1 ARKABUTLA DAM SAFETY MODIFICATION MITIGATION PLAN

1.0 Introduction

One of USACE's directives is to ensure that project-caused adverse impacts to ecological resources have been avoided or minimized to the extent practicable. Any remaining unavoidable impacts would require compensatory mitigation. Compensatory mitigation is the restoration, enhancement, or preservation of aquatic resources to offset the negative impacts of a project. This section discusses what mitigation would be required for unavoidable impacts and the plan for implementing these mitigation efforts.

The legal foundation for mitigation for ecological resources includes the Clean Water Act, Fish and Wildlife Coordination Act (FWCA), Migratory Bird Treaty Act of 1918, Estuary Protection Act of 1968, Endangered Species Act (ESA), Coastal Zone Management Act of 1972, Magnuson – Stevens Fishery Conservation and Management Act, NEPA, various Water Resources Development Acts, and other environmental laws. These laws are implemented and administered through rules, guidance, regulations, and policies issued by Executive Branch agencies.

1.1 Avoidance and Minimization Efforts

During the feasibility phase of this project, the following efforts were made to avoid and minimize impacts to significant resources within the project site:

- Multiple placement locations for the new outlet structure were analyzed during the study. The chosen location in Alternative 2 was selected to reduce impacts to wetlands and avoid impacts to a known cultural site.
- When determining the best way to acquire the borrow material required for the proposed cofferdams, commercial sources were compared to potential USACE borrow areas. For Alternatives 6 and 9, commercial sources were selected to avoid the need to clear forested borrow areas.
- As Alternative 2 would require greater quantities of material when compared to Alternatives 6 and 9, cost considerations determined a USACE selected borrow area would be required. When selecting the potential borrow area multiple locations were investigated. The proposed borrow location was chosen due to the lack of wetland and terrestrial impacts compared to the other potential locations.
- To determine the extent of wetlands in the project area, a wetland delineation was performed. In addition, a Do Not Disturb area was incorporated into the Alternative 2 plan to minimize wetland and terrestrial impacts.
- The backfilled channel (approximately eight acres) would be left at a slightly lower elevation than the surrounding area to allow suitable hydrologic conditions for wetland establishment as well as allowing vegetative regrowth through natural succession. Therefore, an overall increase in wetland functional capacity units (FCU) with project is noted. Additionally, the regrowth would provide 15.7 average annual habitat units (AAHU) of wildlife habitat.

1.2 Impacts to Wildlife Habitat Determination Methods

Impacts to wildlife habitats were calculated using the same ecological models that were used to estimate project impacts. These ecological models were all certified or approved by the USACE Ecosystem Restoration National Planning Center of Expertise and used within their applicable ranges, in accordance with Engineer Circular EC 1105-2-412. A list of these ecological models with their associated resources are included below:

- Terrestrial Habitat: Habitat evaluation procedures (HEP) (USFWS 1980) utilizing the following five HSI Models:
  1) Barred Owl (Allen 1987)
  2) Fox Squirrel (Allen 1982)
  3) Carolina Chickadee (Schroeder 1983a - modified per USFWS Memo dated October 29, 1989)
  4) Pileated Woodpecker (Schroeder 1983b)
  5) Wood Duck (Sousa and Farmer 1983c)

The Habitat Evaluation Procedures (HEP), USFWS (1980), was used to evaluate potential impacts of project alternatives on terrestrial wildlife habitat. The HEP is an accounting system for quantifying and displaying availability index (Habitat Suitability Index (HSI)) models that quantitatively describe the habitat requirements of a species or group of species. HSI models use measurements of appropriate variables to rate the habitat on a scale of zero (unsuitable) to 1.0 (optimal). Habitat units (HU) are the basic unit of HEP to measure project effects on fish and wildlife and are calculated by multiplying the evaluation species' HSI and the acreage of available habitat at a given target year. Changes in habitat quality (HSI) and quantity (i.e., acreages) are predicted for selected target years over the project's period of analysis for future without-project and future with-project conditions. Values are then annualized over the period of analysis for the project providing average annual habitat units (AAHUs) for each of the 5 modeled species. The difference in AAHUs under future with-project conditions and versus future without-project conditions provides a quantitative measure of project impacts. Calculations for mitigation can be found in Section 1.5 of this mitigation appendix

