

# Appendix F

## Habitat Evaluation and Quantification

*Draft Feasibility Report with Integrated Environmental Assessment*  
*OGBTR HREP*

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1 INTRODUCTION

This appendix provides the documentation of the habitat evaluation and quantification process that was conducted to evaluate the benefits of various habitat measures for the Oakwood Bottoms Habitat Rehabilitation and Enhancement Project (HREP). The assessment includes a summary of the existing biological conditions used in the evaluation, as well as, the forecast of future conditions under the No Action Alternative (Future Without Project; FWOP) and each considered action alternatives (Future With Project; FWP).

A multi-agency and interdisciplinary team from the U.S. Forest Service (USFS), and the U.S. Fish and Wildlife Service (USFWS), the St. Louis District Corps of Engineers conducted the habitat evaluation (Table 1).

Table 1. Team that Participated in the Habitat Benefits Analysis for the Oakwood Bottoms HREP

<b>Team Member</b>	<b>Specialty</b>	<b>Affiliation</b>
<b>Matt Mangan</b>	Fish and Wildlife Biologist	U.S. Fish and Wildlife Service
<b>Andy Chappell</b>	Wildlife Biologist	U.S. Forest Service
<b>Chad Deaton</b>	Wildlife Biologist	U.S. Forest Service
<b>Leonard Pitcher</b>	Forester	U.S. Forest Service
<b>Ben McGuire</b>	Wildlife Biologist	U.S. Army Corps of Engineers
<b>Jasen Brown</b>	Project Manager	U.S. Army Corps of Engineers
<b>Chris Hopfinger</b>	Forester	U.S. Army Corps of Engineers

The purpose of the habitat benefits evaluation is to evaluate and quantify, to the extent possible, environmental benefits of alternative plans for the aquatic and floodplain habitat improvements within the study area.

Quantification is needed in the project planning process to evaluate benefits of project measures because traditional benefit/cost evaluation is not applicable. To determine environmental restoration project benefits, models have been developed to quantify habitat benefits of project measures for selected species.

We used both mammalian and amphibian models to evaluate the effects of project measures on habitat at Oakwood Bottoms. This was done because both terrestrial and wetland habitats would be affected by some or all of the proposed measures. For evaluation, we followed the USFWS Habitat Evaluation Procedures Handbook (USFWS 1980) and used Habitat Suitability Index (HSI) Models developed by the USFWS. The HSI models are certified models by the Corps and are widely accepted by local agencies. The HSI models selected by the team represent species that currently use or are anticipated to use the future habitat at Oakwood Bottoms, and they represented different guilds from different taxonomic families. Table 2 summarizes what project measures corresponded to what habitat model used in the evaluation. The gray squirrel HSI model was used to evaluate forest habitat, and the bullfrog HSI model was used to evaluate emergent wetland habitat.

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The gray squirrel, in the family *Sciuridae*, is an important game species in eastern North America. This species occurs in a variety of forest types. However, it has been documented that hard mast (nut-producing trees) is highly correlated with adult and juvenile gray squirrel survival (Heaney 1984). In the Midwest, gray squirrels were found to consume a high proportion of hard mast fruits of their overall annual diet (Nixon *et al.* 1968). To compare project alternatives, the habitat team selected this species HSI model to evaluate the forest habitat cover type, including hard mast.

The bullfrog (*Rana catesbeiana*) is a large aquatic frog that commonly inhabits permanent bodies of standing or slow-moving water. Bullfrogs range from Nova Scotia to central Florida, west to Wisconsin and across the Great Plains to the Rocky Mountains. Bullfrogs are usually found on or near shorelines, but move a number of meters into water when water temperature is higher than air temperature (Graves and Anderson, 1987). To compare project alternatives, the habitat team selected this species HSI model to evaluate the wetland habitat cover type.

Table 2. Project measures with corresponding habitat and HSI model

Measure	Habitat	HSI Model
Overall Forest Improvement	Forest	Grey Squirrel
Berm Degraded (reforestation)	Forest	Grey Squirrel
Emergent Wetland Improvement	Wetland	Bullfrog
Berms to Create	Forest	Grey Squirrel
Timber Stand Improvement	Forest	Grey Squirrel
Ditch Enhancement	Wetland	Bullfrog
Natural Emergent Wetland Succession	Wetland	Bullfrog

Consistent with guidance from the USACE Ecosystem Planning Center of Expertise, the Agency Technical Review (ATR) Team for the Oakwood Bottoms HREP will conduct an assessment of the models used for this project. The chosen models, all of which are Corps approved (per Engineering Circular 1105-2-412) are the gray squirrel (Allen 1987), and bullfrog (Graves 1987). The Habitat Suitability Index (HSI) spreadsheet calculators for each of these models was reviewed by the Ecosystem Restoration Planning Center of Expertise and were recommended for regional use (Memorandum for CECW-MVD; 15 September 2016; Enclosure 1). The Corps Model Certification Panel concurred and the spreadsheet calculators were approved for use (email dated 4 October 2016; Enclosure 1). This process evaluated the technical quality and appropriateness of the models utilized.

## 2 HABITAT EVALUATION METHODOLOGY

The HSI models evaluate the quality and quantity of particular habitat by species selected by team members (Table 2).

### 2.1 Quantity Component

Traditionally, the Corps has used the quantity and quality of habitat jointly, in the form of habitat units, to measure benefits provided by ecosystem restoration projects. The quantity proportion is often measured as area (acres of habitat, landform, etc.); in some

systems, it is measured as length (feet of stream bank). The evaluation conducted for this study area uses acres, delineated by polygons, to represent the quantity. Polygons were created using ArcGIS 10 software. The area associated with each proposed measure must have a clear definition for use as guidance in estimating the area component of the ecosystem output model, and must be applied consistently to all actions evaluated.

Quantities of each project measure varied depending on those measures in each alternative. Habitat was evaluated for the area of influence that each particular project measure would have. For example, the hydrologic improvement evaluated area included the overall forest in the green tree reservoir minus areas that were evaluated for another measure, while the berm degrade evaluated area only include the acres of where the berms would be removed. When evaluation of measures was conducted, the footprint equals the total of the measures with no double-counting of overlap areas addressed my multiple measures. This also resulted in different total acres for each Future With Project (FWP) scenario. To ensure accuracy, the team used that total acreage for a given FWP alternatives to compare to the corresponding Future Without Project Scenario (FWOP) alternative. In other words, the FWOP scenario acreage was not consistent to compare all alternatives, but that each individual FWP was compared to its own FWOP (See Table 4 for all acreages used).

For this study, different scales of area were considered to determine which would be the most suitable area metric to use in the analysis. Table 3 summarizes the capabilities and limitations of each. It was determined of the three scales considered, using “Action Footprint” scale is the optimal approach for this study to estimate ecological benefits. The team decided that estimating the “Potential Area of Influence” scale or “Area of Restored Process” were considered too uncertain and speculative. Even though the “Action Footprint” does not capture all the potential benefits of the project, such as capturing the benefits of restoring bottomland hardwood forest in the Mississippi Flyway to benefit neotropical migratory birds, the uncertainty of quantifying that area of influence was too great. Table 4 provides the acres proposed for use for each alternative by habitat cover type (Forest; Wetland).



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Table 3 Different Scales of Areas Considered for Use

<b>Scale</b>	<b>Description</b>	<b>Capability</b>	<b>Limitation</b>
<b>Action Footprint</b>	Measurement of physical footprint of the project measure	Accurately quantified with a high degree of certainty	Underestimates the spatial extent of ecological benefit
<b>Area of Restored Process</b>	Area directly affected by the restoration process; includes footprint + processes	Accurately quantified with high level of certainty for some measures and more fully captures the area that would experience ecological benefits	Difficult to quantify with certainty for some measures
<b>Potential Area of Influence</b>	Area that could benefit from the process restoration provided by the action; could extend beyond the area of restored process to the greater ecosystem	Fully captures the area of ecological benefits of a given measure	Not feasible to estimate with any degree of certainty and consistency

Table 4. Acres Used by Alternative (rounded to the nearest 10<sup>th</sup> acre)

<b>Alternative Name</b>	<b>Scenario</b>	<b>Acres Used</b>		
		Grey Squirrel	Bullfrog	TOTAL
<b>Forest Service Alternative</b>	FWOP	4487.8	104.4	4592.2
	FWP	4487.8	104.4	4592.2
<b>Minimum Alternative</b>	FWOP	4480.8	102.6	4583.4
	FWP	4480.8	102.6	4583.4
<b>Maximum Alternative</b>	FWOP	4494.7	94.0	4588.7
	FWP	4494.7	-94.0	4400.7

## 2.2 Quality Component

The qualitative component of the analysis is rated on a 0.0 to 1.0 scale, with higher values indicating better habitat for that species. The HSI for a particular habitat type is determined by selecting values that reflect present and future project area conditions from a series of abiotic and biotic metrics. Each value corresponds to a suitability index for each species. Future values are determined using management plans, historical conditions, and best professional judgment. The quantitative component is the number of acres of the habitat being evaluated. From the calculated qualitative and quantitative values, the standard unit of measure, the habitat unit (HU) is calculated using the formula ( $HSI \times Acres = HUs$ ). Habitat units are calculated for specific target years to forecast changes in habitat values over the life of the project with- and without-project conditions. When HSI scores are not available for each year of analysis, a formula that requires only target year HSI and area estimates is used (USFWS 1980). This formula is:

$$\int_0^T HU dt \equiv (T_2 - T_1) \left[ \left( \frac{A_1 H_1 + A_2 H_2}{3} \right) + \left( \frac{A_2 H_1 + A_1 H_2}{6} \right) \right]$$

Where:

$$\int_0^T HU dt = \text{cumulative HU's}$$

$T_1$  = first target year of time interval  
 $T_2$  = last target year of time interval  
 $A_1$  = area of available habitat at beginning of time interval  
 $A_2$  = area of available habitat at end of time interval  
 $H_1$  = habitat suitability index at the beginning of time interval  
 $H_2$  = habitat suitability index at the end of time interval  
 $3 \text{ and } 6$  = constants derived from integration of  $HIS \times Area$  for the interval between any two target years

This formula was developed to precisely calculate cumulative HUs when either HSI or area or both change over a time interval, which is common when dealing with the unevenness found in nature. Habitat Unit gains or losses are annualized by summing the cumulative HUs calculated using the above equation across all target years in the period of analysis and dividing the total (cumulative HU) by the number of years in the life of the project (i.e., 50 years). This results in the Average Annual Habitat Units (AAHUs) (USFWS 1980). The calculation of the HUs and AAHUs were completed in a Microsoft Excel spreadsheet containing the formula above.

The benefits of each proposed project measure (net AAHUs) are then determined by subtracting with-project benefits from without-project benefits. The effects of various habitat improvement measure combinations (alternatives) can then be evaluated by comparing the net AAHUs and costs for each alternative considered.

In preparation of using the HSI models, the evaluation team conducted site visits and reviewed existing data. They also reviewed aerial photography, topographic maps, and preliminary hydrological modeling. During the field evaluation, assumptions were

developed regarding existing conditions and projected with-project conditions relative to habitat changes over time and management practices.

For the purpose of planning, design, and impact analysis, period of analysis was established as 50 years. To facilitate comparison, target years were established at 0 (existing conditions), 1, 5, 25, and 50 years. Target years of 0 (existing condition), 1, 5, 25, and 50 (future without and future with project conditions) are used to analyze HUs and characterize habitat changes over the estimated period of analysis. Target years of 1 and 5 capture short-term changes following construction completion. While target years 25 and 50 capture ecological changes that would occur over a longer period of time. The period of analysis was determined to be 50 years based on the prediction that some project measures (e.g., development of key ecological processes needed to restore ecosystem structure and function) would need a longer period of time to reach maximum benefits; and the accrual of benefits were predicted to level off after 50 years. HSIs and cumulative HUs for each evaluation species were calculated at each of these target years.

Corps guidance requires that the team evaluate a suite of measures that can be combined in various ways, based on dependencies to form project alternatives. The approach used to assess the benefits at Oakwood Bottoms looked at benefits of individual project measures for each alternative. The individual measures were combined for each alternative using formulation strategies. To determine the habitat units created by each measure, the habitat (wetland and floodplain forest) affected by the measure would be evaluated using the applicable HSI spreadsheets.

This appendix contains HSI summary tables and other data derived from the spreadsheet files not included in this appendix. These spreadsheets are available upon request. Please contact, Benjamin McGuire, 314-331-8478, email [Benjamin.M.McGuire@usace.army.mil](mailto:Benjamin.M.McGuire@usace.army.mil) if you would like an electronic copy of these files.

### 3 ASSUMPTIONS

#### 3.1 Habitat Cover Type Assumptions

The following assumptions were made when determining existing and future without project conditions for the primary habitat cover types located within the project area:

**Floodplain Forest.** Forest community composition data was used from a recent forest inventory of the site in 2018 to determine Existing Conditions and used to determine Future Without Project (FWOP) conditions. This data was also used to predict Future With Project (FWP) conditions. Inherent in best professional judgment are the underlying assumptions, which are described in “General Assumptions and Habitat Characteristics.”

**Wetland.** Existing wetland conditions were obtained a vegetation survey utilizing transects and quadrats to determine percent species coverage (INHS 2002). Inherent in best professional judgment are the underlying assumptions, which are described in “General Assumptions”.

#### 3.2 General Assumptions

1. It was assumed that target years of 0 (existing condition), 1, 5, 25, and 50 (future without and future with Project conditions) are sufficient to analyze AAHUs and characterize habitat changes over the estimated period of analysis. The period of analysis was determined to be 50 years based on the prediction that some Project measures (e.g., reforestation leading to mature trees reproducing; development of key ecological processes needed to restore ecosystem structure and function) would need a longer period of time to reach maximum benefits; and the accrual of benefits were predicted to level off after 50 years.
2. Without the Project, the USFS will continue to manage the Project Area. The USFS will continue to maintain existing infrastructure like access roads and habitats dependent on funding, staffing, and natural disasters. However, it is assumed no substantial increases to current operation and maintenance budget for the site would occur while efforts to maintain access roads which will take away from habitat management.
3. We assumed that operation of Oakwood Bottoms would continue under the current management plans and objectives for at least the life of the HREP.
4. We used forest inventory data from unit 30018, stand 41, which was impacted by the flood of 1993 and contained data representative of the entire green tree reservoir area.
5. The USFS cannot currently replant areas, as survival from a 2007 planting was roughly 20%.
6. The Emerald Ash Borer (EAB) will eventually invade the study area and eliminate ash (*Fraxinus* spp.). This would reduce canopy closure (Variable 4 in the Gray Squirrel model) and reduce some areas to an early successional forest community with low canopy closure.
7. Assuming the USFS would do mid-story reductions as time goes on after construction completion and oak regeneration has been restored.
8. For FWOP, conditions it is assumed that at year 25, 100% of hard mast trees will be dead. These are at age 60+ currently.

9. Assumed the USFS forest community target composition is 60% oaks (*Quercus* spp.)
10. Existing OBGTR habitat acreage analyzed is 4,559 acres, the acreage where the HREP measures would be constructed.
11. Current berms are approximately 40 feet wide on average throughout the study area.
12. Total, existing berm lengths equals 280,241 feet, or 257.3 acres assuming a 40 foot width.
13. Existing berm acreages were subtracted from evaluation for existing conditions models and added for FWP models where berm degrades with reforestation in those locations occurred.
14. Where new water conveyance locations were added to FWP scenario, these areas were evaluated with the bullfrog HSI model.
15. Berm degrade locations had a zero HSI for FWOP as they were not considered forested habitat. For FWP, they were assumed to be reforested for their corresponding lengths at a width of 40 feet on average.
16. New berms utilized the FWOP HSI for the overall forest and a zero HSI for FWP as they would no longer be considered habitat, yielding a negative AAHU for that measure.
17. Timber Stand Improvement (TSI) information was provided by the Forest Service for already developed prescriptions. These prescriptions contained a variety of TSI methods such as crop tree release, mid-story thinning, seedling planting, competitive vegetation treatment, etc. For simplicity, a blanket assumption of some sort of TSI was to occur for those associated acreages, thereby improving overall regeneration for that area.
18. For the emergent wetland, it was assumed for FWOP conditions in the Minimum Alternative that the area would naturally revert to early successional forest conditions over time.
19. Due to the complexity of the study area, functional groups of measures were evaluated. For example the current study area contains 33 individual management units with 115 water control structures, yielding a nearly infinite number of potential combinations when factoring in additional improvement types. The functional groups were based on their expected improvement of ecosystem function to a specific habitat type over time based on how that improvement would be accomplished. For example, Modifications to Management Units was assumed to have berm alterations and changes to water control structures within existing and new berms were assumed to improve overall water conveyance throughout the entire study area. Similarly, the Increase Water Inputs functional group incorporated features that were assumed to improve water onto the site such as new water well pumps, a pump from the Big Muddy River, etc. These functional groups are displayed in Table 5.

#### 4 HABITAT BENEFIT EVALUATION RESULTS

Chapter 4 of the main report, *Evaluation of Feasible Project Features and Formulation of Alternative* describes each potential feature in detail. After a lengthy process involving preliminary analysis, identification of compatibility, dependencies and input from our resource agencies, the study planning team identified a list of features and sites to be formulated into

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alternatives before this habitat quantification exercise. Formulation strategies were used to combine features into alternatives. Functional groups (Table 5) were assigned to each alternative and features within each functional group were retained or omitted, depending on the requirements of each strategy. For a detailed description of formulation strategies, see Chapter 5 of the Feasibility Report. Table 5 summarizes the functional groups by each considered alternative.

Table 7 displays the summaries of the results of the habitat benefit evaluations respective to the project feature evaluated per alternative. Maps for the various alternatives are displayed at the end of this appendix.

Table 5. Functional Groups and Features

<b>Functional Group</b>	<b>Features</b>
1. Modifications to Management Units	Berm alterations – degrade, revise, relocate
	Pipes through berms - new or altered
2. Increase water inputs	Wells – new locations or increase size
	Internal Pumps – new locations or increase size
	Check dams in channels
	Revise Oakwood Bottoms Road
	Water distribution and control through pipes
	Channels – new or altered
	Pump in from Big Muddy
3. Improve water removal	Revise pipes through Grand Tower levee
	Pump out to Big Muddy
	Channels – new or altered
4. Forest Improvements	Reforestation/Tree Planting and TSI
5. Wetland Improvements	Emergent wetland improvement
	Expand MSUs (combine)

Table 6. Alternative and Functional Group Combinations

<b>Description</b>		<b>Functional Groups</b>				
<b>Strategy</b>	<b>Description</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>No Action</b>						
<b>Forest Service Preferred</b>	Modifications to management units, improve water removal, forest	X	X	X	X	X

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	improvements, wetland improvements					
<b>Maximum</b>	Modification to management units, forest improvements	X	X	X	X	X
<b>Minimum</b>	Modifications to management units, forest improvements	X			X	

Table 7. Acres used for project measures in each alternative (FWP and FWOP scenarios) and evaluated acreages

Alternative	Evaluation Category	Area (Ac)	Total Acreage Used for FWP & FWOP
Forest Service Preferred	Overall Forest	2,834.7	4,592.2
	Berm Degrade (Reforestation)	56.9	
	Emergent Wetland Improvement	94.0	
	Berms to Create	11.8	
	Ditch Enhancement	10.4	
	Timber Stand Improvement	1,608.0	
Maximum	Overall Forest	2,827.7	4,583.4
	Berm Degrade (Reforestation)	65.8	
	Emergent Wetland Improvement	94.0	
	Berms to Create	20.7	
	Timber Stand Improvement	1,608.0	
	Ditch Enhancement	8.6	
Minimum	Overall Forest	4,464.3	4,400.7
	Berm Degrade (Reforestation)	31.0	
	Berms to Create	0.7	
	With Project MSUs	-94.0	

**4.1 BENEFITS**

Table 8 provides the final suitability index from the gray squirrel and bullfrog models, acres for each alternative, habitat units, gross AAHUs and net AAHUs (ecological lift for each target year (1, 5, 25, and 50) under consideration.

