower and Middle Swan to Control Water Levels

6. Water level control features (including gravity drains, interior closure structures, and pump stations) were constructed to provide for interior water level control.

a. Fuller Lake to Illinois River. a 16,000 GPM reversible pump station facilitates watering and dewatering.

2013 Inspection Results: No information is available from the 2013 Inspection.

2020 Inspection Results: No information is available from the 2020 Inspection.

Fall 2021 Site Visit Results: The team did not visit this structure during this site visit.

Recommendations / Considerations: The geometry of the mechanical components of this pump station is suitable for safe, low maintenance operation. The pump is reasonably sized for the application at 16,000 GPM and thus does not overstress associated mechanical components. It is recommended that future pump stations rely on a larger concrete pad around equipment to reduce safety and maintenance concerns for the Site Manager. No issues associated with the use of CMP were reported by the Site Manager. This building material is readily available to contractors and likely at a lower cost than other concrete components.

The siltation issue that impacts nearly every feature of the Swan Lake system is also a significant concern at this location as it prevents efficient water flow to the pump station from either side. The riverside connection of this pump station to the Illinois River tends to be free of siltation and debris due to the river training structure located immediately upstream of the channel leading to the pump station. However, on the Fuller Lake side of the pump station no direct means for addressing siltation issues was designed and constructed as part of the project, but this could be a consideration for future designs where the risk of siltation is high. Another consideration, perhaps even more importantly, is to prioritize locating pump station inlets in locations that are at a low risk of siltation whenever possible.

b. Middle Swan Lake to Illinois River (Figure G - 25 and G - 26). A 42-inch gated CMP drains Middle Swan to the Illinois River and a 30,000 GPM reversible pump station facilitates watering and dewatering.

2013 Inspection Results: The intake on the riverside of the pump station was filling in with sediment. The depth gauges became covered with sediment and difficult to read, but the remaining portions of the structure work as designed. Recommendations: Clean the intake channel with excavator periodically.

2020 Inspection Results: Overall structure held up well and functioned as designed; however, both sides of the pump station experienced heavy sedimentation.

Fall 2021 Site Visit Results: Overall structure is holding up well and functions as designed. The pump station was noted to be a manually operated and powered by a diesel engine. Siltation was observed on both sides of the pump station, and significant vegetation had grown in the

immediate area around the pump station equipment, which presents an O&M and safety risk. A large snake was observed (moments before being tread on) that had been obscured by the vegetation.

Recommendations / Considerations: The geometry of the mechanical components of this pump station is suitable for safe, low maintenance operation. The pump is reasonably sized for the application at 30,000 GPM and thus does not overstress associated mechanical components. It is recommended that future pump stations rely on a larger concrete pad around equipment to reduce safety and maintenance concerns for the site manager. No issues associated with the use of CMP were reported by the site manager. This building material is readily available to contractors and likely at a lower cost than other concrete components.

The siltation issue that impacts nearly every feature of the Swan Lake system is also a significant concern at this location as it prevents efficient water flow to the pump station from either side. No direct means for addressing siltation issues was designed and constructed as part of the project, but this could be a consideration for future designs where the risk of siltation is high. Another consideration, perhaps even more importantly, is to prioritize locating pump station inlets in locations that are at a low risk of siltation whenever possible.

Figure G - 25: Middle Swan Lake Pump Station

Figure G - 26: Intake Pipe for Middle Swan Pump Station (left) and Fence Around Pump

c. Middle Swan Lake to Lower Swan Lake. Through the interior lake closure between Lower Swan and Middle Swan Lake is a 42-inch gated CMP to exchange water between Middle Swan and Lower Swan (Figure G - 27,G - 28, G - 29). The drainage structure consists of a 42-inch diameter Waterman Industries, Inc. C-20-SB- Y canal gate mounted on the 42-inch CMP inside a 72-inch diameter CMP riser pipe.

2013 Inspection Results: The cross dike between the two units was observed to function satisfactorily. It was observed to be, however, overgrown with woody vegetation (Figure G - 28). The control structure was not functional at the time of inspection. It had been completely sedimented in in both units (Figure G - 29).

2020 Inspection Results: The cross dike between the two units was observed to function satisfactorily. It was, however, overgrown with woody vegetation (Figure G - 28). The control structure was not functional at the time of inspection. It had been completely sedimented in in both units (Figure G - 29) and the gearbox had been compromised. To mitigate the impacts resulting from the failed structure, a 20 foot wide notch was excavated from the cross dike to facilitate flow between units.

Fall 2021 Site Visit Results: This structure was observed during the Fall 2021 Site Visit. The structure had clearly been silted in and was no longer functional. The CMP riser pipe was visible and in good shape. A black coating was observed on the riser pipe, likely to reduce rust and corrosion. The 20-foot notch described in the 2020 inspection results above was also observed.

Recommendations / Considerations: The functionality of this structure was a key component of the Swan Lake HREP design. As a result of the silting in of this structure, the USFWS estimates that they spend up to $50K per year in fuel and labor expenses that could be otherwise be allocated elsewhere on the project. Given the conditions that exist today, this structure is likely significantly undersized and poorly located for optimal project functionality. Future designs should consider a higher factor of safety for flowrates and sediment passage for key infrastructure such as this one.