1.3 Unavoidable Impacts to Natural Resources

While the preferred alternative incorporates environmental design features which reduce anticipated impacts to terrestrial and wetland resources, significant unavoidable impacts to wildlife habitat remain that would require mitigation. The impacted habitat is comprised of forested areas primarily containing oaks and elms. Although alternatives 6, 7, and 9 were carried forward for analysis, due to historic issues (e.g., re-grouting), constructability concerns, risk potential, issues with bypass pumping, and potential to meet the originally authorized purpose, these alternatives were deemed impracticable. Table 1 compares the unavoidable impacts for each project alternative.

Table 1: Unavoidable Impacts Comparison

Alternative	Impacted Acres	AAHU Loss	Cause of Impacts
No Action (Non-breach)	0	0	NA
Alternative 2	31	54.6*	New Channel Construction
Alternative 6	0.8	1.8	Bypass Channel
Alternative 7	0	0	NA
Alternative 9	0.8	1.8	Bypass Channel

*AAHUs still requiring compensatory mitigation after accounting for the 15.7 AAHUs provided by the natural succession of the backfilled channel.

1.4 Mitigation Plan Formulation

An array of mitigation alternatives was analyzed to determine a recommended mitigation plan as part of the overall preferred alternative. For environmental planning, where traditional benefit-cost analysis is not possible because costs and benefits are expressed in different units (*e.g.*, AAHU, FCU) two analytical methods are used in the decision planning process. First, cost effectiveness analysis is conducted to identify the least cost solution for each possible level of environmental output. Subsequent incremental cost analysis of the cost-effective solutions is then performed to identify changes in costs for increasing levels of environmental outputs. Using these analyses makes it possible to compare mitigation alternatives and select the appropriate mitigation plan. The three mitigation alternatives that were considered are discussed below.

1.4.1 Acquisition of Cleared Agricultural Land with Natural Succession

This mitigation alternative would involve the acquisition of low-lying tracts of cleared agricultural land, performing topographic and hydrologic restoration, as needed, and allowing the site to naturally re-vegetate. This mitigation method is especially effective when available acorn or other seed sources exist at or near the site to be acquired. However, often, available mitigation lands are typically cultivated on a large scale for crops with little or no adjacent trees for mast sources or located at the lowest elevations and tracts become dominated with early successional species such as black willow and cottonwood. In addition, the accrual of benefits is much lower than actively managed sites and therefore larger amounts of land are often required to be set aside.

1.4.2 Acquisition of Cleared Agricultural Land with Active Reforestation

This mitigation alternative would reestablish a functional hardwood mast producing forest on frequently flooded agricultural land. This is accomplished by establishing tree species suitable for the hydrologic condition on the mitigation tract. It is anticipated that oak and elm species would be planted in order to provide in-kind compensatory mitigation for project induced impacts to terrestrial forests and wildlife habitats.

1.4.3 Purchase of Credits from a Mitigation Bank

In compliance with the Water Resources Development Act (WRDA) 2007 as amended, where appropriate, USACE considers purchase of credits from approved mitigation banks and in-lieu-fee programs in the impacted watershed to be a reasonable compensatory mitigation alternative.

Mitigation Bank Selection

To comply with Section 2036(a) of the WRDA 2007, and to be consistent with the USACE Regulatory Program, the Vicksburg District investigated the use of mitigation banks within an appropriate, applicable service area. No mitigation banks within the project watershed are able to provide upland hardwoods credits, therefore bottomland hardwood (BLH) credits would need to be purchased instead. Deer Creek Road Mitigation Bank was chosen for this mitigation alternative because it has available BLH credits and is within the same HUC8 (08030204) as the project location (Figure 1).