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Table 8. Forest and wetland benefit evaluation results for each considered alternative (values are rounded)

<b>FOREST SERVICE PREFERRED</b>								
Measure	Acres	Scenario	HSI					AAHUs <sup>1</sup>
			Baseline	Year 1	Year 5	Year 25	Year 50	
Overall Forest (gray squirrel)	2834.7	FWOP	0.75	0.75	0.73	0.24	0.13	1022.5
		FWP	0.75	0.75	0.73	0.39	0.77	1667.4
<b>NET AAHUS</b>							<b>644.9</b>	
Emergent Wetland Improvement (bullfrog)	94.0	FWOP	0.85	0.85	0.77	0.7	0.64	66.8
		FWP	0.85	0.90	0.95	0.90	0.90	85.7
<b>NET AAHUS</b>							<b>18.9</b>	
Ditch Enhancement (bullfrog)	10.4	FWOP	0	0	0	0	0	0
		FWP	0	0.74	0.78	0.78	0.78	8.0
<b>NET AAHUS</b>							<b>8.0</b>	
Berm Degrades (gray squirrel)	56.9	FWOP	0	0	0	0	0	0
		FWP	0	0	0	0.52	0.85	25.4
<b>NET AAHUs</b>							<b>25.4</b>	
TSI (gray squirrel)	1608.0	FWOP	0.75	0.75	0.73	0.24	0.13	580.0
		FWP	0.75	0.73	0.73	0.52	0.85	1070.4
<b>NET AAHUs</b>							<b>490.4</b>	
Berms to Create (gray squirrel)	11.8	FWOP	0.75	0.75	0.73	0.24	0.13	4.2
		FWP	0.75	0	0	0	0	0
<b>NET AAHUs</b>							<b>-4.2</b>	
<b>FOREST SERVICE PREFERRED TOTAL NET AAHUs</b>							<b>1183.4</b>	

<sup>1</sup> Using the Gray Squirrel and Bullfrog Habitat Suitability Index Models



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<b>MAXIMUM ALTERNATIVE</b>								
Measure	Acres	Scenario	HSI					AAHUs <sup>1</sup>
			Baseline	Year 1	Year 5	Year 25	Year 50	
Overall Forest (gray squirrel)	2827.7	FWOP	0.75	0.75	0.73	0.24	0.13	1020.0
		FWP	0.75	0.75	0.73	0.52	0.82	1864.1
<b>NET AAHUs</b>							<b>844.1</b>	
Emergent Wetland Improvement (bullfrog)	94.0	FWOP	0.85	0.85	0.77	0.7	0.64	66.8
		FWP	0.85	0.90	0.95	0.90	0.90	85.7
<b>NET AAHUs</b>							<b>18.9</b>	
Ditch Enhancement (bullfrog)	8.6	FWOP	0	0	0	0	0	0
		FWP	0	0.74	0.78	0.78	0.78	6.6
<b>NET AAHUs</b>							<b>6.6</b>	
Berm Degrades (gray squirrel)	65.8	FWOP	0	0	0	0	0	0
		FWP	0	0	0	0.52	0.85	27.2
<b>NET AAHUs</b>							<b>27.2</b>	
TSI (gray squirrel)	1608.0	FWOP	0.75	0.75	0.73	0.24	0.13	580.0
		FWP	0.75	0.73	0.73	0.52	0.85	1072.0
<b>NET AAHUs</b>							<b>492.0</b>	
Berms to Create (gray squirrel)	20.7	FWOP	0.75	0.75	0.73	0.24	0.13	7.5
		FWP	0.75	0	0	0	0	0
<b>NET AAHUs</b>							<b>-7.5</b>	
<b>MAXIMUM ALTERNATIVE TOTAL NET AAHUs</b>							<b>1381.3</b>	

<sup>1</sup> Using the Gray Squirrel and Bullfrog Habitat Suitability Index Models

<b>MINIMUM ALTERNATIVE</b>								
Measure	Acres	Scenario	HSI					AAHUs <sup>1</sup>
			Baseline	Year 1	Year 5	Year 25	Year 50	
Overall Forest (gray squirrel)	4464.3	FWOP	0.75	0.75	0.73	0.24	0.13	1610.3
		FWP	0.75	0.75	0.73	0.34	0.62	2358.1
<b>NET AAHUs</b>							<b>747.8</b>	
Emergent Wetland Improvement (bullfrog)	-94.0	FWOP	0.85	0.85	0.77	0.70	0.64	66.8
		FWP	0.85	0.85	0.77	0.70	0.64	-66.8
<b>NET AAHUs</b>							<b>0</b>	
Berm Degrades (gray squirrel)	31.0	FWOP	0	0	0	0	0	0
		FWP	0	0	0	0.35	0.63	9.8
<b>NET AAHUs</b>							<b>9.8</b>	
Berms to Create (gray squirrel)	0.7	FWOP	0.75	0.75	0.73	0.24	0.13	0.3
		FWP	0.75	0	0	0	0	0
<b>NET AAHUs</b>							<b>-0.3</b>	
<b>MINIMUM ALTERNATIVE TOTAL NET AAHUs</b>							<b>757.3</b>	

<sup>1</sup> Using the Gray Squirrel and Bullfrog Habitat Suitability Index Models

#### 4.2 TOTAL HABITAT BENEFITS

The Cost Effective and Incremental Cost Analysis (CE/ICA) was conducted to help inform in selecting a plan (See Chapter 8 in the main report). Table 10 provides a summary of the total net AAHUs for each considered alternative, and the results are graphically displayed in Figure 1.

Table 9. Total Habitat Benefits (Net AAHUs) for each considered alternative

Alternative	Forest Habitat Net AAHUs	Wetland Habitat Net AAHUs	Total Net AAHUs
Forest Service Preferred	1131	52	1183
Minimum Plan	716	51	757
Maximum Plan	1305	76	1381

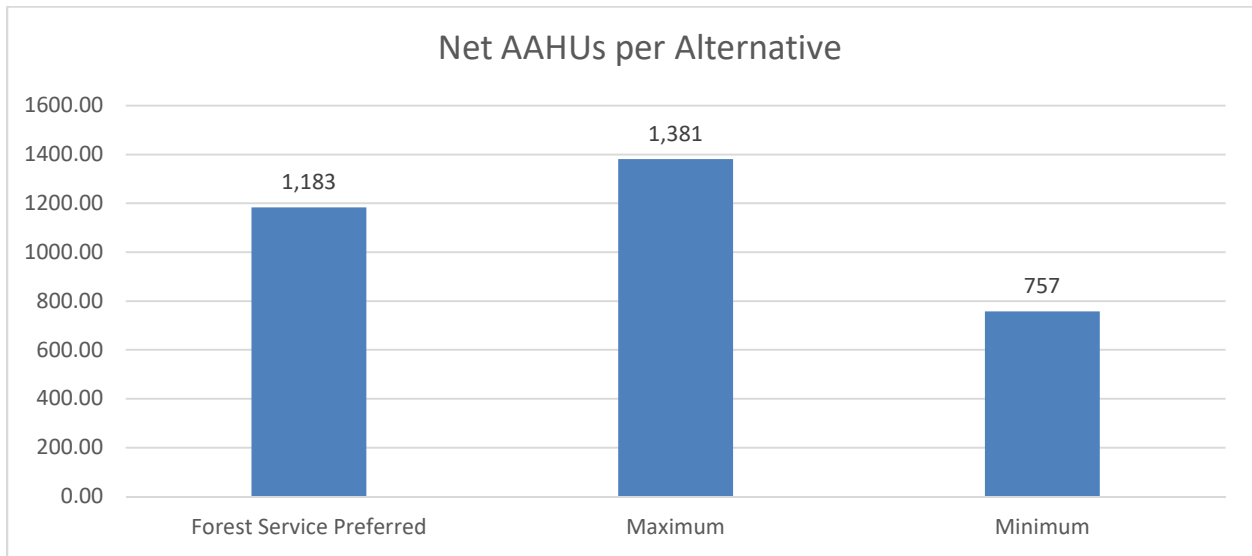


Figure 1. Net AAHUs per alternative.

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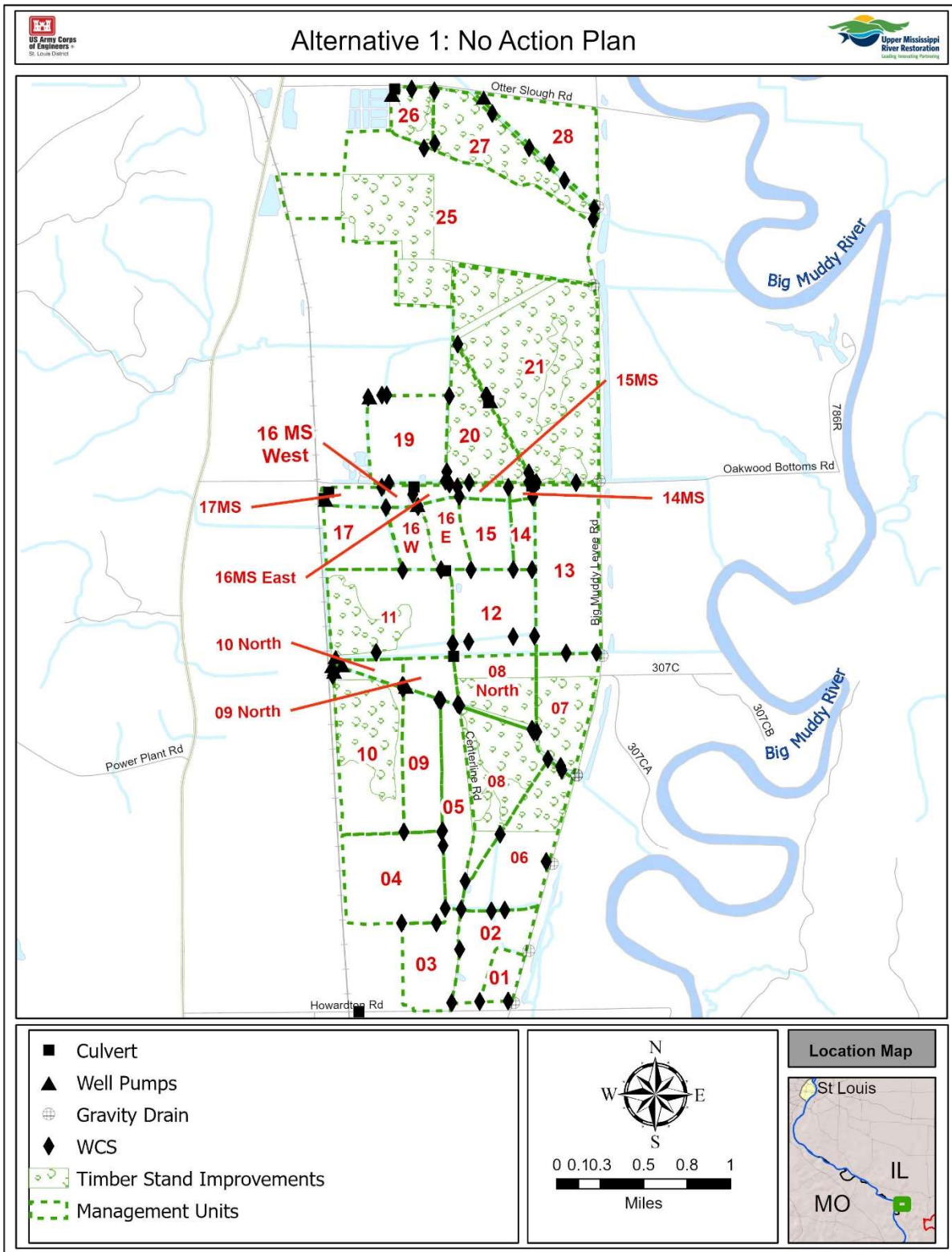


Figure 2. Map of existing study area with existing subunit boundaries and existing water control structures.

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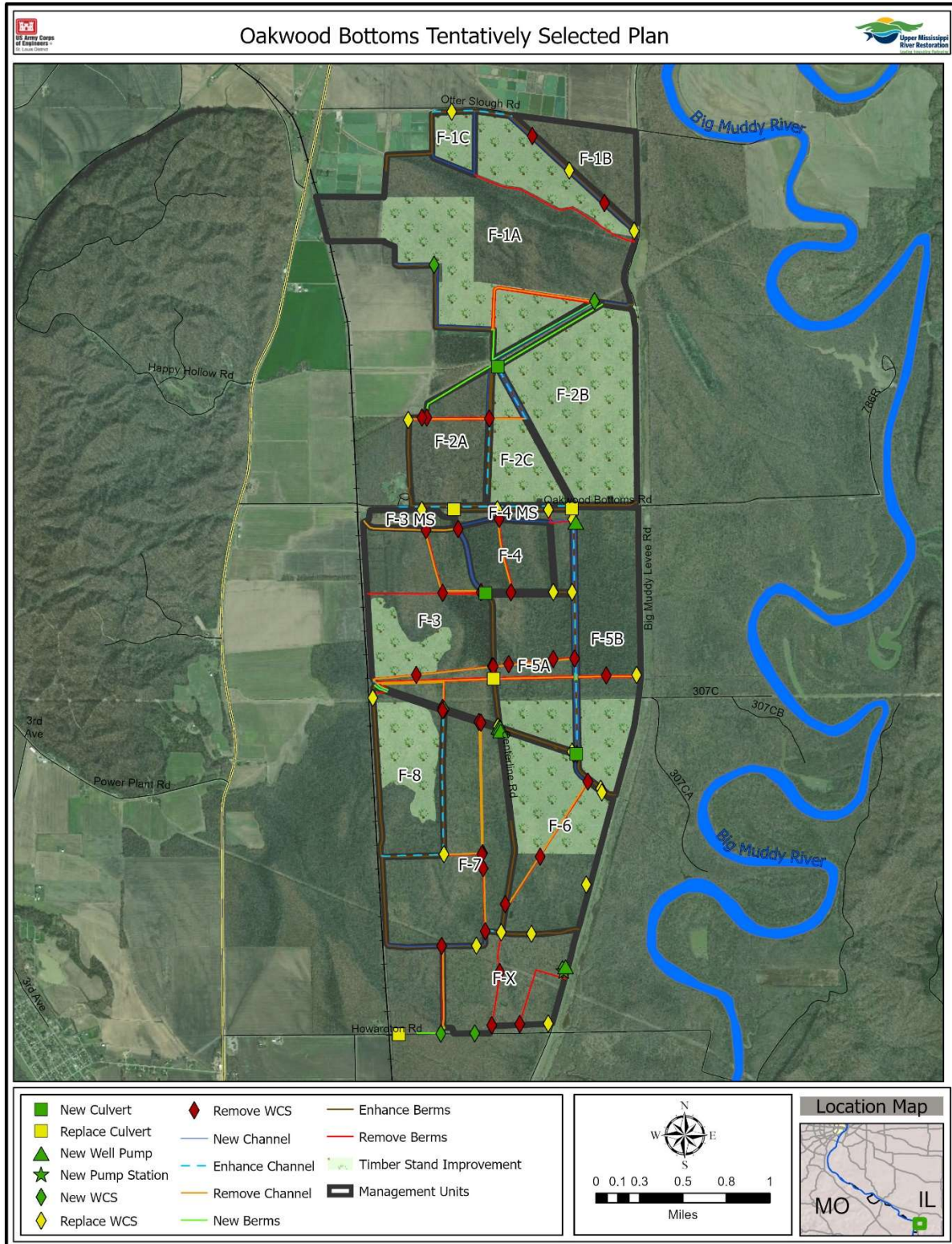


Figure 3. Map of Forest Service preferred alternative.



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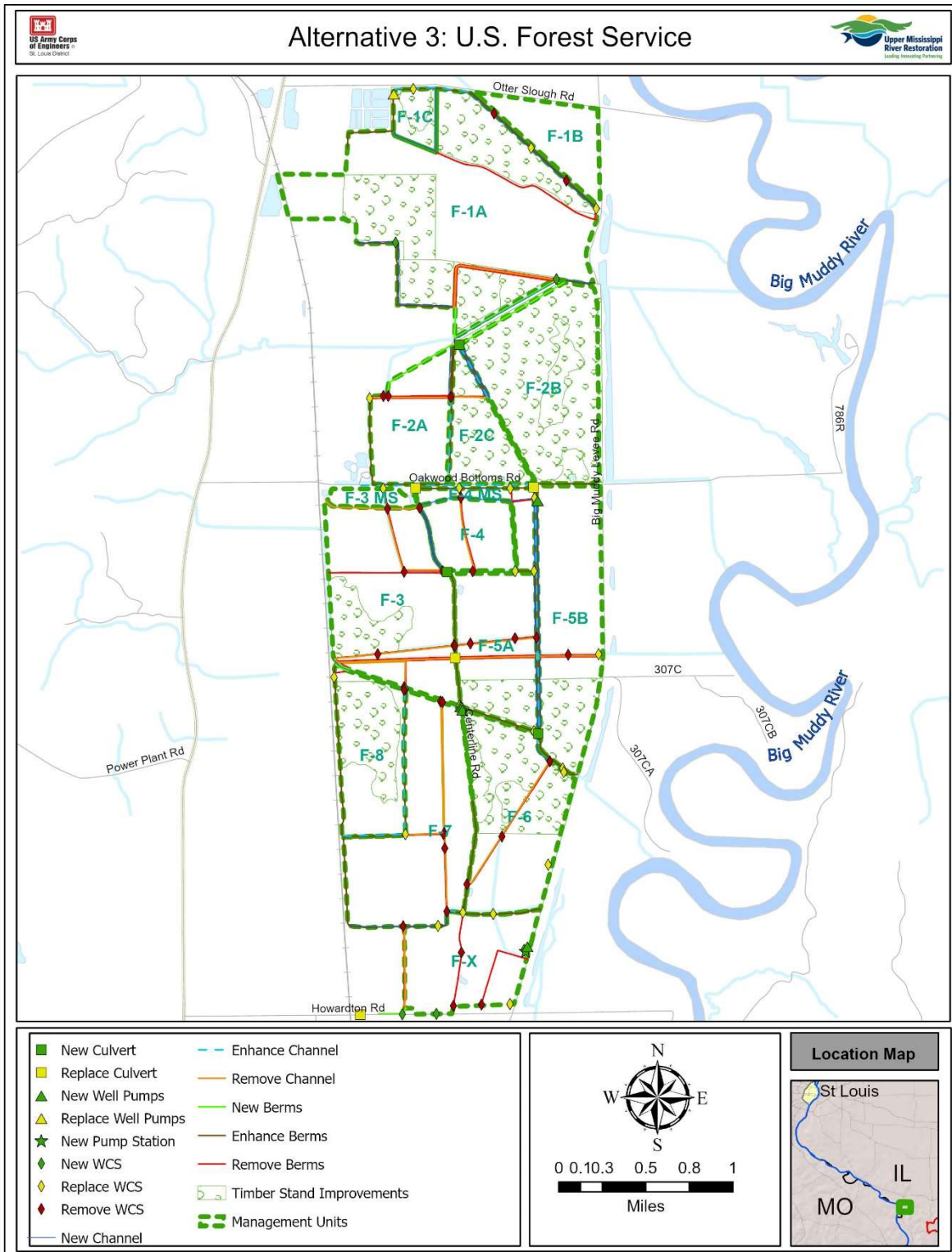


Figure 4. Map of Maximum alternative.