Figure G - 27: A 42-inch gated CMP exists between Middle and Lower Swan Lake

Figure G - 28: The Cross Dike Between Middle and Lower Swan Lake is Currently Covered in Woody Vegetation

Figure G - 29: Control Structure within the Cross Dike Show to be Filled with Sediment

(The water control structure no longer functions. The pipe on both sides is completely sedimented in. Note: The control structure itself is also sedimented in (right)

d. Lower Swan Lake to Illinois River (Figure G - 30). An angle mounted pump is installed in the unit for dewatering (Figure G - 3, G - 34,and G - 35). The pumping capacity is 48,000 GPM.

2013 Inspection Results: This pump station was shown to function efficiently and quickly at the time of inspection. The USFWS removed the screen from pump head because it required too much power from the pump, 60,000 GPM vs 48,000 GPM. The channels leading to the pump station had become clogged with sediment, which restricts the ability to dewater the Middle Swan. The orientation of the bars on the fish and vegetation control structure was observed to function well. Based on information from the project sponsor, debris slides down the bars rather than getting hung up on them and causing blockages. The increased sized gravel (2–3-inch gravel) around the pump station was also reported by sponsor personnel to work well.

2020 Inspection Results: At the time of inspection, the lower pump station was operational; however, there was a noise emanating from the bottom end of the pump. Due to the costs associated with pulling the pump, it had not been adequately diagnosed. The pump unit's right angle gear box was submerged in 2019, causing mineral deposits on metal parts, loss of lubrication, debris deposits, sediment deposits, third failure of input bearing, broken teeth on ring gear, pinion failure, and eight belts catching fire. Other factors such as stress resulting from bearing thrust from belts and sheaves, vibration of metal parts, weld breakages, corrosion of metal from chemical reactions resulted from being submerged in floodwater. Consequently, flooding has caused increased amount and cost of maintenance.

The water conveyance channels to pump were observed to have all filled with sediment making dewatering of Lower Swan not feasible. The pump sump area was also full of sediment and required maintenance. The trash pump was not functional as a result of sediment deposition in sump not allowing the vacuum pump system to prime and thus could not dewater sump.

Figure G - 30: Lower Swan Lake Pump Station Controls Watering and Dewatering of Lower Swan Lake

Figure G - 31: Outlet Structure (riverside) for Lower Swan Lake Pump Station

Figure G - 322: Pump Intake Station (Swan Lake Side) for Lower Swan Lake Pump Station

Figure G - 33: Diesel motor that operates pump at Lower Swan

Fall 2021 Site Visit Results: The pump was not turned on for the site visit as this was deemed unnecessary for the purposes of the visit. The mechanical components of the pump station,

particularly the right-angle gear boxes, were discussed. The geometry of the mechanical components results in the need for two right-angle gear boxes and a large belt drive assembly that are prone to wear and high O&M costs, particularly in this relatively high-powered pump setup.

Construction personnel onsite during the visit indicated that the initial construction of this pump station was completed in approximately six months. Construction of the forebay and gates / trash rack took place in 2011, well after the initial construction of the pump station.

Recommendation / Considerations: Future pump station designs should avoid the indirect drive from the power units. This has proven to be a significant problem for reliability and safety at this pump station.

The inlet to the pump was originally designed with a screen to prevent large, solid materials from being drawn into the pump. This screen proved to be problematic and frequently clogs. The use of the trash racks with a much larger surface area at the forebay of the pump station has proved to be a more reliable method to keep prevent large debris from being drawn into the pump inlet.

The use of a flap gate on the discharge side of the pump station has restricted the flow of the pump station and is commonly propped open by the Site Manager to maximize pump efficiency. The flap gate has proven useful in the past for preventing overtopping flows from entering the pipe and causing damage and/or maintenance issues to the pump as a result.

The construction methodology at this pump station was efficient and relied upon readily available materials and typical construction methods. The use of sheet pile in the construction of the pump station and forebay proved to be an efficient method of construction, even with the need for tiebacks and whalers. Dewatering of the forebay has been limited due to the siltation at the head of the auxiliary pump pipe.

The siltation issue that impacts nearly every feature of the Swan Lake system is also a significant concern at this location as it prevents efficient water flow to the pump station from either side. Direct removal of silt via mechanical methods (excavator) is a necessary maintenance measure for current conditions at Swan Lake, and this should be a consideration for future designs where the risk of siltation is high. Another consideration, perhaps even more importantly, is to prioritize locating pump station inlets in locations that are at a low risk of siltation whenever possible.

Figure G - 34: Fence Around Pump Station (left). View of Pump Bay (Lake Side) and Fish/Vegetation Control Structure (right)

Figure G - 35: Intake Pipe (Swan Lake Side)

Figure G - 36: Auxiliary Pump Site (left)

(Larger gravel placed around the pump station (right) worked better than the previous smaller diameter gravel.)

Figure G - 37: Fish and Vegetation Control Structure at Middle Swan Lake

Figure G - 38: Fish and Vegetation Control Structure

Figure G - 39: Channels Leading to Control Structure Sediments in Rapidly