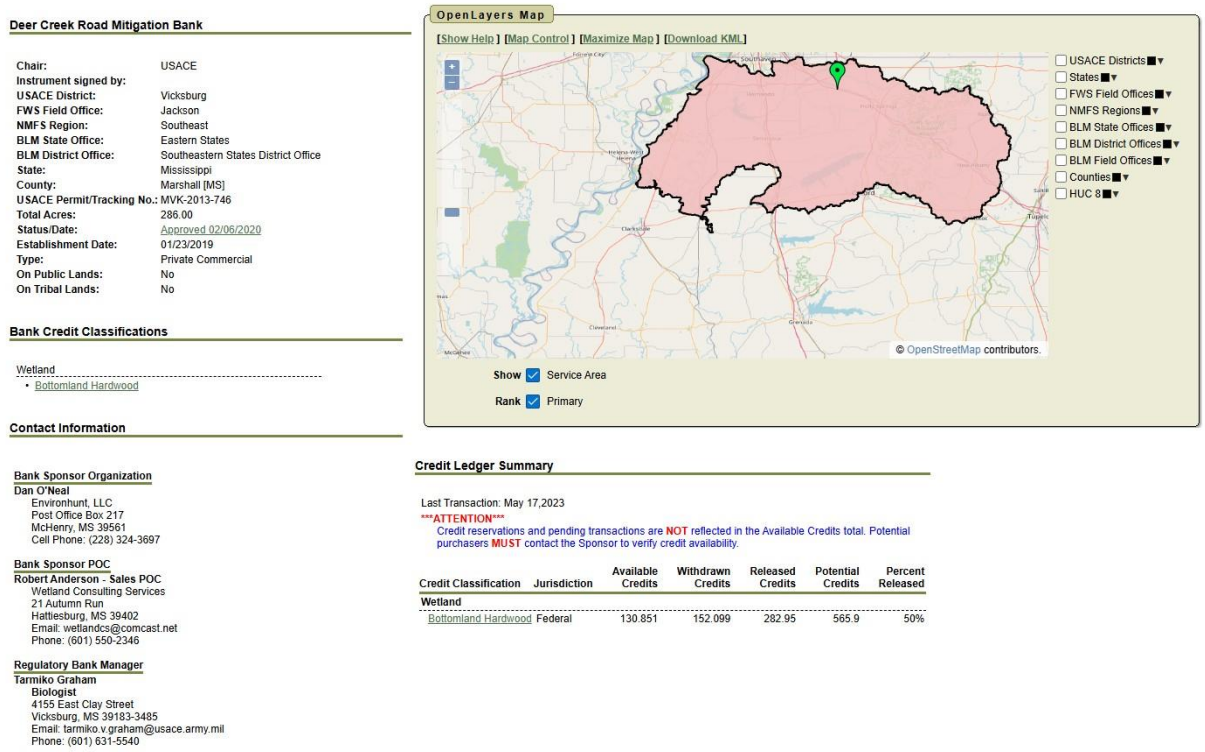

Figure 1: Information for Deer Creek Mitigation Bank.

Since available credits are being included in this mitigation alternative during the feasibility phase, there is risk associated with whether these credits will still be available when this project receives authorization and funding to begin project construction and implementation of the mitigation plan. There is also risk of potential credits identified in the final mitigation plan that do not become released credits by the time the USCAE is required to implement compensatory mitigation. To account for this, prior to initiation of project construction the USACE would evaluate the status of the potential credits included in this mitigation alternative. If there is a foreseeable problem with availability of credits, then re-evaluation of the mitigation plan would be warranted.

1.5 Cost Effectiveness and Incremental Cost Analysis

For environmental mitigation planning, where traditional economic benefit-cost analysis is not practicable or possible, as costs and benefits are expressed in different units (*e.g.*, AAHU, HSI, FCU) two analytical methods are instead used in the planning process. First, cost effectiveness analysis is conducted to identify the least cost solution for each possible level of environmental output. Subsequent incremental cost analysis of the cost-effective solutions is then performed to identify changes in costs for increasing levels of environmental outputs. Therefore, in the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of environmental plans, cost effectiveness and incremental cost analysis are valuable tools to assist in mitigation alternatives development and decision making.

In addition to the results, it is also important to keep in mind that the most useful information developed by these two methods is the information provided about the relative relationships among mitigation alternatives. Additionally, these analyses will usually not lead, and are not intended to lead, to a single best solution or a one size fits all approach. However, they will help improve the quality of decision making by ensuring that a rational, supportable approach is used in considering and selecting mitigation alternatives to produce environmental outputs.