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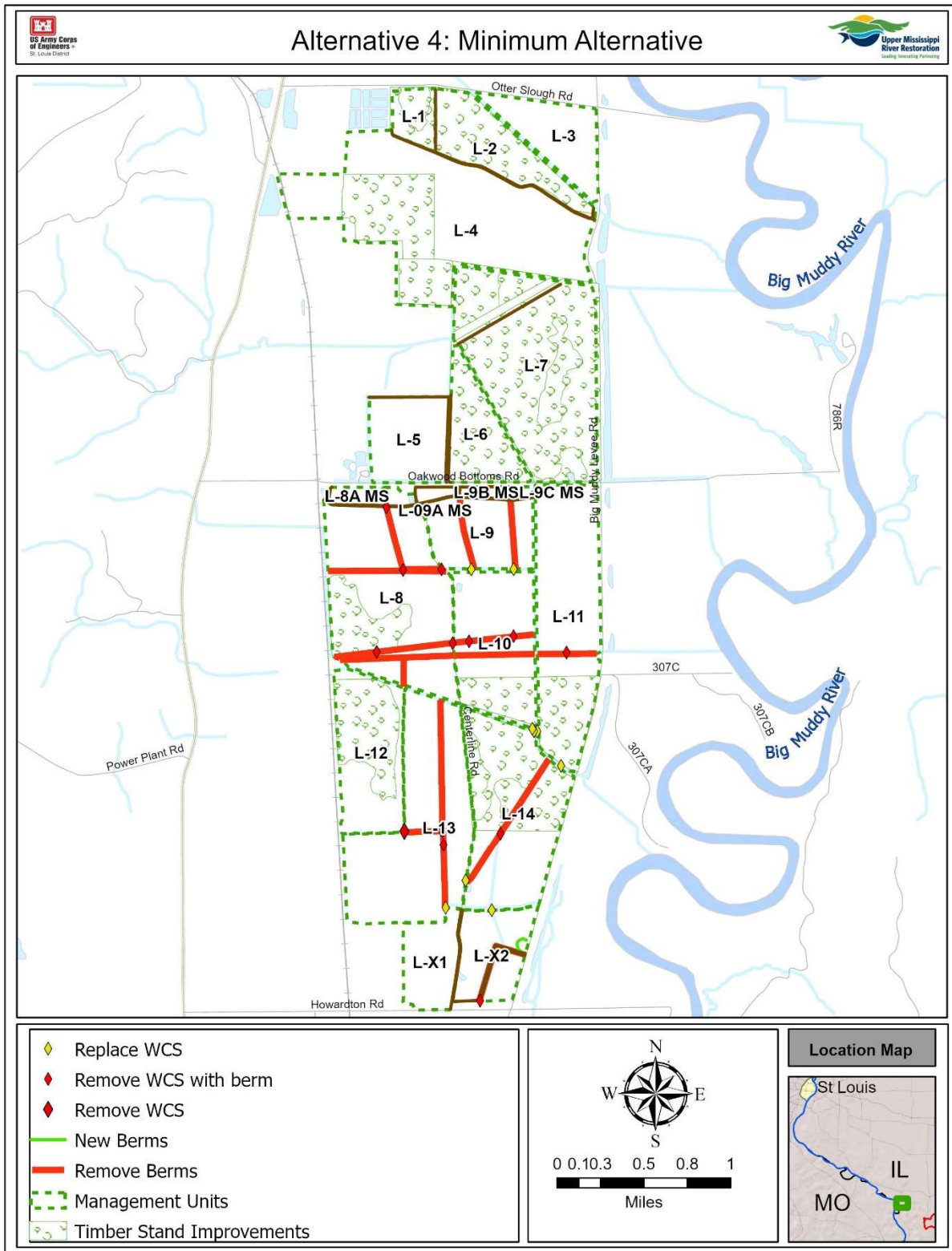


Figure 5. Map of Minimum alternative

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<http://www.fws.gov/policy/ESM102.pdf>

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5 APPROVAL MEMO



**DEPARTMENT OF THE ARMY**  
CORPS OF ENGINEERS, MISSISSIPPI VALLEY DIVISION  
P.O. BOX 80  
VICKSBURG, MISSISSIPPI 39181-0080

CEMVD-PDP

04 October 2016

MEMORANDUM FOR Commander, Rock Island District, U.S. Army Corps of Engineers  
(Attn: Camie Knollenberg, CEMVP-PD-F)

SUBJECT: Regional Use Approval of 11 Spreadsheet Calculators for Application of  
Regionally Approved Habitat Suitability Index Models

1. References:

- a. Engineer Circular 1105-2-412: Assuring Quality of Planning Models, 31 March 2011.
- b. Planning Bulletin 2013-02, Assuring Quality of Planning Models (EC 1105-2-412), 31 March 2013.
- c. Memorandum to Directors of National Planning Centers of Expertise – Subject: Modification of the Model Certification Process and Delegation of Model Approval for Use, 04 December 2017.
- d. Memorandum to CECW-MVD - Subject: Recommendation for Regional Use Approval of 11 Spreadsheet Calculators for Application of Regionally Approved Habitat Suitability Index Models, 15 September 2016.

2. An independent review team managed by the National Ecosystem Restoration Planning Center of Expertise evaluated the subject model (Reference 1.d.). A panel convened by the Office of Water Project Review recommended regional use approval of the calculators in October 2016. Independent technical review of the spreadsheets is complete and the tools meet the criteria in References 1.a. and 1.b for model approval. There are no unresolved issues stemming from the reviews.

3. The spreadsheet calculators for the black capped chickadee, bullfrog, creek chub, fox squirrel, gray squirrel, least tern, smallmouth bass, smallmouth buffalo, striped bass, white bass, and wood duck habitat suitability index models are approved for use in the geographic area defined for each model. These approvals expire on 04 October 2023.

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Date: 2016.08.11 14:21:35 -0500

Gary L. Young  
Chief, MVD Planning and Policy and  
Director, Ecosystem Restoration  
Planning Center of Expertise



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CEMVD-PDP

SUBJECT: Regional Use Approval of 11 Spreadsheet Calculators for Application of Regionally Approved Habitat Suitability Index Models

CF

CECW-PC (Coleman, Matusiak, Trulick, Bee)

CECW-MVD (Williams, Hanneken)

CEMVD-PDP (Mallard, Miller)

CEMVP-PD-C (Johnson, Clark, Allen, Jordan, Popkin, McFarlane)

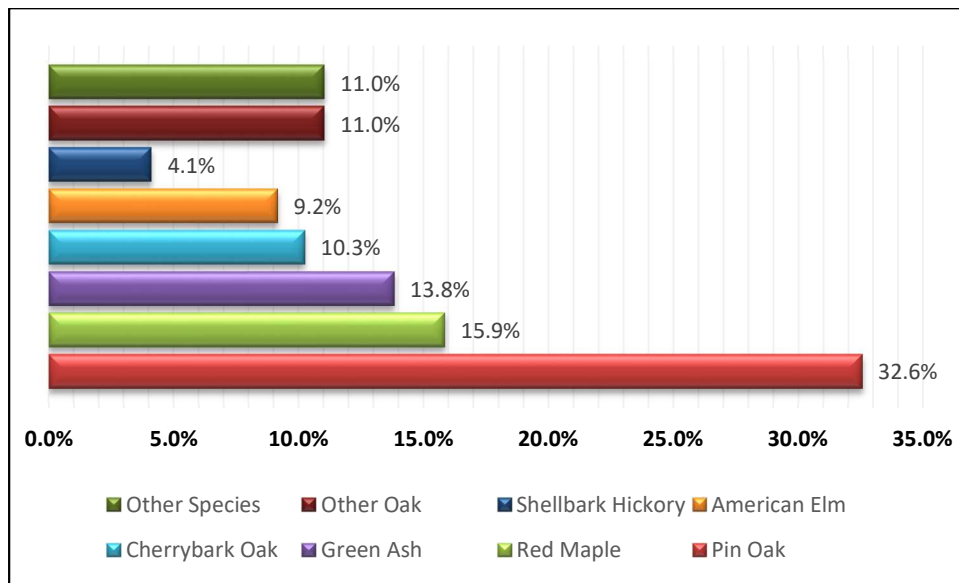
CEMVP-PD-P (Barr, McCain, Herzog, McGuire, Simmons, Ingvalson)

CEMVP-PD-F (Knollenberg, Richards, Opsahl, Savage)

6 2018 FOREST INVENTORY

USFS contractors conducted vegetation data using stratified random sampling method within the Project Area early in 2018. Plot locations were stratified by forested stand and randomly placed within each stand using a predetermined amount of plots required by acreage. A 10 basal area factor (BAF) prism was used to collect tree density at each of the 1,424 plot locations. Plot locations were recorded by latitude/longitude WGS 84 datum. All live and dead trees greater than 1 inch in diameter breast height (DBH) were tallied within each variable plot location, along with collection of tree sapling data within smaller (1/700 acre) fixed radius nested plot. The fixed radius nested plots tallied all live trees .1 to 1 inch DBH, recording both height and species information. Tree age data was collected within each forest stand by taking a tree increment core from a dominant or co-dominant representative tree within each stand. Tree age, height, diameter and species were recorded for each site index tree. Snag and tree decay class were recorded for trees exhibiting outward signs of advanced decay within variable radius plots. The forest type was recorded for each individual stand based upon a USFS classification system. Summary graphs are displayed below in Figures 6-8.

Figure 6. Percent species composition within the green tree reservoir.



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Figure 7. Percent species composition of dead trees within the green tree reservoir.

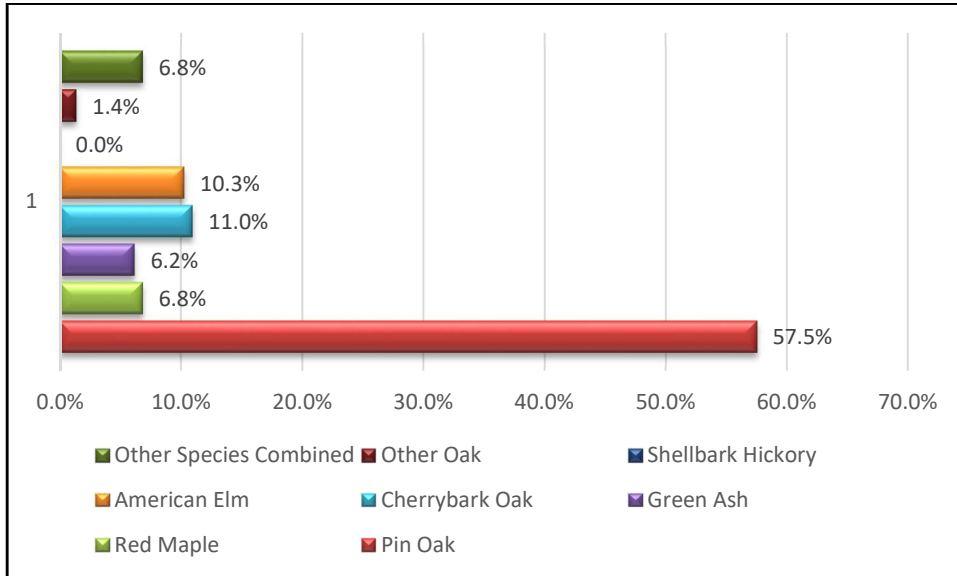
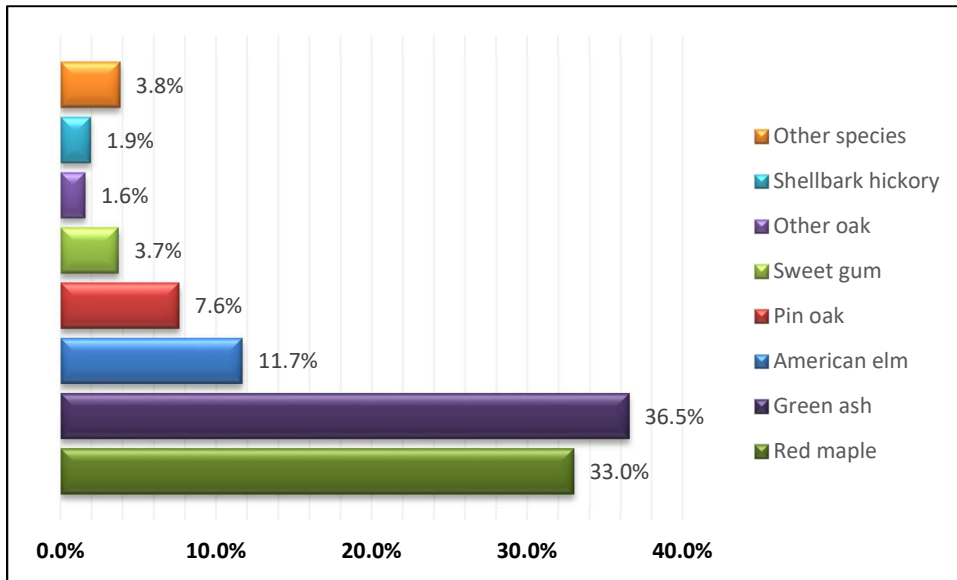
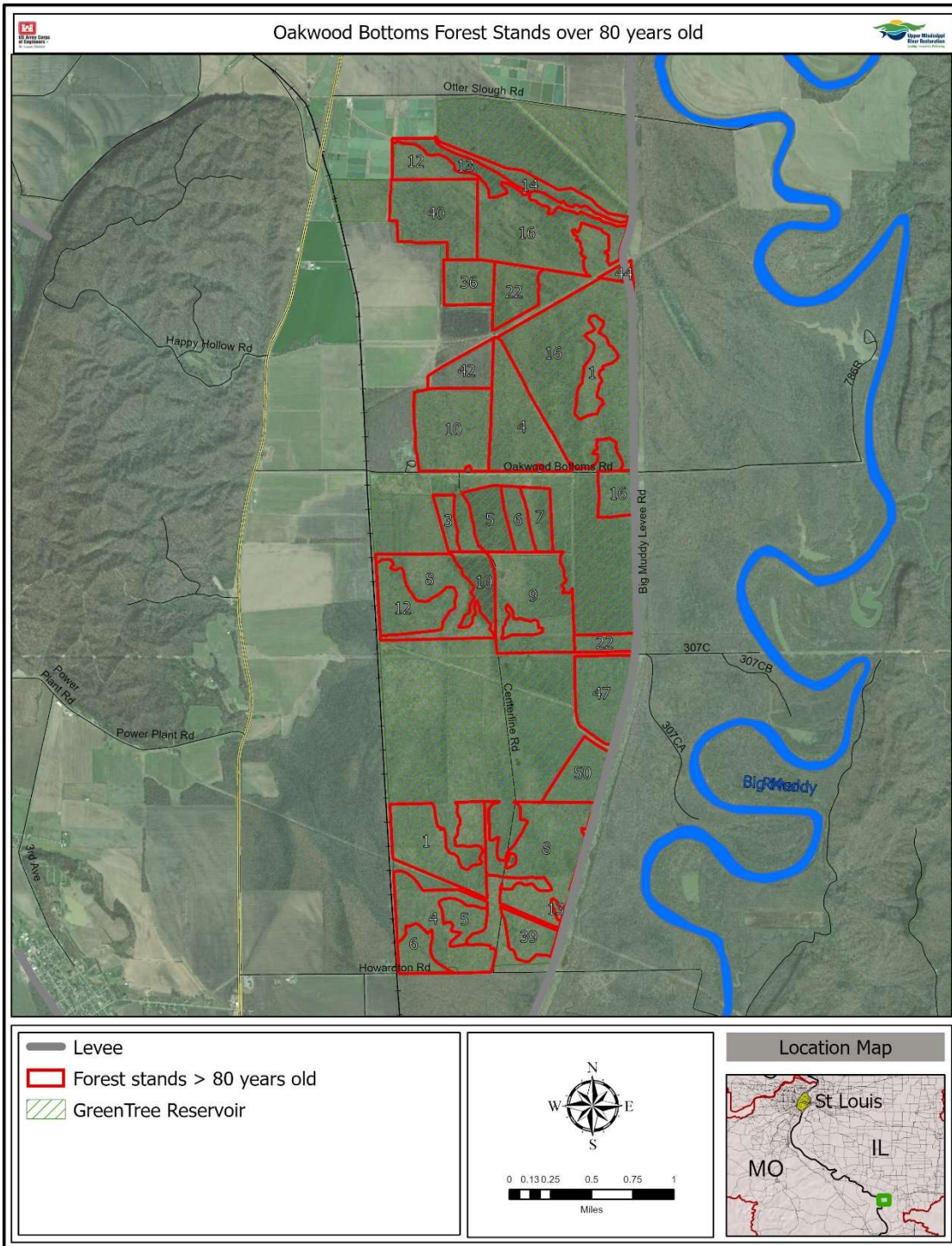


Figure 8. Percent species composition of the seedling layer within the green tree reservoir.



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Figure 9. Forested stands over age 80 within Oakwood Bottoms.



## **Biological Evaluation – Animal Species**

Regional Forester Sensitive Species

**Oakwood Bottoms Greentree Reservoir**

**Habitat Rehabilitation and Enhancement Project**

Hidden Springs-Mississippi Bluffs Ranger District, Shawnee National Forest

Jackson County, Illinois

July, 2020

### **Introduction and Proposed management Action**

This Biological Evaluation (BE) includes effects determinations for Regional Forester designated animal species for the Shawnee National Forest (Forest), (SNF Plan 2006, Appendix H). These site specific effects are determined, in part, using information located in 1) the Programmatic Biological Opinion for the Shawnee National Forest Plan (BO) signed by the U.S. Fish and Wildlife Service (FWS) on December 13, 2005; 2) the Shawnee National Forest Programmatic Biological Assessment for the Forest Plan Revision (BA) dated September 6, 2005; and 3) Chapter 3 of the Final Environmental Impact Statement for the 2006 Forest Plan.

The purpose of this BE is to identify the likely effects of the proposed actions in the Oakwood Bottoms Greentree Reservoir (OBGTR) Habitat Rehabilitation and Enhancement (HREP) project area to Regional Forester Sensitive Species (RFSS) animals for the Forest. The BE is completed to ensure that Forest Service actions (1) do not contribute to a loss of viability or trend toward federal listing of any species and (2) provide a process and standard that ensure the above animal species receive full consideration in the decision making process.

The U.S. Army Corps of Engineers, St. Louis District (USACE) is preparing a Feasibility Report with Integrated Environmental Assessment for implementation of the Oakwood Bottoms HREP. The primary goal of this ecosystem project is to restore and improve the quality and diversity of bottomland hardwood forest and wetland ecosystem resources. The draft feasibility report presents a detailed account of the planning, engineering, construction details, and environmental considerations.

The need for this project is described fully in the draft feasibility report, and only briefly summarized here. Bottomland hardwood forest and emergent wetland have been identified as habitat needs for the Middle Mississippi River (MMR) (Theiling et al., 2000). Existing bottomland hardwood forest is currently in a state of decline with over 30% of the forest composition consisting of oak species that are over the age of 80 years. Without action, the existing bottomland hardwood forest quality would continue to decline impacting the overall forest health and resiliency. In addition, the continued degradation would lead to conversion of forest cover to swamp scrub/shrub translating to a quantitative loss of habitat (resting, foraging, and breeding) for migratory and resident wildlife. Furthermore, floodplain forest within the MMR have been adversely

affected due to past land human-induced actions and have resulted in loss resource for resident and migrant wildlife. The need for this project is now since there is an opportunity to restore a diverse suite of habitats that have all been identified as a habitat need for the MMR within the project area. The restoration of ecosystem structure and function at the project would contribute to restoring ecological health and resiliency of the Upper Mississippi River System. Refer to the main report for more details.

### **The Proposed Action**

The proposed Federal action involves selecting and recommending one of the alternatives for implementation to restore ecosystem structure and function at Oakwood Bottoms HREP. The proposed Federal action for this BE includes the feasibility level of design for the proposed project. For more details on the quantities for the feasibility level of design, see Appendix B – Civil Engineering of the feasibility report produced by USACE.

USACE is preparing to implement a HREP project at Oakwood Bottoms. The project area is approximately 4,500 acres of bottomland hardwood forest and emergent wetland habitat (Figure 1).

The proposed project involves degrading some berms within the project area that were unsystematically constructed beginning in the 1940s and continuing until approximately 20 years ago. Berm degrading would allow for more efficient and effective water transport throughout the project area. The water transport would be improved by the construction of a pump station to the Big Muddy River allowing the project area to be drained and filled more quickly during the spring and fall, respectively. Approximately 4,500 acres of bottomland hardwood forest would benefit from degrading berms and the construction of a pump station. Additionally, 69 acres would be reforested where the degraded berms occurred. Approximately, 94 acres of emergent wetland habitat would be improved with the degrading of several berms and the placement of new water control structures, allowing these emergent wetland areas to be effectively managed with water finite water level manipulations (Figure 2).

### **Details of the proposed project**

#### **Berm Degrades**

Approximately 94 acres of existing berms would be degraded and material would be placed into the adjacent borrow ditches from which it was originally excavated. The former berm area would then be reforested. This activity would restore natural contours to the landscape and would be considered wetland restoration and would have major effect on wetlands. Overland sheet flow and water conveyance would be restored through this action and the forested wetland community health would improve.

#### **Structure Replacement**

A total of 62 water control structures in the project area would be removed and a total of 30 water control structures that would be upgraded for additional capacity.

#### **Moist Soil Unit Enhancement**

Approximately 94.0 acres of wetland would be enhanced within the project area. The emergent wetlands currently do not have acceptable infrastructure to drain and fill at times appropriate for moist-soil unit management. Berm degrades and upgrading water control structures will improve management capability. Disking of the area will reset the vegetation from non-desirable species. Additionally, approximately 24 acres would be cleared in Unit 14 to expand existing moist-soil unit habitat for migratory waterfowl. As this unit is currently managed as moist-soil, conflicting management dates exist. For example ideal time to remove water from a moist-soil unit is typically June to July to facilitate the growth of moist-soil vegetation. Whereas for a greentree reservoir management scenario, the ideal time to remove water is before the start of the growing season, which is typically early to mid-March in this area, to limit the impacts of the water on the trees. Since Unit 14 is already being managed for moist-soil, the trees present would not survive long term.

### **Pump Installation**

A pump would be installed within the lower portion of the greentree reservoir. This pump would allow the Forest Service the capability to remove water from the interior of the Grand Tower Levee when water levels in the Big Muddy River are higher than the gravity drains, preventing normal draining. The pump station would sit atop a concrete pad that is approximately 40 feet by 40 feet.

### **Reforestation**

Approximately 94 acres where berm degrades would occur, berms would be reforested with tree plantings. The species use would be dictated by the surrounding forest community and the specified by the Forest Service Silviculturist but would primarily consist of Oak (*Quercus* spp.) such as cherrybark oak and pin oak.

### **Berm Creation**

Approximately 6 acres of additional berms would be constructed. New berms will consist of placement of embankment to create berms for subunit boundaries. Embankment will be brought up to the required elevation so the subunits can be flooded to an elevation which allows for the needed depth of inundation within the subunits and to provide adequate freeboard to prevent overtopping of the berms. Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1 Vertical to 3 Horizontal to allow for maintenance equipment to traverse the slopes. 1 Vertical to 4 Horizontal slopes were assumed for quantities. The slope of the side slopes will be further refined when geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the new berm footprints along with grubbing of the foundation soils. New berm footprints will be stripped and the stripped material will be stockpiled for use as final dressing on the new berms. The new berms and other associated disturbed areas will be seeded.

Of this area, approximately 5 acres would need to be cleared of trees. The additional berms would serve as connecting pieces to the modified unit layout.

### **Berm Raises**



Berm raises will consist of adding additional embankment to existing berms to bring them up to the required elevation so the subunits can be flooded to an elevation which allows for the needed depth of inundation within the subunits and to provide adequate freeboard to prevent overtopping of the berms. Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1 Vertical to 3 Horizontal to allow for maintenance equipment to traverse the slopes. 1 Vertical to 4 Horizontal slopes were assumed for quantities. The slope of the side slopes will be further refined when geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the berm raise footprint along with grubbing of the foundation soils. Berms will be stripped prior to raising and the stripped material will be stockpiled for use as final dressing on the raised berms. The berm raise footprint and other associated disturbed areas will be seeded. The total area of the berm raises would be approximately 55 acres. Of the 55 acres, approximately 14 acres currently have trees of various sizes and species growing upon them that would require removal in order to place additional material.

### **Channels to Increase Water Conveyance**

Channels, both new and with modifications, are required to increase water conveyance. Construction of channels will consist of excavation of material to the required depth and grades. Channels will vary in dimensions but will be either v-shaped or trapezoidal. Dimensions will be based on the required capacity of the channel. Assumptions were made for the dimensions of the channel based on output from the hydraulic model and engineering experience. Slopes will be 1 Vertical to 3 Horizontal or flatter to meet operation and maintenance requirements. Trees and other large diameter vegetation will be removed within the footprints along with grubbing of the foundation soils. This area includes approximately 5 acres of trees that are of various size and species. New channel footprints will be stripped and the stripped material will be stockpiled for use as final dressing. The channels will not be seeded as they will natural vegetate as seeding and other organic material is deposited when the management units are flooded.

Of this area, approximately 5 acres would need to be cleared of trees.

### **Timber Stand Improvement**

Timber Stand Improvement would consist of approximately 1,608 acres of forest improvement activities such as midstory removal, crop tree release, and gap formation with the use of cutting and herbicide. Planting of hard mast trees such as oaks would also be done to improve the forest composition and replace the hard mast seed source where oaks have been overtaken and are no longer existent. These activities have already completed the NEPA process and coordinated with the USFWS through the 2018 Big Muddy River Bottoms Habitat Improvement II Project, the 2014 Phase Two and Three-Oakwood Bottoms Moist Soil Openings and Shallow-Watered Areas Project and the 2013 Oakwood Bottoms Moist Soil Openings Mastication Project, which outline the proposed methods for understory thinning. This includes removing existing understory and mid-story vegetation up to 9 inches in diameter and grinding stumps to retard re-sprouting.



### **Forest Openings**

Forest openings currently exist in Units 11, 16, 19, 20, and 21 however they cannot be managed due to down woody debris. The woody debris would be removed and additional removal of early successional scrub/shrub and non-desirable mid-story trees (i.e. TSI) would occur. This area would be approximately 57 acres total. These areas would be maintained to allow emergent wetland via mowing and potentially light disking. Within Units 3, 5, 10, 10N, openings would be maintained and expanded to allow for emergent wetland management via mowing and potentially light disking. Within these openings downed trees, early successional scrub/shrub, and non-desirable mid-story trees (i.e. TSI) would be removed. Large desirable trees would be avoided or maintained unless it is necessary to remove in order to accomplish project objectives. Overall overstory tree removal would be minimal in these units. The area would be approximately 50 acres in size.

Within the Otter Slough area in Unit 25, historic aerial imagery from 1984 shows that the area was more open and did not have a closed canopy. The forest inventory data further supports this by showing that the stands within the open area in the photo are younger in age class than surrounding areas. A polygon was drawn in ArcMap using the aerial photo to determine the acreage of the previously open area, which is approximately 25 acres. Within this area, early successional scrub/shrub and non-desirable mid-story trees (i.e. TSI) would be removed. Large desirable trees would be avoided or maintained unless it is necessary to remove to accomplish project objectives. Overall removal of overstory trees would be minimal in this unit. Overall, this proposed action would fit under the 2013 Oakwood Bottoms Moist Soil Openings Mastication Project which has already completed the NEPA process and has been coordinated with the USFWS.

Feasibility Report with Integrated Environmental Assessment  
 Oakwood Bottoms HREP

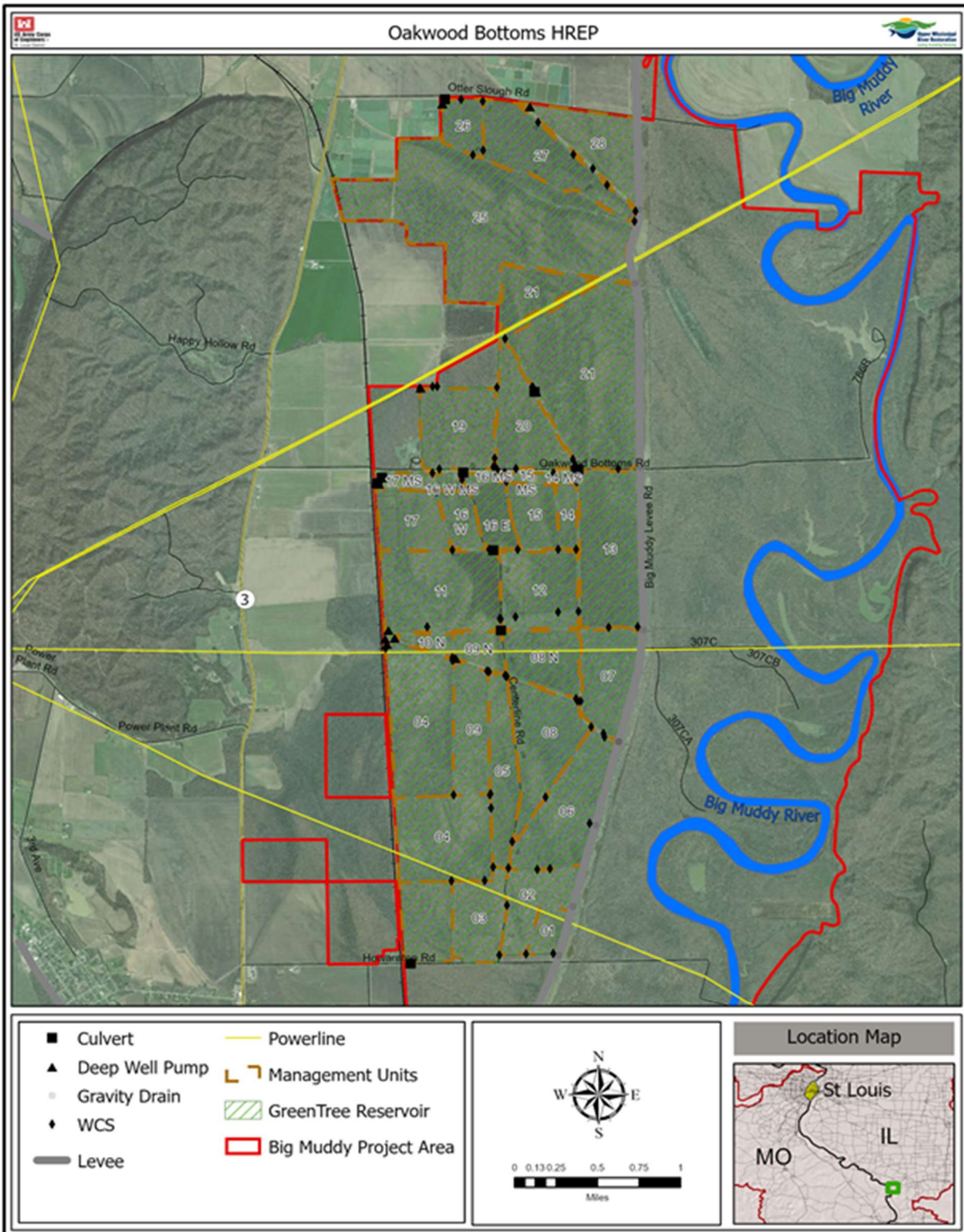


Figure 1. Oakwood Bottoms HREP project area with existing infrastructure.



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Oakwood Bottoms HREP

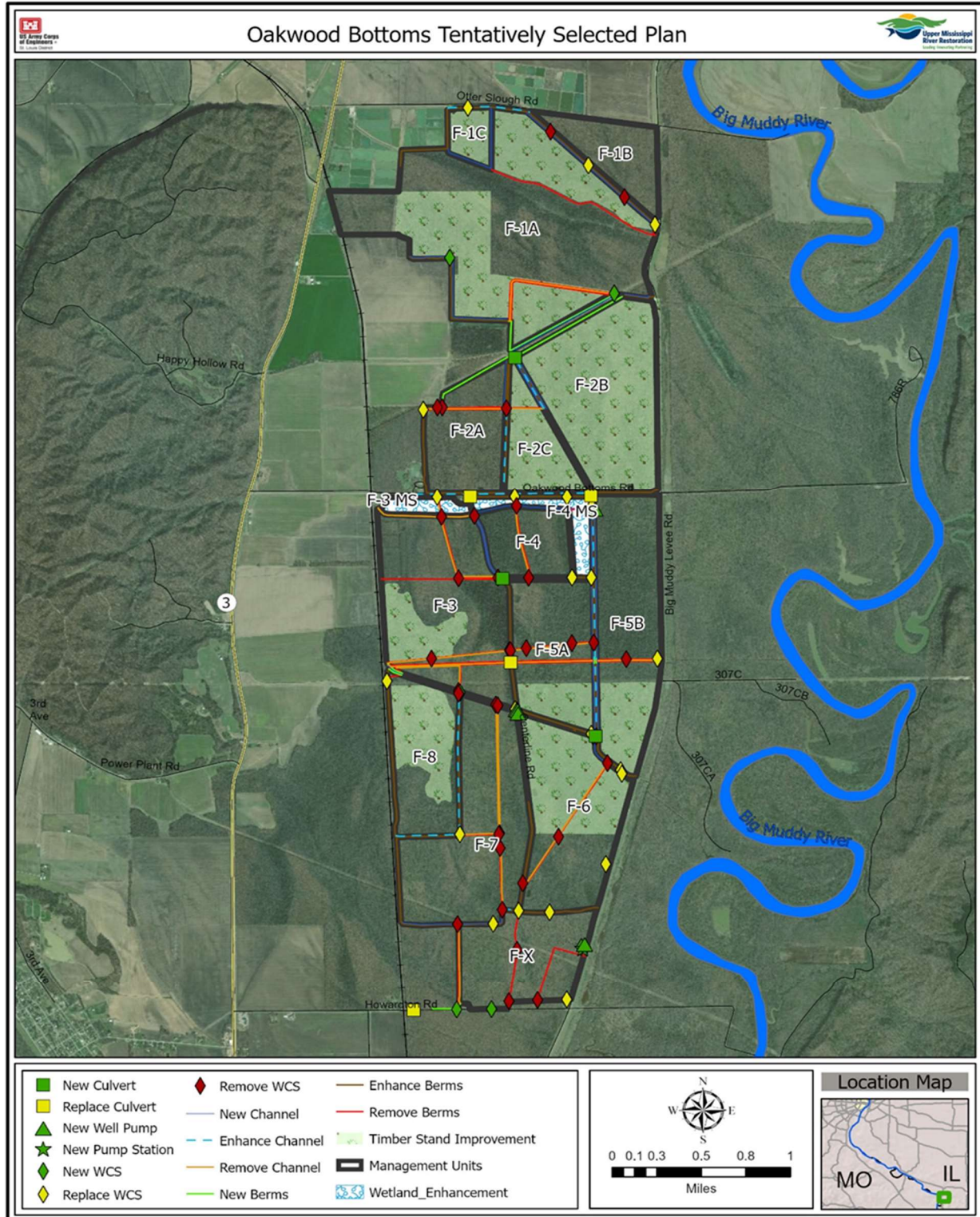


Figure 2. Proposed Plan at Oakwood Bottoms HREP

**Design Criteria**

Design criteria have been built into the proposed actions so as to meet Forest Plan standards and guidelines and comply with the Forest Plan BO; this to reduce the

likelihood of incidental take and prevent adverse effects to federally and state-listed bat species, while also protecting other wildlife such as migratory birds and associated habitat.

1. All tree clearing resulting from the USACE proposed action will occur during the inactive season from November 16 to March 31 unless negative presence/probable absence survey results were obtained for the action area through appropriate surveys approved by the U.S. Fish and Wildlife Service (USFWS).
2. If the project is located in a karst area and will involve construction methods that may cause deep ground disturbance, the USACE will require a cave search be conducted to determine if any caves are present in the action area that would be considered suitable habitat for bats and/or are currently or formerly used by listed bats.
3. During clearing, dead trees, split trees, trees that have cavities, and trees with exfoliating bark would be favored for retention where possible.
4. Indiana bat habitat assessments and presence/absence surveys would be conducted as needed per USFWS requests.

**Species Reviewed**

The RFSS list for the Forest is from 2017. Table 1 below lists the RFSS grouped by animal class. The species below are evaluated for the proposed project based on habitat associations and documented distribution. We give a brief description of distribution and habitat, documented occurrences and threats or limiting factors. This information will not be repeated throughout the document. The NatureServe website (<http://www.natureserve.org>) contains detailed information on each of these species.

Table 1. Regional Forester’s Sensitive Species

Scientific Name	Common Name	Habitat	Comment
<b>Invertebrates</b>			
<i>Crangonyx anomalus</i>	Anomalous spring amphipod	Subterranean and surface springs	Found only in the Lusk Creek drainage
<i>Crangonyx packardii</i>	Packard cave amphipod	Subterranean and surface springs	Documented in Hardin County near Forest
<i>Ligumia recta</i>	Black sandshell	Ohio and Mississippi Rivers and tributaries	Documented in Massac and Pulaski Counties
<i>Sinella cavernarum</i>	Cavernicolous springtail	Caves	Equality Cave, Brown’s Hole Cave
<i>Danaus plexippus</i>	Monarch	Aquatic habitats include; marshes, peatlands, rivers and streams, swamps, wet prairies and fens. Species does not occupy woodland habitats. Prairie and edge habitats include; black soil prairie, dolomite prairie, edge, gravel prairie, hill prairie, sand prairie and shrub prairie.	Species use a variety of habitats associated with the Forest

Feasibility Report with Integrated Environmental Assessment

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Scientific Name	Common Name	Habitat	Comment
<i>Bachtrurus brachycaudus</i>	Short-tailed bactroid	Subterranean and spring seeps	
<i>Caecidotea bicrenata whitei</i>	A cave - obligate isopod	Subterranean and surface springs	Only three records in IL, two of which are in Union County, IL
<i>Caecidotea stygia</i>	A cave isopod	Subterranean and surface springs	Documented in Johnson and Hardin Counties near Forest
<i>Stenotrema (Euchemotrema) hubrichti</i>	Carrinate pillsnail	Rock (limestone) ledges in the Pine Hills section of the Larue/Pine Hills/Otter Pond Research Natural Area (RNA) (Anderson 2005).	Populations occur on the Forest in the LaRue-Pine Hills RNA (Anderson 2005).
<i>Toxolasma lividus</i>	Purple liliput	This species is reported from the headwaters of small to medium sized rivers and some lakes (Cummings and Mayer 1992).	This species is suspected to occur in extreme NE areas of the Forest (Cummings and Mayer 1992).
<i>Ergodesmus remingtoni</i>	Millipede	Subterranean obligate debris.	Suspected to occur in caves on the Forest since these are within the range of the species.
<i>Gammarus bousfieldi</i>	Bousfield's amphipod	Found in pools with little current, deep mud-detritus bottom, and emergent vegetation in high gradient streams debris (Nature Serve 2020).	Known from Hardin, Massac, and Pulaski counties in Southern Illinois.
<i>Orconectes indianensis</i>	Indiana crayfish	The Indiana crayfish lives in rocky riffles and pools of small to medium-sized streams (Page, 1985). In Illinois and Indiana, the Indiana crayfish usually occurs in first, second, or third order streams. Within these streams, the species is frequently found under rocks and in woody debris. Page and Mottes (1995) reported collecting the species exclusively from sites with water depths less than 50 cm.	The Indiana Crayfish occurs in the lower Wabash and Ohio river drainages in extreme southeastern Illinois and southwestern Indiana (Taylor 2002a). In Illinois, the species is historically known to occur in Brushy Slough (Wabash River drainage), the Saline River drainage, and Honey and Rock Creeks (Ohio River drainage). It is known from the following counties and streams in Illinois: Gallatin County—Eagle Creek and Robinette Creek; Hardin County—Honey Creek, Sheridan Branch, and Rock Creek; Johnson County—Clifty Creek and Sugar Creek; Pope County—Burden Creek; Saline County—Little Saline River and Rock Branch; White County—Brushy Slough; and Williamson County—South Fork Saline River and Sugar Creek (Taylor 2002a).