1.5.1 Land Acquisition with Natural Succession

The HEP calculations for each species and the required mitigation acres using natural succession are shown below in Table 2. These calculations include the 15.7 AAHUs that would be recovered from allowing 8.0 acres of the backfilled channel to natural regrow. The ratio of impacted acres to required mitigation acres is just under 1:2.5. This means mitigating using natural succession would require 16.6 additional acres when compared to active reforestation (See Section 1.5.2) to compensate for anticipated impacts of the proposed project. Increased acreage requirements associated with natural succession are primarily due to the lack of anticipated mast producing species being established as well as greater levels of uncertainty (*e.g.*, single species dominance, invasive species potential, etc.) compared to active reforestation.

Table 2. HEP Calculations and Required Mitigation Acres Using Natural Succession

	Impacted Acres	Existing HSI	Impacted AAHU (Loss)	Back Filled Channel Reforestation Acres	Back Filled Channel Reforestation HSI *	Back Filled Channel Reforestation AAHU (Gain)	Required Mitigation Acres	Natural Succession Mitigation HSI*	Natural Succession Mitigation AAHU (Gain)	Net Balance AAHU
Barred Owl	-31.0	0.7367	-22.84	8.0	0.3435	2.75	75.1	0.3435	25.80	5.71
Gray Squirrel		0.6953	-21.56		0.2595	2.08		0.2595	19.49	0.01
Carolina Chickadee		0.4015	-12.45		0.4680	3.74		0.4680	35.15	26.44
Pileated Woodpecker		0.4364	-13.53		0.2700	2.16		0.2700	20.28	8.91
Wood Duck		0.00	0.00		0.6270	5.02		0.6270	47.09	52.10
Total			-70.37			15.74				93.17

*Natural Succession, site entirely within 328 ft of a lake or stream that contains water for 6 months per year, or the site is forested wetland flooded for 6 months per year. This assumes the site is shallowly flooded during the March-to-May wood duck brood-rearing period, abundant over-water brood cover is present, and well-maintained nest boxes are provided.

The costs for land acquisition with natural succession include the purchase of available frequently flooded agricultural lands via fee simple title and monitoring of the land. Monitoring would cost approximately $2,000 per trip and would likely be required for at least 10 years. A breakdown of these costs per acre is described below (Table 3).

Table 3. Mitigation Costs for Natural Succession of Agricultural Lands

Agricultural Land (Cost/Acre)	$5,625*
Required Acres Of Mitigation	75.1
Monitoring Costs	$20,000
Total Mitigation Costs	$442,437

*Includes 25% contingency

1.5.2 Land Acquisition with Active Reforestation

The HEP calculations for each species and the required mitigation acres using active reforestation are shown below in Table 4. These calculations include the 15.7 AAHUs that would be recovered from allowing 8.0 acres of the backfilled channel to regrow through natural succession. The ratio of impacted acres to required mitigation acres is just under 1:2. This is mostly being driven by the habitat requirements of the barred owl, which needs unfragmented tall old growth forests with a variety of prey and abundant hollows for nesting.

Table 4. HEP Calculations and Required Mitigation Acres using Active Reforestation

	Impacted Acres	Existing HSI	Impacted AAHU (Loss)	Back Filled Channel Reforestation Acres	Back Filled Channel Reforestation HSI*	Back Filled Channel Reforestation AAHU (Gain)	Required Mitigation Acres	Active Reforestation Mitigation HSI**	Active Reforestation Mitigation AAHU (Gain)	Net Balance AAHU
Barred Owl	-31.0	0.7367	-22.84	8.0	0.3435	2.75	58.5	0.3435	20.09	0.01
Gray Squirrel		0.6953	-21.56		0.2595	2.08		0.4785	27.99	8.51
Carolina Chickadee		0.4015	-12.45		0.4680	3.74		0.4680	27.38	18.67
Pileated Woodpecker		0.4364	-13.53		0.2700	2.16		0.2700	15.80	4.43
Wood Duck		0.00	0.00		0.6270	5.02		0.6270	36.68	41.70
Total			-70.37			15.74				73.31

*Natural Succession, site entirely within 328 ft of a lake or stream that contains water for 6 months per year, or the site is forested wetland flooded for 6 months per year. This assumes the site is shallowly flooded during the March-to-May wood duck brood-rearing period, abundant over-water brood cover is present, and well-maintained nest boxes are provided.