Feasibility Report with Integrated Environmental Assessment

Oakwood Bottoms HREP

Scientific Name	Common Name	Habitat	Comment
<i>Orconectes kentuckiensis</i>	Kentucky crayfish	Common in small to large streams ranging in width from 2 to 8 m with bottom substrates of cobble or large gravel. In these streams the species can usually be found under the cobble or gravel. While Page (1985) reported the species almost exclusively from rocky pools, the author has found that in Kentucky it occurs most commonly in flowing riffles averaging 0.4 m in depth.	In Illinois, the species is historically known to only occur in Big, Hosick, and Peter's creeks, three direct tributaries of the Ohio River in Hardin Co (Taylor 2002b).
<i>Orconectes placidus</i>	Big-claw crayfish	<i>Orconectes placidus</i> occupies rocky riffles and pools with scattered cobble or fractured bedrock in small to large-sized streams and rivers (Page, 1985). Within these streams and river, the species is frequently found under rocks or cobble. Large individuals are occasionally collected from woody debris in slower flowing regions of streams or pools. The species usually occurs at water depths ranging from 0.1 to 1.0 m. In Illinois, <i>O. placidus</i> is known only from first, second, or third order streams. In Kentucky, the species usually occurs in second to fifth order streams.	It occurs in a single direct tributary of the Ohio, the Big Creek drainage in Hardin Co (Taylor 2002c).
<i>Stygobromus subtilis</i>	Subtle cave amphipod	Groundwater seeps and drip pools in caves (Lewis 2002).	Known from one, historical location on the Forest in Jackson County, Toothless Cave. However there is some karst habitat in other areas of the Forest that could be considered, unoccupied, suitable habitat (Lewis 2002).
<b>Fish</b>			
<i>Lepomis symmetricus</i>	Bantam sunfish	Typically inhabits sloughs, oxbows, ponds, backwaters, lakes, and swamps. The vegetated margins are dominated by <i>Nymphaea advena</i> (spatterdock), <i>Nelumbo lutea</i> (American lotus), <i>Sagittaria latifolia</i> (common arrowhead), <i>Ceratophyllum demersum</i> (coon tail), and <i>Lemna</i> spp. (duckweed) and are the preferred habitat for this fish. Substrates commonly consist of detritus, mud, and silt, with some sand (Zeman and Burr 2004).	Known from Clear Creek and Running Lake Ditch drainages on the Forest. It is known from Larue-Pine Hills RNA in Larue Swamp (Zeman and Burr 2004).
<i>Lepomis miniatus</i>	Redspotted sunfish	Swamps, backwater sloughs, bottomland lakes, pools of creeks, and small to medium rivers	Pine Hills Swamp, Wolf Lake area, Clear Creek
<b>Reptiles</b>			

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Scientific Name	Common Name	Habitat	Comment
<i>Nerodia cyclopion</i>	Mississippi green watersnake	Bald cypress-water tupelo backwater areas.	Known only from Pine Hills RNA
<i>Tantilla gracilis</i>	Flat-headed snake	Rocky wooded hillsides, forest edges, pine-oak uplands, pine woods.	Known only from Pine Hills RNA
<i>Crotalus horridus</i>	Timber rattlesnake	High, dry ridges with oak-hickory forest interspersed with open areas, deciduous forest, hardwood forests, river bottoms, swampy areas and floodplains, cane fields. Hibernacula usually in rocky area with underground crevices, fissures, talus (rock slide), and open scree slopes (Brandon 2005a).	Known to occur in Alexander, Hardin, Gallatin, Jackson, Johnson, Pope, Saline, Williamson and Union Counties on the Forest and considered an uncommon species across the Forest (Brandon 2005a).
<i>Macrolemys temminckii</i>	Alligator snapping turtle	Slow moving, deep water of rivers, sloughs, oxbows, swamps, bayous, and ponds near rivers, Shallow creeks that are tributary to occupied rivers with mud bottom and some aquatic vegetation but may use sand-bottomed creeks. Almost entirely aquatic; rarely out of water except to nest.	Known to historically occur in Jackson and Union Counties in aquatic habitats within bottomland and floodplain forests.
<b>Amphibians</b>			
<i>Pseudacris streckeri illinoensis</i>	Illinois chorus frog	Sand prairies, open sandy areas of river lowlands	Documented in Alexander County
<i>Gastrophryne carolinensis</i>	Eastern narrow-mouth toad	Open moist areas with ground cover, ponds, lakes, swamp edges, marshy fields, sandy loam soils	Only occurs on national forest lands in IL.
<i>Hyla avivoca</i>	Bird-voiced treefrog	Forested and swampy floodplains of large rivers and smaller streams with semi-permanent and permanent pools that support stands of bald cypress and tupelo trees (Brandon 2005b)	Known to occur in Jackson, Johnson, Pope, Pulaski, Union, and Alexander Counties in Southern Illinois and on the Forest (Brandon 2005b).
<b>Birds</b>			
<i>Ammodramus henslowii</i>	Henslow's sparrow	Unmowed or burned, large-sized (>40 acre) grasslands (USDA Forest Service 2003a).	Known to occur in Jackson, Johnson, Pope, Saline, and Union Counties in Southern Illinois and on the Forest in Pope and Johnson Counties in three, large openlands (Shawnee National Forest Bird Monitoring Information 1990-2009).
<i>Dendroica cerulea</i>	Cerulean warbler	Forested wetlands, riparian areas. Mixed hardwood forests (USDA Forest Service 2002).	Species is documented occurring in one of the proposed NA: LaRue-Pine Hills RNA and the surrounding hardwoods. Some, unoccupied, suitable habitat maybe present in other areas (Shawnee National Forest Bird Monitoring Information 1990-2009).

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Scientific Name	Common Name	Habitat	Comment
<i>Lanius ludovicianus</i>	Loggerhead shrike	Openland with scattered trees and shrubs (Maddox and Robinson 2005).	Known to occur in Gallatin, Hardin, Jackson, Johnson, Massac, Pope, Saline, Union, and Williamson counties in Southern Illinois but only in one location on the Forest in Pope County (Maddox and Robinson 2004).
<i>Limnothlypis swainsonii</i>	Swainson's warbler	Deciduous floodplain and swamp forests; requires areas with deep shade from both canopy and understory cover (Eddleman 2005).	Historically known to occur on the Forest in Jackson county (Cave Valley) (Eddleman 2005).
<b>Mammals</b>			
<i>Myotis austroriparius</i>	Southeastern myotis	Roost in a variety of shelters including caves, mines, and tree hollows. During winter, they typically hibernate in tightly packed clusters in caves and mines (Feldhamer et.al. 2015).	Known from Saline, Pope, Pulaski, Alexander and Union counties. Known from the Forest in Saline and Pope counties (Shawnee National Forest Monitoring Reports 2005-2008).
<i>Myotis leibii</i>	Eastern small-footed bat	Caves and mines in fall and winter and trees with exfoliated bark, rock outcrops and caves in spring and summer (Feldhamer et.al. 2015).	Known from the Forest and in Illinois only from Johnson County (Steffen et. al. 2006) and Pope County (Whitby et.al 2013). Some unoccupied, suitable habitats (small caves and some sandstone bluffs) are present on the Forest.
<i>Myotis lucifugus</i>	Little brown bat	<u>Hibernacula</u> : caves and mines <u>Maternity Roosts</u> : dead trees with sloughing bark, man-made structures, abandoned buildings	Distributed throughout southern Illinois where suitable habitat is present
<i>Perimyotis subflavus</i>	Tri-colored bat	<u>Hibernacula</u> : caves and mines <u>Maternity Roosts</u> : green foliage within tree canopy	Distributed throughout southern Illinois where suitable habitat is present

RFSS animal species that may potentially be affected by this proposed project were examined using the following existing available information:

1. Reviewing the list of RFSS animal species known or likely to occur on the Shawnee National Forest, and their habitat preferences. This review included the current Region Nine Sensitive Species list for the Forest.
2. Consulting the most current element of occurrence records (EOR's) animal species as maintained by the Illinois Department of Natural Resources-Natural Heritage Program, and supplied to the Forest.
3. Reviewing sources listed in the references portion of this report.
4. Reviewing the results of any past field surveys that may have been conducted in or near the project area.

Based on their known or likely occurrence within or in close proximity to the affected project areas, the following 11 species, (Table 2), were selected for further effects analysis:



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Table 2. RFSS species further analyzed

Common Name	Scientific Name	Taxa
Monarch	<i>Danaus plexippus</i>	Invertebrate
Timber rattlesnake	<i>Crotalus horridus</i>	Reptile
Alligator snapping turtle	<i>Macrochelys temminckii</i>	Reptile
Bird-voiced treefrog	<i>Hyla avivoca</i>	Amphibian
Eastern narrow-mouth toad	<i>Gastrophryne carolinensis</i>	Amphibian
Cerulean warbler	<i>Dendroica cerulea</i>	Bird
Swainson's warbler	<i>Limnothlypis swainsonii</i>	Bird
Southeastern myotis	<i>Myotis austroriparius</i>	Mammal
Eastern small-footed myotis	<i>Myotis leibii</i>	Mammal
Little brown bat	<i>Myotis lucifigus</i>	Mammal
Tri-colored bat	<i>Perimyotis subflavus</i>	Mammal

**Monarch (*Danaus plexippus*)**

The North American populations (subspecies *plexippus*) are strongly migratory. By September a huge majority of newly emerging eastern North American Monarchs are reproductively inactive and attempt to migrate to Mexico for the winter. Monarch migration is very well documented (Center for Biological Diversity et al. 2014 and Flockhart et al. 2013). Apparently almost none of the winter population originates in Florida, Mississippi, Alabama and Georgia. Monarchs breed in those states in spring and early summer but their offspring migrate north (NatureServe 2020).

During the summer breeding season, monarchs live from 2-5 weeks during which they mate and lay the eggs that become the next generation. The last generation of the year does not become reproductive and is said to be in “reproductive diapause”. These butterflies are the ones that migrate to Mexico where they overwinter. These butterflies become reproductive in February and March as they move north, laying eggs on milkweeds as they progress northward into the United States. Milkweed and flowering plants are needed for monarch habitat. Adult monarchs feed on the nectar of many flowers, but they breed only where milkweeds are found (USDA 2020).

**Eastern timber rattlesnake (*Crotalus horridus*)**

The historic range of the timber rattlesnake in Illinois was quite broad and included forests of the Ozark Hills, the Mississippi Border, the Southern Division, the Western Division, and the Jo Daviess Hills. Illinois Natural Heritage EOR’s exist for this species in Jackson County. Suitable habitat is typically described as rocky hillside bluffs for den sites and woodland forests for summer habitat (Brandon et al. 1994). Brandon et al. (1994) described three distinct habitats where timber rattlesnakes may be encountered during the year were listed, (rocky den sites, summer ranges, and transient areas) within their activity ranges, and habitat may vary with age and sex of the individual. Den sites are of three types: fissures in rocky ledges, talus or rock slides, and fallen rock partly covered by soil. During summer months, timber rattlesnakes are commonly found in or near brush piles, upland forest or cultivated fields, and near rocky areas. Gravid

females tend to use open rocky sites close to dens where they bask and feed, and for nursery areas.

In 2014, the SNF worked with Scott Ballard, herpetologist for the IDNR, to review all known timber rattlesnake occurrence records. Records were separated into those records likely to be denning or nursery area records, and records likely to be foraging snakes or adult males seeking females during the breeding season. From these records, and through the use of buffers, areas were delineated to depict areas across the SNF where timber rattlesnakes were likely to be present. Second areas were delineated as “core areas”. Core areas are those areas believed to be representing either denning or nursery area records, and for which one mile buffer zones were established. These maps are stored by the IDNR by Scott Ballard. As new timber rattlesnake records are reported, it is possible that the boundaries surrounding these two timber rattlesnake areas may be revised to reflect these new records.

The proposed project area is located within an area that timber rattlesnakes are present during the summer months. No suitable timber rattlesnake denning sites should be impacted or altered from proposed project activities. No rock outcrop habitats occur within the project area and there is no known suitable denning habitat present. Timber rattlesnakes could be present within the project activity areas during summer months, and individual snakes could be affected by proposed project activities or operation of equipment.

#### **Alligator snapping turtle (*Macrochelys temminckii*)**

The alligator snapping turtle is known to occur historically in Jackson and Union counties in aquatic habitats within bottomland and floodplain forest. It has declined throughout southern Illinois due to channelization, levying and draining of floodplain wetlands (Illinois Natural History Survey 2020).

Preferred habitat includes slow moving deep water of rivers, sloughs, oxbows, swamps, bayous and ponds near rivers. Usually it occurs in water with a mud bottom and some aquatic vegetation but may use sand bottomed creeks. Almost entirely aquatic, it is rarely out of water except to nest. It is mainly a bottom feeder whose diet includes various aquatic animals, vertebrate and invertebrate, carrion, and some plant material.

While not recently documented, suitable proposed project area habitat for this species includes the Big Muddy River and Oakwood Bottoms levees.

#### **Bird-voiced treefrog (*Hyla avivoca*)**

The bird-voiced treefrog habitat includes permanent wooded swamps (tupelo, cypress, birch, buttonbush, and vine tangles) bordering rivers and streams. The frogs may climb high into trees. They are generally intolerant of impoundments that flood habitat. Males call from trees, shrubs, and vines that are in or next to water. Eggs and larvae develop in swamp pools (NatureServe 2020). Bald cypress-tupelo habitat does occur within Oakwood Bottoms.

**Eastern narrow-mouth toad (*Gastrophryne carolinensis*)**

Eastern narrow-mouthed toads occur a wide variety of habitats, usually in areas with sandy or loamy soils. On land, they range up to several hundred meters from water. They burrow underground or hide beneath objects in daytime and when conditions are cold or dry. Breeding sites include lakes, ponds, sloughs, flooded roadside ditches, swamps, stream margins, rain puddles, etc., in both temporary and permanent waters (NatureServe 2020). Breeding occurs usually after heavy rains, mostly in spring and summer but as early as March or as late as November. Individual females produce a clutch of up to about 850 eggs (divided among several batches). Aquatic larvae hatch from floating jelly in a couple days, metamorphose into the terrestrial form in about 3-10 weeks (NatureServe 2020).

**Cerulean warbler (*Dendroica cerulea*)**

The cerulean warbler is a neotropical migrant songbird species that nests and forages in large-sized blocks (greater than 1000 acres) of mature bottomland and floodplain, hardwood forests, riparian forests, and mature upland forests, dominated by large white oaks on the Shawnee National Forest (USDA Forest Service 2002). A tentative description of the characteristics of breeding habitat is a structurally mature hardwood forest in a mesic or wetter situation, with a closed canopy (NatureServe 2020).

**Swainson's warbler (*Limnothlypis swainsonii*)**

Swainson's Warblers breed in bottomland forests with varied overstory species, and dense understory. Substantial recent information suggests understory species is not the key factor, but understory density. Giant cane and similar plants are oftentimes the only understory species that occur in sufficient density to meet this requirement thus the emphasis on giant cane management in most parts of the breeding range of Swainson's Warbler. The mechanism by which the combination of vegetation traits provides suitable habitat is unknown whether it is ease of foraging, suitable nest sites, or suitable prey abundance (Eddleman 2005). A tentative description of the characteristics of breeding habitat is a structurally mature hardwood forest in a mesic or wetter situation, with a closed canopy (NatureServe 2020)

**Southeastern myotis (*Myotis austroriparius*)**

Southeastern myotis range in a broad band from Indiana and Illinois along the Mississippi River and around the southeastern coastal plain to North Carolina. Five caves and a mine are used as hibernacula by southeastern myotis in southern Illinois. Three of these caves, Brasher, Equality and Dutchman/Jug Springs and the Jason Mine are located on NFS lands. The privately-owned Griffith and Cave Springs Caves are within the Forest proclamation boundary. Equality and Dutchman Caves are new hibernacula for this species.

Forest, Illinois DNR biologists and university researchers have documented the presence of southeastern myotis in the summer along several major streams in southern Illinois, including Bay Creek, the Saline River, the Cache River and Grand Pierre Creek. Southeastern myotis typically utilize hollow trees as roosts during the summer, and bachelor males and non-reproductive females will use caves and mines.

Foraging areas are usually over riparian habitat bordering streams, swamps and rivers. Aquatic insects such as caddisflies, flies, some true bugs and moths form the basis of the food species for the Southeastern myotis (Feldhamer et al. 2015).

While this species has not been reported from Jackson County, it has been documented from Union County to the south. The proposed project area also contains suitable foraging and roost habitat.

**Eastern small-footed myotis (*Myotis austroriparius*)**

Eastern small-footed bats were not documented in Illinois until 2005. A male and a female, roosting under rocks in somewhat open glade habitat at Fink Sandstone Barrens in Johnson County. During the summer of 2011, a cooperative survey involving Forest personnel and Ball State University researchers documented 23 individuals roosting under rocks in open cedar-sandstone glades in Johnson and Pope Counties suggesting that the population may be more extensive than initially believed (Feldhamer et al. 2015). This bat uses caves and mines in the fall and winter, and trees with exfoliating bark, rock outcrops and caves in spring and summer. Foraging habitat is often associated with riparian areas, but may occur elsewhere in the forest or forest edge.

While this species has not been documented in either Jackson or Union County, suitable riparian foraging habitat is present.

**Little brown bat (*Myotis lucifugus*)**

The little brown bat has a somewhat wide range, which includes North America from the Alaskan-Canadian boreal forest, south through most of the contiguous United States, though the species is generally absent from the southern Great Plains region (NatureServe 2020). Little brown bat is currently somewhat common and abundant across the SNF wherever suitable roosting and foraging habitat is present near permanent watered areas. The species is considered “secure” in Illinois (NatureServe 2020).

The little brown bat is known to utilize at least 16 caves and mines in southern Illinois as winter roost sites based on surveys conducted by IDNR and USFS biologists. The species occurs from a few individuals to over 1000 with many of the hibernacula being used by around 30-100 bats. Several hibernacula routinely support from 100- 750 bats. No hibernacula are known to be present on or near the project area. All of the caves and mines known to be used by the species on the SNF have some type of closure device (cave gates, fencing, etc.) constructed across the openings to prevent unauthorized entry throughout the year. Entry into hibernacula is only by Forest authorization, or for surveys and monitoring conducted by state, university, and federal biologists.

Little brown bats have been documented having WNS in at least several caves in southern Illinois, and have documented substantial winter population declines within the

past two-three years due to exposure to WNS. It is likely that the continual spread of WNS throughout southern Illinois will result in substantially lower population levels for the long-term.

Extreme flooding events dating back to the early 1990's which caused high tree mortality in and around the proposed project area has made the area especially suitable for snag-roosting species such as the little brown bat. Due to the abundance of bottomland habitat and interspersed upland forest and openings, virtually all of the action area provides suitable little brown bat habitat.

Suitable summer habitat occurs in proposed project area. Per the proposed action description, the intent of this project is to improve the overall health of the bottomland forest habitat involved. Removing shade-tolerant trees through TSI and herbicide treatments will increase desired hardwood regeneration. Although the combined prescription has the potential to contribute to the loss of dead and hollow trees both directly and indirectly, at the same time it will also help replenish the quantity and quality of standing dead trees and help decrease vegetative clutter.

Suitable foraging and roosting habitat occurs across the proposed project area.

#### **Tri-colored Bat (*Perimyotis subflavus*)**

The species prefers partly open country with large trees and woodland edges, avoiding deep woods and open fields. Summer roosts probably are mainly in tree foliage and occasionally in buildings. Caves may be used as night roosts between foraging forays. Hibernation sites usually are in caves or mines having high humidity. Pregnant and lactating females typically roost exclusively in foliage, in clusters of dead leaves and less often in live foliage or squirrel nests (NatureServe 2020; Perry and Thill. 2007; Veilleux et al. 2003; Veilleux and Veilleux 2004).

Tri-colored bats are known to be present in most caves and mines in southern Illinois even when no other bats species are present. Tri-colored bat use appears to be highest in caves or mines that have somewhat higher temperatures and humidity levels. No caves or mines known to be used by tri-colored bats are located in or near the project area.

Because this species roosts during the summer in the canopies of live trees, suitable habitat occurs across the project area.