**Active Reforestation, site entirely within 328 ft of a lake or stream that contains water for 6 months per year, or the site is forested wetland flooded for 6 months per year. This assumes the site is shallowly flooded during the March-to-May wood duck brood-rearing period, abundant over-water brood cover is present, and well-maintained nest boxes are provided.

Costs for land acquisition with active reforestation include the purchase of available frequently flooded agricultural lands via fee simple title, the costs of active reforestation (*e.g.*, seedling purchase and planting, cold storage and transportation, land preparation, labor to conduct plantings, etc.), and monitoring the land. Monitoring would cost approximately $2,000 per trip and would likely be required for at least 10 years. A breakdown of these costs per acre is described below (Table 5).

Table 5. Mitigation Costs for Active Reforestation of Agricultural Lands.

Agricultural Land (Cost/Acre)	$5,625*
Active Reforestation (Cost/Acre)	$225
Total Cost/Acre	$5,850
Required Acres Of Mitigation	58.5
Monitoring Costs	$20,000
Total Mitigation Cost	$362,225

*Includes 25% contingency

1.5.3 Mitigation Banks

The availability and costs of mitigation credits from mitigation banks can vary depending on supply and demand, resulting in a considerable amount of uncertainty with costs. The required number of credits were calculated using the same method utilized by Mississippi mitigation banks (Charleston Method) and using the acreage required to mitigate for the remaining AAHU loss after accounting for the 8 acres of backfilled channel that would regrow. Mitigation using a mitigation bank would require the purchase of 154 credits. A breakdown of the mitigation costs is described below (Table 6).

Table 6. Mitigation Credit Costs

Cost per Credit	$4,800
Required Credits	154
Total Mitigation Costs	$739,200

1.6 Cost Comparison

Agricultural land acquisition with active reforestation was determined to be the most cost-effective wildlife habitat compensatory mitigation plan. A comparison of plans with cost rankings is described below (Table 7).

Table 7. Comparison of Wildlife Mitigation Plans

Plan	Cost	Ranking
Land Acquisition with Active Reforestation	$362,225	1
Land Acquisition with Natural Succession	$442,437	2
Mitigation Bank Credits	$739,200	3

1.7 Conclusions and Plan Selection

The mitigation planning analysis indicates that active reforestation of agricultural land is the most cost-efficient means of overall project environmental resource impact compensation. Incremental cost analysis was used to rank different mitigation measures in order of cost effectiveness. Thus, selection of mitigation measures followed a sequence of cost effectiveness.

Amongst the array of mitigation alternatives considered (*i.e.*, no-action, natural succession, active reforestation, and mitigation banks), acquisition and active reforestation of frequently flooded agricultural lands was determined to be the most cost-effective alternative and was selected as the recommended mitigation plan.

1.8 Mitigation Implementation

Following a project decision, USACE would acquire mitigation lands in accordance with Federal law. It is anticipated that lands would be acquired from willing sellers. Landowners would be queried in the project area regarding their willingness to sell. Once a suitable tract, or tracts, available to be acquired are identified, preliminary information (*e.g.*, landscape position, hydrology, soils, etc.) would be gathered to implement the most beneficial and practicable means of restoration.

Upon acquisition, a draft, tract-specific mitigation plan would be developed. Applicable levee and drainage districts and other landowners would also be coordinated with during the completion of the tract-specific detailed mitigation plan. The tract-specific mitigation plan would contain baseline information, planned earthwork activities, hydrologic restoration features, and anticipated compensatory mitigation benefits quantified in a consistent manner in which impacts were quantified (HEP). Mitigation would progress prior to or concurrent with construction. USACE would develop and maintain a database of identifying its mitigation needs, approved mitigation plans, and construction-related impacts. In response to Section 2036(b) of the WRDA of 2007, as amended, USACE provides annual status reports on USACE construction projects requiring mitigation.

Avoidance, protection, or treatment of cultural resource sites would be included in the development of tract-specific detailed mitigation plans. USACE would consult with federally recognized Tribes, the Mississippi SHPO, and other interested parties following the provisions of the PA. As appropriate, mitigation sites would be surveyed to determine if historic properties are present in the proposed mitigation areas. Protection of cultural resources sites would be incorporated into the natural resources mitigation plan and long-term management of mitigation lands.

A Hazardous Toxic and Radioactive Waste (HTRW) site assessment would also be conducted on any potential mitigation tract to gather and evaluate data regarding the existence or potential for encountering HTRW. USACE is obligated under Engineer Regulation (ER) 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all HTRW contamination within the vicinity of proposed actions. ER 1165-2-132 identifies that HTRW policy is to avoid the use of project funds for HTRW removal and remediation activities.

Mitigation would not be considered complete until all impacted habitat units have been compensated. Completion is not determined on a specific amount of mitigation acreage.

1.9 Mitigation Plan

This section presents a proposed plan for mitigating and monitoring the foreseeable effects of the proposed actions. The approach entails plan development and implementation followed by monitoring and adaptive management. The information presented in this section serves as a compensatory mitigation plan prepared in accordance with Engineer Regulation 1105-2-100, Appendix C.

Mitigation requirements were calculated using the same ecological models that were used to estimate project impacts. These ecological models were all certified or approved by the USACE Ecosystem Restoration National Planning Center of Expertise and used within their applicable ranges, in accordance with Engineer Circular EC 1105-2-412. A list of these ecological models with their associated resources listed in Section 1.2 of this Appendix.

In Federal Register Vol. 73, No. 70, April 10, 2008, specifically Part 332, § 332.4 (c)(1) Compensatory Mitigation for Losses of Environmental Resources, Planning and documentation, Mitigation Plan, Preparation and Approval, guidance was set forth requiring the preparation of a mitigation plan that would address the following 12 items: 1) objectives; 2) site selection; 3) site protection instrument; 4) baseline information; 5) determination of credits; 6) mitigation work plan; 7) maintenance plan; 8) ecological performance standards; 9) monitoring requirements; 10) long-term management plan; 11) adaptive management plan; 12) financial assurances; and other information.

Each of the twelve criteria is discussed below in order. Please note that if mitigation banks or in-lieu- fee credits are pursued during later phases, the mitigation plan only requires the baseline information and credit determination methodology for the purposes of purchasing credits.

Once a potential mitigation tract is identified, a tract-specific, detailed mitigation plan comprising the mitigation measures recommended below would be developed. Mitigation would not be considered complete until all impacted habitat units have been compensated. Mitigation sites would be monitored by USACE to verify mitigation benefits, and USACE is committed to adaptively managing the project should initial restoration efforts be determined unsuccessful.

1.9.1 Objectives

The objective of mitigation is to avoid, minimize, and compensate for environmental impacts. It is the policy of the USACE Civil Works program to avoid and minimize impacts to terrestrial and aquatic resources to the extent practicable, and that unavoidable impacts are compensated. A variety of measures to avoid and minimize impacts are described in Sections 1.1. Impacts that could not be avoided and require compensatory mitigation are described in this section. Although mitigation ratios are commonly used for USACE- permitted activities, a more rigorous function- and habitat-based assessment was used to determine what and how much mitigation would be appropriate in this case. In 33 C.F.R. § 332.2(f), it states:

If the district engineer determines that compensatory mitigation is necessary to offset unavoidable impact to aquatic resources, the amount of required compensatory mitigation must be, to the extent practicable, sufficient to replace lost aquatic resource functions. In cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used.

Table 8 shows the unavoidable impacts reasonably likely to occur if the preferred alternative is implemented.

Table 8. Environmental Impacts

Impact Type	Impacted Acres	Loss of AAHU*
Wildlife Habitat	31	54.6

*Average Annual Habitat Units still requiring mitigation after accounting for AAHUs created by natural succession of the backfilled channel.

The overall objective for this mitigation plan would be to fully compensate for the unavoidable impacts to terrestrial habitat by creating at least 54.6 AAHUs of wildlife habitat through land acquisition and active reforestation.