#### **Analysis of Potential Effects of the Proposed Action**

For every decision that results in the implementation of a management activity that affects the type, amount, distribution, and/or arrangement of terrestrial or aquatic habitat within a landscape area, there will be corresponding potential differences in effects to habitat conditions (distribution, abundance, and quality), species diversity, and species abundance. Given the fact that different animal species have different habitat requirements, changes in the amount and type of habitat may have differing corresponding positive or negative effects to species abundance and diversity. As a

general rule, as habitat conditions become less favorable, some species would be expected to become less abundant or to disappear all-together either due to mortality or movement out of the habitat. Conversely, as habitat conditions become more favorable, other species would be expected to become more abundant. For some species that have wider tolerances to habitat conditions, population numbers may exhibit little to no change.

Implementation of the proposed management activity may result in population levels lower than pre-implementation. The population of some species may decline due to changes in habitat quality but can still remain at or above a viable or desirable population level within a given area, as well as across the Forest planning area. For some species, a particular habitat type may be considered to be more highly suitable, but the species will utilize other habitat types of lower quality at lower population levels.

This analysis of potential effects to terrestrial and aquatic animal species was conducted using, to the degree practical, the “best available science”.

The implementation of the proposed action could result in elevated disturbance levels so as to temporarily force wildlife species that are sensitive to spikes in human induced disturbances to temporarily leave activity areas. Since mechanized heavy equipment is proposed to be used to accomplish construction activities and harvest and/or extract timber resources, and activity could take place during the peak of nesting season for birds. This potential disturbance effect is projected to be very localized and temporal in nature. Some species would be expected to return to treated stands as soon as a few hours after suspension of activities (i.e. in the evening when workers go home, or on weekends), while for other species, returning to treated stands may take longer (i.e. several days to several weeks post activity). For some species, it may take multiple decades before habitat conditions become minimally suitable for habitation.

Elevated human induced disturbance levels could constitute an adverse impact to the point of disrupting nesting or reproduction for the year for some species. No species are expected to be adversely affected at such a level so as to result in substantially reduce population numbers across the Forest.

Implementation of the proposed action could result in direct mortality to some wildlife species. Individuals of less mobile species, incubating female birds, roosting bats with non-volant young and bird nestlings could be killed by the felling of trees, crushed by falling logs, and/or crushed from the operation of mechanized equipment. Any adverse effects that result from the implementation of the proposed action should be restricted to isolated individuals, localized in effects, of short-term duration, and are expected to have no long-term adverse impacts to species viability across the Forest. There are no known occurrence records for any rare reptiles, amphibians, snails, or invertebrates within the proposed project activity areas.

A reasonable attempt was made to conduct a comprehensive summary of all past, present, and reasonably foreseeable activities that could affect RFSS within a five mile

radius surrounding the proposed project boundary. While it extremely difficult to anticipate activities that may take place on private lands, past activities have been used to make estimates on activities likely to take place into the near future.

### **Potential Direct, Indirect and Cumulative Effects to RFSS**

#### **Monarch**

No direct adverse effects are anticipated to occur from implementation of the proposed project due to the unlikely occurrence of this species being present within the project area during proposed project activities. Implementation of the proposed project is expected to have beneficial indirect effects for the short-term due to the creation of suitable habitat within the project area. No cumulative adverse effects are anticipated to take place to monarch populations within the project area or across the Forest from the implementation of the proposed project activities, because: 1) the project area represents low quality-unsuitable monarch habitat, and will remain as such in the long-term; and, 2) relatively low level and type of activities occurring on non-National Forest and National Forest lands that could involve suitable monarch habitat.

There will be no impact on monarch by implementation of the proposed action. Indirect and cumulative impacts from the proposed action should be an overall positive impact with the improvement of suitable habitat.

#### **Eastern timber rattlesnake**

The timber rattlesnake is commonly found throughout the project area during the summer months (foraging and potentially breeding). Individual snakes could be affected by proposed project activities. Implementation of the proposed action could result in adverse direct impacts to individual timber rattlesnakes. Indirect and cumulative impacts should be an overall positive impact with the improvement of foraging and basking habitat.

Implementation of the proposed action may result in direct adverse impacts to individuals, but should not contribute to the loss of species viability, nor cause a trend toward federal listing.

#### **Alligator snapping turtle**

The alligator snapping turtle is not known for being in the proposed project area. However, individual turtles could be affected by proposed project activities if they are present. Implementation of the proposed action could result in adverse direct impacts to individual timber rattlesnakes. Indirect and cumulative impacts should be an overall positive impact with the improvement of foraging and basking habitat.

Implementation of the proposed action may result in direct adverse impacts to individuals, but should not contribute to the loss of species viability, nor cause a trend toward federal listing.

#### **Bird-voiced treefrog and Eastern narrow-mouth toad**

The Bird-voiced treefrog and Eastern narrow-mouth toad are not known for being in the

proposed project area. However, these amphibians could be affected by proposed project activities if they are present. These species were analyzed collectively due to the limited suitable habitat available, (limited in quality and quantity), and/or known occurrences in the area. Bald cypress-tupelo habitat does occur within Oakwood Bottoms.

Implementation of the proposed action may result in direct adverse impacts to individuals, but should not contribute to the loss of species viability, nor cause a trend toward federal listing.

### **Cerulean warbler and Swainson's warbler**

The Cerulean warbler and Swainson's warbler are not known for being in the proposed project area. However, birds could be affected by proposed project activities if they are present. These species were analyzed collectively due to the limited suitable habitat available, (limited in quality and quantity), and/or known occurrences in the area.

Implementation of the proposed action may result in direct adverse impacts to individuals, but should not contribute to the loss of species viability, nor cause a trend toward federal listing.

### **RFSS Bats**

Suitable roost habitat occurs in the proposed project area and documented little brown bat roost sites are known within the project area. In order to eliminate the likelihood that a roosting bat would be affected during any of the proposed project activities, the design criteria listed above would be implemented. There will be no effects to any bat hibernacula from proposed activities or alternatives.

The implementation of timber operations and construction activities may cause direct harm to individual bats that may be using suitable roost trees during the summer months. The less-dense understory that would result from the TSI mortality of dense woody vegetation could improve foraging conditions as well as wetland enhancement within the proposed project area.

On-going and anticipated future cumulative effects would result in removal of potential suitable roost trees within the project area from the varying proposed project management actions. The proposed project actions have the potential to eliminate some suitable roost trees, but will also likely create some snags as well.

Implementation of the proposed action may result in direct adverse impacts to individuals, but should not contribute to the loss of species viability, nor cause a trend toward federal listing. Indirect and cumulative impacts from the proposed action alternative should be an overall positive impact with the improvement of foraging and roosting habitat.

The use of authorized herbicides and their associated risk assessments were analyzed during the 2012 Forest's Invasive Species Management Project BE and the 2018 Big



Muddy River Bottoms Habitat Improvement II Project.

**Required Mitigation**

The Forest Plan contains standards and guidelines to protect habitat, to sustain species diversity, to conserve biological diversity, and to ensure the sustaining of populations for the majority of the federal listed and proposed, as well as regional sensitive species known or likely to occur on lands within the administrative boundary for the Shawnee National Forest. These standard and guidelines would apply when and where needed during various stages of project implementation. These standards and guidelines were reviewed by the US Fish and Wildlife Service during formal consultation for the Amended Forest Plan. In the event any new information is derived that would indicate the presence of other federally listed or region sensitive species within the project activity area, project activities would be temporarily suspended, the information would be analyzed, and a determination rendered for any additional project stipulations or mitigation deemed necessary to protect species viability across the Forest.

Prepared by:

/s/Andy Chappell  
2020  
Andy Chappell  
Wildlife Biologist

July 30,  
Date

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8 BIOLOGICAL EVALUATION – PLANT SPECIES

**Biological Evaluation**  
**Regional Forester’s Sensitive Species Plants**  
**Oakwood Bottoms Greentree Reservoir**  
**Habitat Rehabilitation and Enhancement Project**  
**Mississippi Bluffs Ranger District**  
**Shawnee National Forest**  
**September 18, 2020**

**I. INTRODUCTION**

Forest Service Manual (FSM) Section 2672.41 requires a biological evaluation (BE) and/or biological assessment (BA) be conducted for all Forest Service planned, funded, executed, or permitted programs and activities. The objectives of this BE are: 1) to ensure that Forest Service actions do not contribute to the loss of population viability of any native or desired non-native species or contribute to trends toward federal listing; 2) to comply with the requirements of the Endangered Species Act (ESA) so that federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of any federally listed species; and, 3) to provide a process and standard ensuring that federally threatened or endangered and Regional Forester’s Sensitive plants receive full consideration in the decision-making process.

The Shawnee National Forest has known occurrences of federally threatened or endangered and Regional Forester’s Sensitive (TES) plant species, which were considered in this analysis. This BE documents the analysis of potential effects of the proposed action to TES plant species and associated habitats. It also serves as biological input for the environmental analysis of project-level decision making to ensure compliance with the ESA National Environmental Policy Act (NEPA) and National Forest Management Act (NFMA).

**II. PURPOSE AND NEED**

**A. BACKGROUND**

The purpose of this BE is to identify the likely effects of the proposed actions in the Oakwood Bottoms Greentree Reservoir (OBGTR) Habitat Rehabilitation and Enhancement (HREP) project area to Regional Forester Sensitive plant Species (RFSS) species for the Forest.

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*Oakwood Bottoms HREP*

The U.S. Army Corps of Engineers, St. Louis District (USACE) is preparing a Feasibility Report with an Integrated Environmental Assessment for implementation of the Oakwood Bottoms HREP. The primary goal of this ecosystem project is to restore and improve the quality and diversity of bottomland hardwood forest and wetland ecosystem resources. The draft feasibility report presents a detailed account of the planning, engineering, construction details, and environmental considerations.

**B. PURPOSE AND NEED FOR ACTION**

The need for this project is described fully in the draft feasibility report, and only briefly summarized here. Bottomland hardwood forest and emergent wetland have been identified as habitat needs for the Middle Mississippi River (MMR) (Theiling et al., 2000). Existing bottomland hardwood forest is currently in a state of decline with over 30% of the forest composition consisting of oak species that are over the age of 80 years. Without action, the existing bottomland hardwood forest quality would continue to decline impacting the overall forest health and resiliency. In addition, the continued degradation would lead to conversion of forest cover to swamp scrub/shrub translating to a quantitative loss of habitat (resting, foraging, and breeding) for migratory and resident wildlife. Furthermore, floodplain forest within the MMR have been adversely affected due to past land human-induced actions and have resulted in a loss of resources for resident and migrant wildlife. The need for this project is now since there is an opportunity to restore a diverse suite of habitats that have all been identified as a habitat need for the MMR within the project area. The restoration of ecosystem structure and function at the project would contribute to restoring ecological health and resiliency of the Upper Mississippi River System. Please refer to the Environmental Assessment for more details.

**III. PROPOSED ACTION**

The proposed Federal action involves selecting and recommending one of the alternatives for implementation to restore ecosystem structure and function at Oakwood Bottoms HREP. The proposed Federal action for this BE includes the feasibility level of design for the proposed project. For more details on the quantities for the feasibility level of design, see Appendix B – Civil Engineering of the feasibility report produced by USACE.

USACE is preparing to implement a HREP project at Oakwood Bottoms. The project area is approximately 4,500 acres of bottomland hardwood forest and emergent wetland habitat (Figure 1).

The proposed project involves degrading some berms within the project area that were unsystematically constructed beginning in the 1940s and continuing until approximately 20 years ago. Berm degrading would allow for more efficient and effective water transport throughout the project area. The water transport would be improved by the construction of a pump station to the Big Muddy River allowing the project area to be drained and filled more quickly during the spring and fall, respectively. Approximately 4,500 acres of bottomland hardwood forest would benefit from degrading berms and the construction of a pump station. Additionally, 69 acres would be reforested where the degraded berms occurred. Approximately, 94 acres of emergent wetland habitat would be improved with the degrading of several berms and the placement of new water control structures, allowing these emergent wetland areas to be effectively managed with water finite water level manipulations (Figure 2).

## **Details of the proposed project**

### **Berm Degrades**

Approximately 94 acres of existing berms would be degraded and material would be placed into the adjacent borrow ditches from which it was originally excavated. The former berm area would then be reforested. This activity would restore natural contours to the landscape and would be considered wetland restoration and would have major effect on wetlands. Overland sheet flow and water conveyance would be restored through this action and the forested wetland community health would improve.

### **Structure Replacement**

A total of 62 water control structures in the project area would be removed and a total of 30 water control structures that would be upgraded for additional capacity.

### **Moist Soil Unit Enhancement**

Approximately 94.0 acres of wetland would be enhanced within the project area. The emergent wetlands currently do not have acceptable infrastructure to drain and fill at times appropriate for moist-soil unit management. Berm degrades and upgrading water control structures will improve management capability. Disking of the area will reset the vegetation from non-desirable species. Additionally, approximately 24 acres would be cleared in Unit 14 to expand existing moist-soil unit habitat for migratory waterfowl. As this unit is currently managed as moist-soil, conflicting management dates exist. For example ideal time to remove water from a moist-soil unit is typically June to July to facilitate the growth of moist-soil vegetation. Whereas for a greentree reservoir management scenario, the ideal time to remove water is before the start of the growing season, which is typically early to mid-March in this area, to limit the impacts of the water on the trees. Since Unit 14 is already being managed for moist-soil, the trees present would not survive long term.

### **Pump Installation**

A pump would be installed within the lower portion of the greentree reservoir. This pump would allow the Forest Service the capability to remove water from the interior of the Grand Tower Levee when water levels in the Big Muddy River are higher than the gravity drains, preventing normal draining. The pump station would sit atop a concrete pad that is approximately 40 feet by 40 feet.

### **Reforestation**

Approximately 94 acres where berm degrades would occur, berms would be reforested with tree plantings. The species use would be dictated by the surrounding forest community and the specified by the Forest Service Silviculturist but would primarily consist of Oak (*Quercus* spp.) such as cherrybark oak and pin oak.

### **Berm Creation**

*Oakwood Bottoms HREP*

Approximately 6 acres of additional berms would be constructed. New berms will consist of placement of embankment to create berms for subunit boundaries. Embankment will be brought up to the required elevation so the subunits can be flooded to an elevation which allows for the needed depth of inundation within the subunits and to provide adequate freeboard to prevent overtopping of the berms. Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1 Vertical to 3 Horizontal to allow for maintenance equipment to traverse the slopes. 1 Vertical to 4 Horizontal slopes were assumed for quantities. The slope of the side slopes will be further refined when geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the new berm footprints along with grubbing of the foundation soils. New berm footprints will be stripped and the stripped material will be stockpiled for use as final dressing on the new berms. The new berms and other associated disturbed areas will be seeded.

Of this area, approximately 5 acres would need to be cleared of trees. The additional berms would serve as connecting pieces to the modified unit layout.

### **Berm Raises**

Berm raises will consist of adding additional embankment to existing berms to bring them up to the required elevation so the subunits can be flooded to an elevation which allows for the needed depth of inundation within the subunits and to provide adequate freeboard to prevent overtopping of the berms. Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1 Vertical to 3 Horizontal to allow for maintenance equipment to traverse the slopes. 1 Vertical to 4 Horizontal slopes were assumed for quantities. The slope of the side slopes will be further refined when geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the berm raise footprint along with grubbing of the foundation soils. Berms will be stripped prior to raising and the stripped material will be stockpiled for use as final dressing on the raised berms. The berm raise footprint and other associated disturbed areas will be seeded. The total area of the berm raises would be approximately 55 acres. Of the 55 acres, approximately 14 acres currently have trees of various sizes and species growing upon them that would require removal in order to place additional material.

### **Channels to Increase Water Conveyance**

Channels, both new and with modifications, are required to increase water conveyance. Construction of channels will consist of excavation of material to the required depth and grades. Channels will vary in dimensions but will be either v-shaped or trapezoidal. Dimensions will be based on the required capacity of the channel. Assumptions were made for the dimensions of the channel based on output from the hydraulic model and engineering experience. Slopes will be 1 Vertical to 3 Horizontal or flatter to meet operation and maintenance requirements. Trees and other large diameter vegetation will be removed within the footprints along with grubbing of the foundation soils. This area includes approximately 5 acres of trees that are of various size and species. New channel footprints will be stripped and the stripped material will be stockpiled for use as final dressing. The channels will not be seeded as they will natural vegetate as seeding and other organic material is deposited when the management units are flooded.

Of this area, approximately 5 acres would need to be cleared of trees.

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### **Timber Stand Improvement**

Timber Stand Improvement would consist of approximately 1,608 acres of forest improvement activities such as midstory removal, crop tree release, and gap formation with the use of cutting and herbicide. Planting of hard mast trees such as oaks would also be done to improve the forest composition and replace the hard mast seed source where oaks have been overtaken and are no longer existent. These activities have already completed the NEPA process and coordinated with the USFWS through the 2018 Big Muddy River Bottoms Habitat Improvement II Project, the 2014 Phase Two and Three-Oakwood Bottoms Moist Soil Openings and Shallow-Watered Areas Project and the 2013 Oakwood Bottoms Moist Soil Openings Mastication Project, which outline the proposed methods for understory thinning. This includes removing existing understory and mid-story vegetation up to 9 inches in diameter and grinding stumps to retard re-sprouting.

### **Forest Openings**

Forest openings currently exist in Units 11, 16, 19, 20, and 21 however they cannot be managed due to down woody debris. The woody debris would be removed and additional removal of early successional scrub/shrub and non-desirable mid-story trees (i.e. TSI) would occur. This area would be approximately 57 acres total. These areas would be maintained to allow emergent wetland via mowing and potentially light disking.

Within Units 3, 5, 10, 10N, openings would be maintained and expanded to allow for emergent wetland management via mowing and potentially light disking. Within these openings downed trees, early successional scrub/shrub, and non-desirable mid-story trees (i.e. TSI) would be removed. Large desirable trees would be avoided or maintained unless it is necessary to remove in order to accomplish project objectives. Overall overstory tree removal would be minimal in these units. The area would be approximately 50 acres in size.

Within the Otter Slough area in Unit 25, historic aerial imagery from 1984 shows that the area was more open and did not have a closed canopy. The forest inventory data further supports this by showing that the stands within the open area in the photo are younger in age class than surrounding areas. A polygon was drawn in ArcMap using the aerial photo to determine the acreage of the previously open area, which is approximately 25 acres. Within this area, early successional scrub/shrub and non-desirable mid-story trees (i.e. TSI) would be removed. Large desirable trees would be avoided or maintained unless it is necessary to remove to accomplish project objectives. Overall removal of overstory trees would be minimal in this unit. Overall, this proposed action would fit under the 2013 Oakwood Bottoms Moist Soil Openings Mastication Project which has already completed the NEPA process and has been coordinated with the USFWS.

## **IV. Design Criteria**

In order to minimize effects on resources, several design criteria are included for botanical resources (Table 1).

Table 1. Botanical Resources Design Criteria for Oakwood Bottoms HREP.

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Resource	Design Criteria	Rationale/Effectiveness
<b>Invasive Species</b>	<ul style="list-style-type: none"> <li>• Clean all equipment before entering and leaving project sites.</li> <li>• Workers should inspect, remove and properly dispose of plant parts found on clothing and equipment before entering or leaving the project area.</li> <li>• Minimize soil disturbance to avoid creating favorable conditions that encourage invasives establishment.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimizes spread of noxious weeds from one site to the next (USDA-FS 2004). Guide to Noxious Weed Prevention Practices (2001).</li> </ul>
<b>Rare Species</b>	<ul style="list-style-type: none"> <li>• Protect rare plant resources, including Sensitive (Regional Forester Sensitive Species) and IL-TE (State of Illinois-Listed Threatened and Endangered Species), from construction activities</li> </ul>	<ul style="list-style-type: none"> <li>• Forest Service Manual Policy, FSM 2670.32, Sensitive Species, “3. Avoid or minimize impacts to species whose viability has been identified as a concern”</li> <li>• Forest Plan (2006) p. 43, Forest Wide (FW) 26.5 (Guideline), State of Illinois-Listed Threatened or Endangered Species, , “...activities should not jeopardize their continued existence on the Forest”</li> </ul>

## V. Monitoring the Action Alternative

We will monitor our implementation of the proposed action in cooperation/collaboration with interested parties and the public to determine whether we are accomplishing expected outcomes (Table 2). If monitoring reveals unacceptable outcomes, we will implement appropriate measures to correct problems.

Table 2. Monitoring under Action Alternative

Monitoring Activity	Description	Location and Timing
<b>Botanical Resources</b>	Monitor sites where rare species are known to occur. Ensure that they are being protected and habitat enhanced to the extent practical.	In berms and access routes prior to and after project completion.

## VI. Environmental Analysis

### Cumulative Impacts

#### Spatial and Temporal Boundaries

Spatial and temporal boundaries for Botanical Resources of the proposed action are described

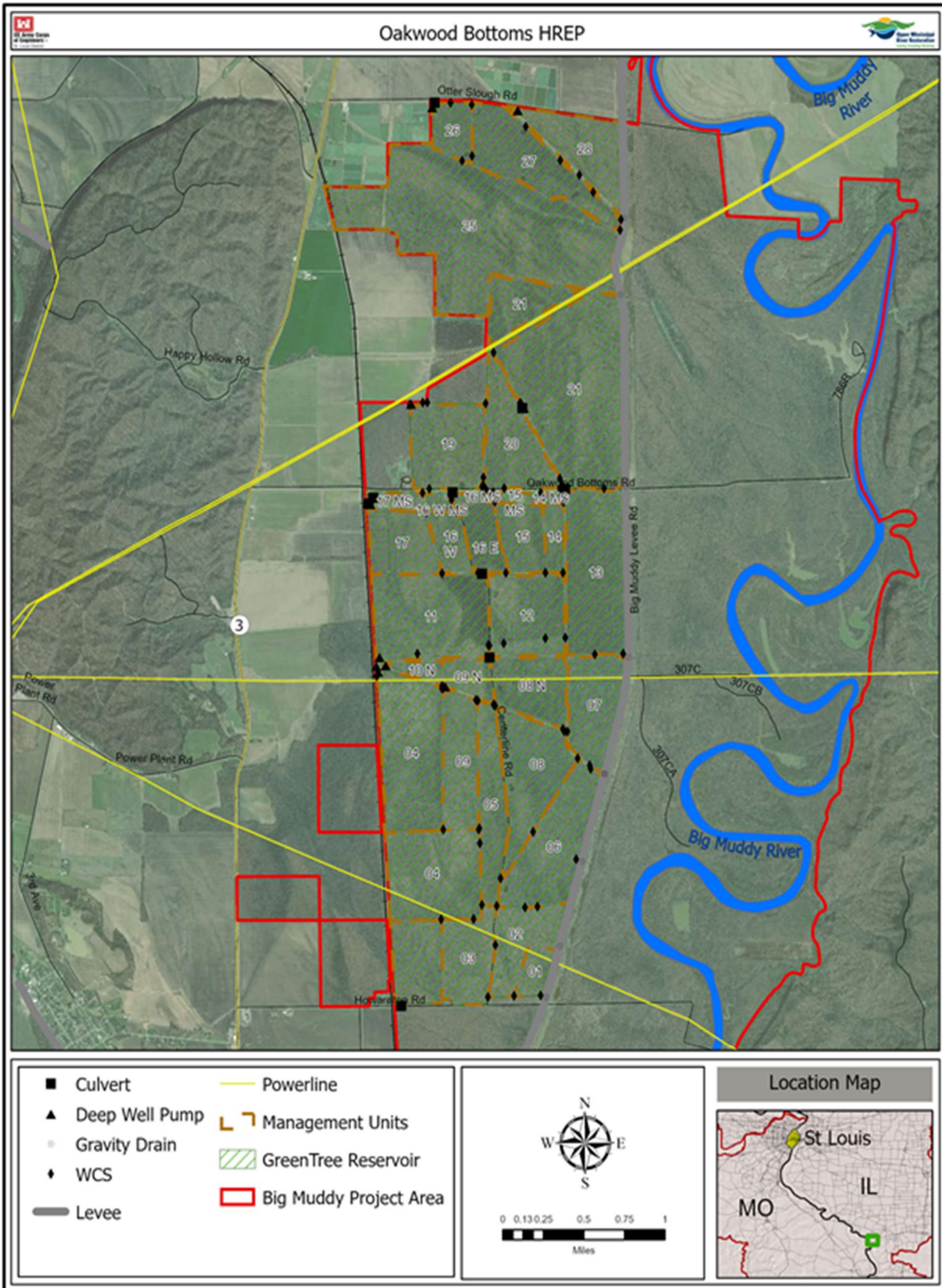
*Feasibility Report with Integrated Environmental Assessment*  
*Oakwood Bottoms HREP*

in Table 4.

Table 4. Spatial and temporal boundaries for rare botanical resources.

<b>Resource</b>	<b>Boundary</b>	<b>Rationale</b>
Botanical	Spatial: The project area, which in this case is the Oakwood Bottoms Greentree Reservoir project areas.	The effects of the proposal would be confined to the area described.
	Temporal: 10 years in the past to a point 10 years post project implementation	Ten years before and ten years after project implementation is adequate to gauge management effects.

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 Oakwood Bottoms HREP





Oakwood Bottoms HREP

Figure 1. Oakwood Bottoms HREP project area with existing infrastructure.

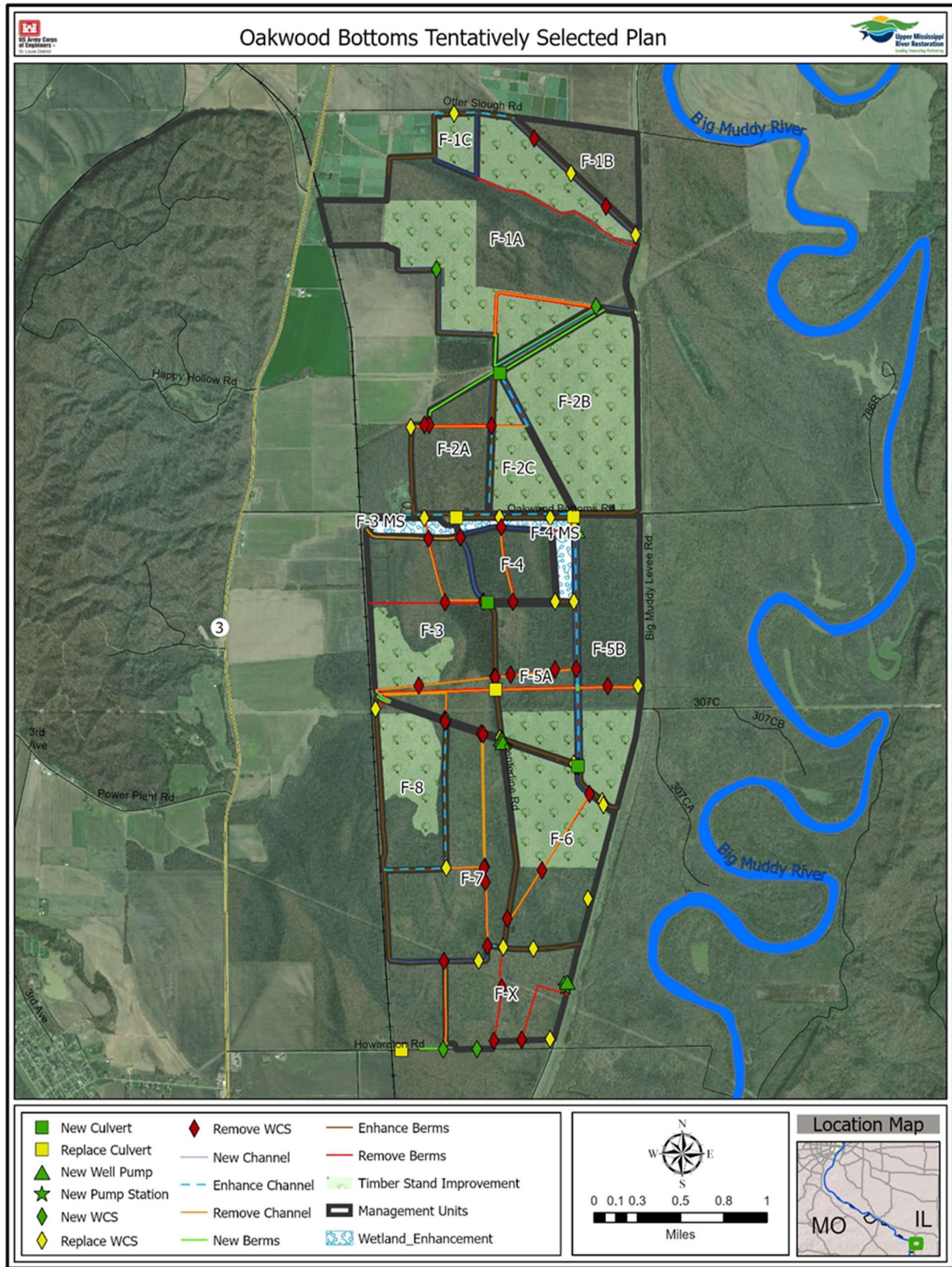


Figure 2. Proposed Plan at Oakwood Bottoms HREP.

## Regional Forester’s Sensitive Plants Evaluated

The Shawnee National Forest has 95 RFSS (sensitive or Regional Forester’s Sensitive) plants recorded on its lands. The proposed action covers a small portion of the Shawnee National Forest, so only the RFSS plants known from Jackson County were evaluated for this project. Table 5 lists all RFSS plants, as well as the counties where they have been found on the Forest. Fifty-two (52) of the RFSS plants are historically known from Jackson County. Of those 52 RFSS plants, twenty-one (21) do not occur within the Oakwood Bottoms project area, nor is there known suitable habitat for these species. These species are indicated in Table 5 with the superscript “1.” These species can be found analyzed in Appendix 1.

Twenty-two (22) of the 52 Jackson County species are noted in Table 5 with the superscript “2.” These species have potential habitat within the Oakwood Bottoms project site but have never been found within the project area. These 22 species are analyzed in Appendix 2.

Nine (9) of the 52 Jackson County species are noted in Table 5 with the superscript “3” and are known to occur within the Oakwood Bottoms project site. The analysis for these nine species is found immediately following the “RFSS Habitats” section below.

Table 5. Regional Forester’s Sensitive Plant Species (RFSS) documented as present or historically present in the 11 counties of southern Illinois where there are lands managed by the Shawnee National Forest. Counties indicated as: A = Alexander, G = Gallatin, H = Hardin, Ja = Jackson, Jo = Johnson, M = Massac, P = Pope, Pu = Pulaski, S = Saline, U = Union, and W = Williamson. Those that occur in Jackson County are listed in bold.

Scientific Name	Common Name	Counties
<b>1. <i>Actaea rubifolia</i><sup>1</sup></b>	<b>Appalachian bugbane</b>	<b>G, H, Ja, Jo, M*, P, S</b>
2. <i>Amorpha nitens</i>	shining false indigo	A, M, P, S
3. <i>Aronia melanocarpa</i>	black chokeberry	Jo, S
<b>4. <i>Asplenium bradleyi</i><sup>1</sup></b>	<b>Bradley's spleenwort</b>	<b>Ja, S, U</b>
<b>5. <i>Asplenium resiliens</i><sup>1</sup></b>	<b>blackstem spleenwort</b>	<b>A*, Ja, U</b>
6. <i>Bartonia paniculata</i>	twining screwstem	Jo*, P
7. <i>Berchemia scandens</i>	Alabama supplejack	S
<b>8. <i>Botrychium biternatum</i><sup>2</sup></b>	<b>sparselobe grapefern</b>	<b>A, G, H, Ja*, Jo, P, Pu*, S, U*</b>
<b>9. <i>Bromus nottowayanus</i><sup>2</sup></b>	<b>Nottoway Valley brome</b>	<b>Ja, P</b>
<b>10. <i>Buchnera americana</i><sup>1</sup></b>	<b>American bluehearts</b>	<b>Ja, P</b>
11. <i>Calamagrostis porteri</i> ssp. <i>insperata</i>	Porter’s reedgrass	P
<b>12. <i>Carex alata</i><sup>3</sup></b>	<b>broadwing sedge</b>	<b>Ja*, M*, P</b>
13. <i>Carex atlantica</i>	prickly bog sedge	P
<b>14. <i>Carex bromoides</i><sup>2</sup></b>	<b>brome-like sedge</b>	<b>Ja, Jo, P</b>

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Scientific Name	Common Name	Counties
15. <i>Carex cherokeensis</i> <sup>2</sup>	Cherokee sedge	A, H, Ja, P, U
16. <i>Carex decomposita</i>	cypress-knee sedge	G*, Jo, P, Pu, U
17. <i>Carex gigantea</i> <sup>2</sup>	giant sedge	Ja, Jo, M, Pu, U
18. <i>Carex intumescens</i> <sup>3</sup>	greater bladder sedge	A, Ja, Jo, P, Pu, S
19. <i>Carex lupuliformis</i> <sup>3</sup>	false hop sedge	A*, H*, Ja, Jo*, M*, P*, Pu*, S*, U*
20. <i>Carex nigromarginata</i> <sup>1</sup>	black edge sedge	A, G, H, Ja, P*, U
21. <i>Carex oxylepis</i> var. <i>pubescens</i>	sharpscale sedge	H
22. <i>Carex prasina</i>	drooping sedge	Jo, M*, P
23. <i>Carya pallida</i>	sand hickory	A, H, U
24. <i>Chamaelirium luteum</i>	fairywand	H, M, P
25. <i>Chelone obliqua</i> var. <i>speciosa</i> <sup>2</sup>	red turtlehead	A*, G*, Ja*, Jo*, M*, P*, U*
26. <i>Chimaphila maculata</i>	striped prince's pine	H, P
27. <i>Cirsium carolinianum</i> <sup>1</sup>	soft thistle	H*, Ja*, P, S
28. <i>Cladrastis kentukea</i>	Kentucky yellowwood	A, G*
29. <i>Cynosciadium digitatum</i> <sup>3</sup>	finger dogshade	Ja
30. <i>Cyperus lancastris</i>	manyflower flatsedge	M*, P, Pu, S
31. <i>Cypripedium parviflorum</i> var. <i>pubescens</i> <sup>2</sup>	greater yellow lady's slipper	A, G, Ja, Jo, M, P, U, W
32. <i>Dennstaedtia punctilobula</i>	eastern hay-scented fern	Jo, P
33. <i>Dichanthelium jorii</i> **	variable panic grass	Jo, M*, U
34. <i>Dichanthelium ravenelii</i>	Ravenel's rosette grass	H, P, U*
35. <i>Dichanthelium yadkinense</i> **	Yadkin's panic grass	G, Jo*, P
36. <i>Dirca palustris</i> <sup>1</sup>	Eastern leatherwood	Ja, Jo, P
37. <i>Dodecatheon frenchii</i> <sup>1</sup>	French's shootingstar	Ja, Jo, P, S, U, W
38. <i>Dryopteris goldieana</i> <sup>1</sup>	Goldie's woodfern	Ja, Jo, P, U, W
39. <i>Eleocharis wolfii</i> <sup>3</sup>	Wolf's spikerush	G, Ja, M, P, S, U
40. <i>Eryngium prostratum</i>	creeping eryngo	A, M, P, S, W
41. <i>Eupatorium hyssopifolium</i>	hyssopleaf thoroughwort	Jo, P
42. <i>Gentiana alba</i> <sup>1</sup>	plain gentian	A, Ja, M, P
43. <i>Glyceria arkansana</i> <sup>3</sup>	Arkansas mannagrass	A, Ja, Jo, U
44. <i>Helianthus angustifolius</i>	swamp sunflower	M, P
45. <i>Heteranthera reniformis</i>	kidneyleaf mudplantain	A*, P, U*
46. <i>Hexalectris spicata</i> <sup>1</sup>	spiked crested coralroot	H, Ja*, P*
47. <i>Hottonia inflata</i> <sup>2</sup>	American featherfoil	Ja, Jo, P, S, U

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Scientific Name	Common Name	Counties
48. <i>Huperzia porophila</i> <sup>1</sup>	rock clubmoss	A*, G, Ja*, Jo, M*, P, S, U*
49. <i>Hydrastis canadensis</i> <sup>2</sup>	goldenseal	A, G, H, Ja, Jo, M, P, Pu, S, U, W
50. <i>Hydrolea uniflora</i> <sup>2</sup>	one-flowered false fiddleleaf	A*, Ja, Jo, M*, U
51. <i>Hylotelephium telephioides</i> <sup>1</sup>	Allegheny stonecrop	G, H, Ja, P, S
52. <i>Isotria verticillata</i>	large whorled pogonia	P
53. <i>Juglans cinerea</i> <sup>2</sup>	butternut	A, H, Ja, Jo, M, P, S, U
54. <i>Lilium superbum</i> <sup>2</sup>	Turk's-cap lily	G, H, Ja, Jo, P, W
55. <i>Lonicera dioica</i> var. <i>glaucescens</i> ** <sup>1</sup>	limber honeysuckle	Ja
56. <i>Lonicera flava</i> <sup>1</sup>	yellow honeysuckle	Ja, P
57. <i>Malus angustifolia</i> <sup>3</sup>	southern crab apple	Ja*, M, P, Pu
58. <i>Melothria pendula</i> <sup>2</sup>	Guadeloupe cucumber	A, H, Ja, Jo, M, P, U
59. <i>Oxalis illinoensis</i> <sup>2</sup>	Illinois wood sorrel	H, Ja, P
60. <i>Panax quinquefolius</i> <sup>2</sup>	American ginseng	A, G, H, Ja, Jo, M, P, S, U, W
61. <i>Penstemon tubaeformis</i> <sup>1</sup>	white wand beardtongue	A, Ja*, M*, P*, S*, U*
62. <i>Phaeophyscia leana</i>	wreath lichen	G, H, M, P
63. <i>Phemeranthus parviflorus</i>	sunbright	Jo, M, P, U
64. <i>Plantago cordata</i> <sup>1</sup>	heartleaf plantain	Ja, Jo, P, S
65. <i>Platanthera clavellata</i>	small green wood orchid	P
66. <i>Platanthera flava</i> var. <i>flava</i>	palegreen orchid	Jo, M, P, U
67. <i>Poa alsodes</i> <sup>1</sup>	grove bluegrass	Ja, P*
68. <i>Polygala incarnata</i>	procession flower	M*, P
60. <i>Polytaenia nuttallii</i> <sup>1</sup>	Nuttall's prairie parsley	G*, Ja*, Jo*, P*, S*, U*
70. <i>Quercus montana</i> <sup>1</sup>	chestnut oak	A, G, H, Ja, S, U
71. <i>Rhexia mariana</i> <sup>2</sup>	Maryland meadowbeauty	Ja*, M, P, S, W
72. <i>Rhynchospora glomerata</i>	clustered beaksedge	Jo, P
73. <i>Rudbeckia fulgida</i> var. <i>sullivantii</i>	Sullivant's coneflower	H*, P*
74. <i>Sagittaria australis</i>	longbeak arrowhead	P, U*
75. <i>Sanicula smallii</i>	Small's blacksnakeroot	H
76. <i>Saxifraga virginensis</i>	early saxifrage	H
77. <i>Scirpus polyphyllus</i>	leafy bulrush	H, M, P
78. <i>Scleria oligantha</i>	little nutrush	H
79. <i>Scleria pauciflora</i> <sup>2</sup>	fewflower nutrush	H, Ja, Jo, M, P, U, W
80. <i>Silene ovata</i>	Blue Ridge catchfly	H



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Scientific Name	Common Name	Counties
81. <i>Silphium trifoliatum</i>	whorled rosinweed	H*
<b>82. <i>Spiranthes vernalis</i><sup>3</sup></b>	<b>spring lady's tresses</b>	<b>Ja, Jo, M*, P, S, U*, W</b>
83. <i>Stellaria pubera</i>	star chickweed	H, P
<b>84. <i>Stenanthium gramineum</i><sup>2</sup></b>	<b>eastern featherbells</b>	<b>G, Ja, Jo, M*, P, Pu, U</b>
<b>85. <i>Styrax americanus</i><sup>2</sup></b>	<b>American snowbell</b>	<b>A, Ja, Jo, M, P, U</b>
86. <i>Styrax grandifolius</i>	bigleaf snowbell	A, P, Pu
<b>87. <i>Synandra hispidula</i><sup>2</sup></b>	<b>Guyandotte beauty</b>	<b>Ja, W</b>
88. <i>Thelypteris noveboracensis</i>	New York fern	P
<b>89. <i>Torreyochloa pallida</i><sup>3</sup></b>	<b>pale false mannagrass</b>	<b>Ja, U</b>
90. <i>Tragia cordata</i>	heartleaf noseburn	G, H, Jo, P
91. <i>Trichomanes boschianum</i>	Appalachian bristle fern	G* H, Jo, P, U
<b>92. <i>Trifolium reflexum</i><sup>1</sup></b>	<b>buffalo clover</b>	<b>G*, Ja, Jo</b>
<b>93. <i>Trillium viride</i><sup>2</sup></b>	<b>wood wakerobin</b>	<b>Ja, U, W*</b>
<b>94. <i>Triphora trianthophora</i><sup>2</sup></b>	<b>threebirds</b>	<b>A, Ja, Jo, S, U</b>
95. <i>Vaccinium stamineum</i>	deerberry	H, P*

\* species assumed extirpated in that county

\*\* Mohlenbrock's (2014) nomenclature; all other nomenclature from the PLANTS database (2020)

<sup>1</sup> Indicates that the species is known from Jackson County, the species is not known from the Oakwood Bottoms project site, nor does suitable habitat occur there.