1.9.2 Site Selection Criteria

A site-specific mitigation tract has not yet been identified or acquired. Pending a FONSI being signed, and the Damn Safety Modification Report being approved a tract-specific mitigation site would be selected. Landowners in the proposed mitigation areas near the project site would be surveyed to identify willing sellers. Preliminary information would then be gathered on the prospective tract(s) including hydrological conditions, elevation, soil characteristics, habitat connectivity, compatibility with adjacent land uses, geomorphic setting, adjacent drainage patterns, and proximity and relation to other desirable tracts, and then the tract(s) would be assessed for suitability and sustainability and prioritized accordingly for acquisition. These tract-specific parameters would be used to determine if the tract is suitable for planting of mast producing species such as oaks and elms.

1.9.3 Site Protection Instrument

Federal policy permits several different real estate acquisition methods for the Federal Government to procure interests in real estate. Interests that may be acquired, all of which are planned to be perpetual, include fee title, third-party conservation easements, and restrictive covenants.

All compensatory mitigation lands retained in private ownership, but subject to third-party conservation easements, would be inspected on an annual basis according to the terms and conditions of the easement. Supplemental or corrective action would be taken, as needed.

If it is determined that any proposed mitigation lands would be turned over to another public land managing agency for long-term protection and management, coordination with that agency would occur to ensure any specific requirements are met.

1.9.4 Baseline Information

Complete descriptions for "Baseline Information", are available in the following Sections within the main EA (EAXX-202-00-B4P-1729611288): 1.1 Project Location; 1.2 Project Area Description; 3.2.1 Geology; 3.3.1.1 Description of the Watershed; 3.3.2 Terrestrial Resources and Wildlife; and 3.3.3 Wetlands.

Information on the most recent conditions pertaining to each prospective mitigation site would be acquired and assessed as part of the process of preparing a tract-specific detailed mitigation plan. This would include project future (without mitigation) hydrology, soil types, elevations, delineation of waters of the United States (if applicable), and geomorphologic characteristics. In addition, where practical, historic conditions would also be described. Finally, any information on historical and cultural resources, as well as any hazardous contamination, would also be included.

1.9.5 Credit Determination Methodology

The amount of compensatory mitigation credit provided for wildlife habitat would be calculated for the selected mitigation tract using the same models (HEP) and assumptions employed to determine project impacts. Additional information regarding impact analyses, calculations, and units of measurement used in mitigation determinations are discussed in Section 1.7 of this document and Section 3.3.2 of the accompanying EA (EAXX-202-00-B4P-1729611288).

1.9.6 Mitigation Work Plan

The mitigation work plan would be refined once a specific mitigation tract has been determined. The tract-specific work plan would include the following information:

- Geographic boundaries of the site.
- Landscape position of the site.
- Surrounding land use.
- Site soil mapping/verification of the site.
- Mitigation implementation methods, sequencing, and timing of implementation.
- Hydrologic sources including projected future flood frequency elevations and site-specific additional sources (e.g., plugging farm drains, perimeter levee degradation), connections, durations, depths, timing, and fish access measures.
- Detailed plantings
- Proposed grading plans, including the establishment of micro-topography and sub- soiling.

- Plans to control invasive species.
- Soil management measures.
- Erosion control measures.

1.9.7 Maintenance Plan

In 33 C.F.R. § 332.7(b), it states the following: "mitigation projects should be designed, to the maximum extent practicable, to be self-sustaining once performance standards have been achieved. This includes minimization of active engineering features (*e.g.*, pumps) and appropriate siting to ensure that natural hydrology and landscape context would support long- term sustainability. Where active long-term management and maintenance are necessary to ensure long-term sustainability (*e.g.*, prescribed burning, invasive species control, maintenance of water control structures, easement enforcement), the responsible party must provide for such management and maintenance. This includes the provision of long-term financing mechanisms where necessary".

The potential reforestation sites in the project area are anticipated to be maintenance-free and self-sustaining once established. USACE would be responsible for any routine maintenance (e.g., mowing, minor repair of any water retention features, invasive species control). Routine maintenance would be identified in the tract-specific mitigation plan.

1.9.8 Ecological Performance Standards

The goal of mitigation is to compensate significant unavoidable impacts to the extent justified and mandated by law. Therefore, the ecological performance standard for the overall project would be based on recovering the 54.6 AAHUs lost from terrestrial wildlife habitat impacts. This value would mitigate the impacts of the preferred alternative. However, to measure how effectively the site-specific tract is achieving the desired outcome through time, monitoring reports would be prepared to establish baseline conditions at the mitigation location and document changes in habitat suitability over time.

Success criteria, which are early indicators of meeting overall ecological performance standards, would be considered achieved when the monitoring parameters summarized in Table 9 have been met.

Table. 9 Compensatory Mitigation Monitoring Parameters

Mitigation Type	Monitoring Parameter
Forested/Herbaceous Restoration Areas	• Vegetation Present (percent composition, diversity, percent coverage) • Success of Planted Vegetation • Hydrology functioning as designed (duration, depth, timing) • HEP Variables (See Table Below)

Vegetation

Vegetation would be monitored by visually inspecting the mitigation tract(s). Parameters measured would include vegetation present (percent composition), success of planted vegetation, diversity, and percent coverage.

Hydrology

Hydrology could be monitored by a variety of methods. Hydrology of the borrow areas could be measured utilizing aerial photography and GIS by determining surface acres that remain inundated. Therefore, tract-specific hydrologic performance standards would be determined and included during the completion of the tract-specific mitigation plan.

HEP Variables

The same HEP variables that were used in the wildlife habitat impact analysis would be used as mitigation success criteria. Changes in AAHUs for the mitigation tract would need to correspond to the values in Table 10.

Table 10. AAHU Success Criteria

	Impacted Acres	Existing HSI	Impacted AAHU	Required Mitigation Acres	Mitigation HSI	Mitigation AAHU	Net Balance AAHU
Barred Owl	-31.0	0.7367	-22.84	58.5	0.3435	20.09	0.01
Gray Squirrel		0.6953	-21.56		0.4785	27.99	8.51
Carolina Chickadee		0.4015	-12.45		0.4680	27.38	18.67
Pileated Woodpecker		0.4364	-13.53		0.2700	15.80	4.43
Wood Duck		0.00	0.00		0.6270	36.68	41.70
Total			-70.37				73.31

1.9.9 Mitigation Tract Monitoring Requirements

Each site would be monitored by USACE to ensure successful mitigation. Monitoring would be conducted before mitigation measures are undertaken (Year 0) and then as determined in each tract's site-specific mitigation plan for a period of five years, or until mitigation has been determined successful. Monitoring results would be coordinated with the interagency team (IAT). Formal monitoring would be performed by USACE biologists at least once during each growing season (26 March-3 November). Annual monitoring will continue for five years, or until mitigation is deemed successful with concurrence from the IAT.

Habitat Suitability

Evidence of living and non-living fauna will be documented and photographed in each trip report. Any direct observations of wildlife usage will be noted and photographed. General observations of evidence of wildlife usage including scat, used food sources, remnants of hatched eggs, etc. will also be noted in each trip report.

Monitoring Reports

After each monitoring event, a findings report will be written and provided to members of the IAT. A final annual report will be provided to the IAT by the end of each calendar year for the duration of USACE monitoring.

1.9.10 Adaptive Management Plan

Flexibility will be retained in the management of the mitigation tracts that will provide options to maximize benefits to all fish and wildlife resources. Potential options may include additional tree planting, species modification, or natural succession. Any invasive species establishment will be controlled; however, methods will depend on extent of harm to the system and the species becoming established. Expected and observed habitat gains during monitoring activities would be compared, and overall mitigation would be adjusted appropriately, if required.

1.9.11 Long-term Management Plan

Under current authorities and policies, mitigation lands acquired in fee by the Federal Government could be managed by State agencies or Federal agencies once mitigation acquisition is completed and determined to meet ecological success criteria. It is the intent of USACE to turn over mitigation lands to a suitable third party for long-term management. However, USACE is ultimately responsible in ensuring that mitigation is achieved and maintained.

1.9.12 Financial Assurances

Financial assurances, including mitigation and monitoring requirements, are included in the project costs and would be subject to the Federal Government's annual appropriations.