<sup>2</sup> Indicates that the species is known from Jackson County, the species is not known from the Oakwood Bottoms project site, but suitable habitat does occur at the project site.

<sup>3</sup> Indicates that the species is known from the Oakwood Bottoms project site and suitable habitat occurs there.

RFSS plants on the Shawnee National Forest can be grouped by the habitats in which they are found. The following habitat types list RFSS plants found in them, as well as the approximate number of known locations on the Forest and the months in which they flower (Mohlenbrock 2014, primarily). More detailed information about these species is provided in Appendices 1 and 2 of this document.

## RFSS Habitats

### 1.1.1.1 Acid Gravel Seeps, Woods Adjacent to Seeps, and Springs

- *Bartonia paniculata* (twining screwstem) (6) Aug-Sep
- *Carex atlantica* (prickly bog sedge) (8) May
- *Carex bromoides* (brome-like sedge) (5) Apr-May
- *Carex prasina* (drooping sedge) (1) (May-Jun)
- *Helianthus angustifolius* (swamp sunflower) (4) Aug-Oct
- *Isotria verticillata* (large whorled pogonia) (2) May-Jun

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- *Platanthera clavellata* (small green wood orchid) (4) Jun-Aug
- *Rudbeckia sullivantii* (Sullivant's coneflower) (2) Jul-Oct
- *Scirpus polyphyllus* (leafy bulrush) (9) Jul-Sep
- *Thelypteris noveboracensis* (New York fern) (1) Jun-Sep

1.1.1.2 **Forested Wetlands and Swamps**

- *Carex decomposita* (cypress-knee sedge) (2) Jun-Aug
- *Carex gigantea* (giant sedge) (2) May-Aug
- *Carex intumescens* (greater bladder sedge) (3) May-Sep
- *Carex lupuliformis* (false hop sedge) (3) Jun-Oct
- *Chelone obliqua* var. *speciosa* (red turtlehead) (1) Aug-Oct
- *Cynoscium digitatum* (finger dogshade) (1) May-Jun
- *Dichanthelium jorii* (variable panic grass) (2) Jun-Oct
- *Eleocharis wolfii* (Wolf's spikerush) (2) May-Jul
- *Glyceria arkansana* (Arkansas manna grass) (4) May-Jun
- *Heteranthera reniformis* (kidneyleaf mudplantain) (1) Jul-Aug
- *Hottonia inflata* (American featherfoil) (3) Jun-Aug
- *Hydrolea uniflora* (one-flowered false fiddleleaf) (3) Jun-Sep
- *Platanthera flava* var. *flava* (palegreen orchid) (4) Jun-Aug
- *Sagittaria australis* (longbeak arrowhead) (2) Jul-Oct
- *Styrax americanus* (American snowbell) (1) Apr-May
- *Torreyochloa pallida* (pale false mannagrass) (2) May-Aug
- *Triphora trianthophora* (threebirds) (2) Aug-Oct

1.1.1.3 **Floodplain and Riparian Forests, Lakes, Ponds, Creeks, and Other Mesic Areas**

- *Amorpha nitens* (shining false indigo) (2) May-Jun
- *Carex alata* (broadwing sedge) (2) May
- *Carex cherokeensis* (Cherokee sedge) (2) (May-Sep)
- *Cyperus lancastris* (manyflower flatsedge) (1) Aug-Oct
- *Dichanthelium yadkinense* (Yadkin's panic grass) (9) May-Sep
- *Eryngium prostratum* (creeping eryngo) (1) May-Nov
- *Lilium superbum* (Turk's-cap lily) (16) Jul
- *Oxalis illinoensis* (Illinois woodsorrel) (10) Jun-Sep
- *Phaeophyscia leana* (wreath lichen) (1)
- *Plantago cordata* (heartleaf plantain) (8) Apr-Jul
- *Rhexia mariana* (Maryland meadowbeauty) (8) Jun-Sep
- *Rhynchospora glomerata* (clustered beaksedge) (5) Jul-Oct
- *Stellaria pubera* (star chickweed) (4) Mar-May
- *Stenanthium gramineum* (eastern featherbells) (8) Jun-Aug
- *Tragia cordata* (heartleaf noseburn) (3) Jul-Sep
- *Trillium viride* (green trillium) (1) Apr

1.1.1.4 **Open Barrens, Prairies, Glades, and Fields**

- *Buchnera americana* (American bluehearts) (1) Jun-Sep
- *Bromus nottowanus* (Nottoway Valley brome) (2) Jun-Aug

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- *Cirsium carolinianum* (Carolina thistle) (8) Jun-Jul
- *Eupatorium hyssopifolium* var. *hyssopifolium* (hyssopleaf thoroughwort) (1) Aug-Nov
- *Malus angustifolius* (southern crab apple) (2) May
- *Melothria pendula* (Guadeloupe cucumber) (~12) Jun-Sep
- *Penstemon tubaeflorus* (white wand beardtongue) (3) Jun
- *Phemeranthus parviflorus* (sunbright) (12) Jun-Jul
- *Polygala incarnata* (procession flower) (5) Jun-Aug
- *Polytaenia nuttallii* (prairie parsley) (12) Apr-Jun
- *Scleria oligantha* (littlehead nutrush) (1) Jun-Sep
- *Scleria pauciflora* (fewflower nutrush) (12) Jun-Sep
- *Silphium trifoliatum* (whorled rosinweed) (2) Jul-Sep
- *Spiranthes vernalis* (spring lady's tresses) (7) Jul-Aug
- *Trifolium reflexum* (buffalo clover) (2) May-Jul

**1.1.1.5 Cliff Tops, Cliff Faces, Cliff Bases, and Rich Slopes of Cliffs**

- *Actaea rubifolia* (Appalachian bugbane) (25) Jul-Oct
- *Aronia melanocarpa* (Black chokecherry) (1) May-Jun
- *Asplenium bradleyi* (Bradley's spleenwort) (5)
- *Asplenium resiliens* (Black-stem spleenwort) (2)
- *Botrychium biternatum* (sparselobe grapefern) (20+)
- *Calamagrostis porteri* ssp. *insperata* (Porter's reedgrass) (4)
- *Carya pallida* (sand hickory) (4) Apr-May
- *Dennstaedtia punctilobula* (eastern hay-scented fern) (4) Jul-Oct
- *Dodecatheon frenchii* (French's shootingstar) (25+) Apr-May
- *Huperzia porophila* (rock clubmoss) (8) Jun-Sep
- *Hylotelephium telephioides* (Allegheny stonecrop) (13) Aug-Sep
- *Lonicera dioica* var. *glaucescens* (limber honeysuckle) (2) May-Jun
- *Lonicera flava* (yellow honeysuckle) (4) Apr-May
- *Saxifraga virginiana* (early saxifrage) (6) Apr-Jun
- *Trichomanes boschianum* (Appalachian bristle fern) (12)
- *Vaccinium stamineum* (deerberry) [also dry-mesic upland woods] (2) May-Jun

**1.1.1.6 Xeric, Dry, and Dry-Mesic Upland Woods, and Pine Plantations**

- *Berchemia scandens* (supplejack) (1) Apr-Jun
- *Carex nigromarginata* (black-edge sedge) (13) Apr-May
- *Carex oxylepis* var. *pubescens* (sharpscale sedge) (5+) Apr-May
- *Chamaelirium luteum* (fairytale) (8) May-Jun
- *Chimaphila maculata* (spotted wintergreen) (6) Jun-Jul
- *Cypripedium parviflorum* var. *pubescens* (greater yellow lady's slipper) (16) Apr-Aug
- *Cirsium carolinianum* (Carolina thistle) (8) Jun-Jul
- *Dichanthelium ravenelii* (Ravenel's rosette grass) (4) Jun-Oct
- *Gentiana alba* (plain gentian) (2) mid-Aug-Oct
- *Hexalectris spicata* (spiked crested coralroot) (6) Jun-Sep
- *Poa alsodes* (grove bluegrass) (1) May-Jun
- *Polytaenia nuttallii* (prairie parsley) (12) Apr-Jun

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- *Quercus montana* (chestnut oak) (9) Apr-May
- *Sanicula smallii* (Small's blacksnakeroot) (1) Jul
- *Silene ovata* (Blue Ridge catchfly) (5) Aug

1.1.1.7 **Dry-Mesic and Mesic Upland Woods, Hollows, and Ravines**

- *Botrychium biternatum* (sparselobe grapefern) (20+)
- *Cladrastis kentukea* (Kentucky yellowwood) (1) May
- *Dirca palustris* (Eastern leatherwood) (4) Apr-May
- *Dryopteris goldieana* (Goldie's woodfern) (2) Jun-Sep
- *Hydrastis canadensis* (Goldenseal) (widespread) Apr-May
- *Juglans cinerea* (Butternut) (uncommon) Apr-May
- *Panax quinquefolius* (American ginseng) (widespread) Jun-Jul
- *Styrax grandifolius* (Bigleaf snowbell) (2) May
- *Synandra hispidula* (Guyandotte beauty) (3) May-Jun

**RFSS Analysis of Nine (9) Plant Species that occur at Oakwood Bottoms**

Four of the RFSS species are indicated on the following map with the GPS coordinates associated with them.

**1. *Carex alata* (Broadwing sedge)**

***Carex alata*** is a perennial tufted sedge with culms reaching up to 1.4 m high. It is a species of wet ground and is found in the eastern United States and Midwest, including Ontario, Canada. This species flowers during May in southern Illinois.

The Nature Conservancy assigned *Carex alata* the Global Ranking of G5 in 1984 and has determined it to be vulnerable in Indiana, Ohio and North Carolina; imperiled in Pennsylvania and Missouri; critically imperiled in Texas, Arkansas, Kentucky, Illinois, Connecticut, and Ontario, Canada; apparently secure in New York and New Jersey; and secure in Virginia, and Delaware. It is possibly extirpated in New Hampshire. It is not ranked or is under review in 11 eastern states (NatureServe 2018).

In southeastern Illinois, it is rare and local in swamps and floodplain forests and wet ground. It is presently known from the following localities in the state; a private swamp border in Pope County (3 colonies first observed by John Schwegman on March 15, 1977 and last observed June 13, 2001), a flatwoods in a state fish and wildlife area (Massac County, 1987), and near Lake Glendale next to a dam (2 clumps found by John Schwegman June 7, 2010, Pope County). Separate searches by John Schwegman and Beth Shimp at Lake Glendale did not detect this species during 2017. There is a report of this species possibly being at another Pope County location (2001) but the details were unavailable at the time of this writing. There are also reports that this species once occurred in Cook and Wabash counties but is no longer extant at either site. A Jackson County location of *Carex brevior* was found by L. Rick Phillippe on June 24, 1993 at Oakwood Bottoms. It was annotated to *Carex alata* X *Carex tribuloides* by P. Rothrock (Taylor University) on February 1996. Although this is not a protected species, it

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does indicate that at one time, one of the parent species, *Carex alata*, may still exist at Oakwood Bottoms.

**Environmental Impacts:**

Alternative 2 may have direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex alata* X *Carex tribuloides*. Although this is a hybrid, the parent species must be present for this cross to occur; this species has not been seen within the Oakwood Bottoms Greentree Reservoir Project Area for 27 years but it could occur here since potential habitat does exist. It is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight others below, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. However, since these only occur at so few sites on the Forest, damage to populations at the Oakwood Bottoms site could cause a decrease in viability on the Forest. It is recommended that the site that this hybrid is found that it is avoided if possible. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others. The latitude and longitude are not known, however, the following location was given at the time it was discovered at Oakwood Bottoms: "T10S R3W N1/2 NE1/4 Sec 4. Rick Phillippe described the site as "along High Power Line right-of-way in open forb dominated community in bottomland." A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here.

**2. *Carex intumescens* (Greater bladder sedge)**

***Carex intumescens*** is a perennial cespitose sedge with culms reaching 80 cm tall. Its range is the eastern United State and adjacent Canada. In Illinois it occurs in forested wetlands and swamps and is known from Alexander, Jackson, Johnson, Saline, and Pope counties (in Pope County; EL Shimp and AS Biagi #4023 15 June 1992; MA Basinger and EL Shimp #5717, #5770, #5822 21 June 1993, Big Grand Pierre Creek; MA Basinger and J Rundle #8738 11 July 1994, #8763 12 July, 1994; JP Shimp and MA Basinger #5293 15 Aug 1994; EF Ulaszek and EL Shimp #2814 31 July 1995). In Jackson County it was found by Chris Benda on 25 June 2018 (Biotics) in Oakwood Bottoms. In Johnson County it is known from the Grantsburg Swamp Ecological Area (LR Stritch #2223 10 June 1991; JPShimp, RH Mohlenbrock and LR Stritch #970 28 May 1992; and north of Reevesville by Chris Benda on 9 September 2011). The 3 Jackson County collections were all found nearby at Oakwood Bottoms, and Pulaski County specimens were not known at the time of this writing. This species flowers between May and September in southern Illinois.

The G5 Global Ranking for this species was assigned by The Nature Conservancy in 1984. It is critically imperiled in Labrador, Canada, Illinois, and Wyoming. It is also listed as vulnerable in

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South Dakota and Manitoba, Canada. It is apparently secure in New Foundland, Canada and West Virginia and secure in Arkansas, Mississippi, North Carolina, Virginia, Kentucky, Delaware, New Jersey, New York, Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edwards Island, Canada. It is not ranked or is under review in 23 of the United States (NatureServe 2017).

**Environmental Impacts:**

Alternative 2 may have direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex intumescens* unless they are avoided during the project implementation; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Carex intumescens* occurs in the project area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**3. *Carex lupuliformis* (false hop sedge)**

***Carex lupuliformis*** is a caespitose or singularly growing perennial sedge. It is uncommon in eastern North America, west to southwestern Quebec, Wisconsin and Louisiana. It is found scattered throughout Illinois and occurs in wet woods, wooded swamps, marshes, meadows, and roadside ditches. In southern Illinois, this species flowers from June through October.

Being a wetland species, *Carex lupuliformis* is threatened by the destruction of its native habitat. Damming of rivers, ditching, channeling, floodplain cultivation, and spring flood cycle interruptions are major threats of this species throughout its range. Other threats have been documented as being habitat destruction and ATV use. The G4 Global Ranking for this species was assigned by The Nature Conservancy in 2000 and is listed as having widespread declines throughout its range. It is possibly extirpated in Iowa, critically imperiled in Quebec and Ontario, Canada, Pennsylvania, New Jersey, Massachusetts, North Carolina, Arkansas, Maryland, and Texas. It is also listed as imperiled in Wisconsin, Michigan, Indiana, Ohio, New York, Vermont, West Virginia, Virginia, Delaware, and Tennessee, and vulnerable in Illinois. It is apparently secure in Connecticut, Kentucky and Mississippi. It is not ranked or is under review in Minnesota, Missouri, Oklahoma, Louisiana, Florida, South Carolina, Georgia, and Maine (NatureServe 2017).

*Carex lupuliformis* is listed as historically occurring in Alexander, Pope, Johnson, Jackson, Massac, Pulaski, Saline, Hardin, and Union counties. This species is not as common as once

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thought to be in Illinois because original specimens have been previously misidentified and found to actually be *Carex gigantea* or *Carex lupulina*. There is a possibility that some of the above county records may be misidentifications that have perpetuated over the years. This species is not listed as threatened or endangered in the State of Illinois, which makes tracking collections and records more difficult. Although this species is not listed in Illinois, there have not been any sightings or collections made on the Shawnee National Forest or southern Illinois counties in over 40 years until recently. Shannan Sharp found this species at Oakwood Bottoms on September 15, 2014 at two sites (#20 and #21). She found it growing with *Carex lupulina*. Records from the Illinois Natural History Survey collections (specimen list provided to Elizabeth Shimp by e-mail on December 17, 2004 from Loy R. Phillippe) indicate that the following specimens are available at the herbarium: Alexander (Evers #30438, 20 June 1951, east of Miller City, lake shore; Evers #32872, 19 September 1951, southeast of Olive Branch, bottomland ditch), Pope (Evers #23561, 10 June 1950, east of Dixon Springs, marsh), Pulaski (Evers #19997, 25 August 1949, south of Ullin, marsh land), and Union counties (Henry #2203, 22 July 1966, LaRue Swamp, wet ground). Mark Basinger collected specimens at Horseshoe Lake Conservation Area on May 30, 1996 in Alexander County.

**Environmental Impacts:**

Alternative 2 may have direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex lupuliformis*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Carex lupuliformis* occurs in the project area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**4. *Cynosciadium digitatum* (Finger dogshade)**

***Cynosciadium digitatum*** is an annual (or perennial) herb whose stems grow 20-80 cm tall. Its range is Mississippi to Texas, north to southern Illinois and Oklahoma (Herkert and Ebinger 2002). It occurs in swamps, floodplain forests, and flatwoods and reaches its northern range limit in southern Illinois. It is known from a single state locality in Jackson County at Oakwood Bottoms, which is a pin oak flatwoods and adjacent sites on the Forest. It was originally collected in 1969 (Herkert and Ebinger 2002). It was collected several times at various locations at Oakwood Bottoms by Rick Phillippe during 1993.

According to NatureServe (2019), this species was assigned a G-Rank of G4G5 in 1985. It is critically imperiled in Illinois, imperiled in Missouri, and apparently secure in Mississippi. It is not ranked or is under review in Texas, Oklahoma, Arkansas, Louisiana, Tennessee, and

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Alabama. Threats to this species include the destruction of its native wetlands. Oakwood Bottoms has several locations of this species. The threat of non-native species is occurring at Oakwood Bottoms, especially with the influx of waterfowl, and roads and levees acting as conduits for species movement.

**Environmental Impacts:**

Alternative 2 may have direct or indirect short-term or long-term negative impacts on known individuals or populations of *Cynosciadium digitatum*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Cynosciadium digitatum* occurs in the project area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**5. *Eleocharis wolfii* (Wolf's spikerush)**

***Eleocharis wolfii*** is perennial, rhizomatous sedge of marshes, swamps, wet prairies and other wetland habitats from New York to North Dakota south to Texas and Georgia. This species flowers from May – July and requires high levels of light to produce seed (NatureServe 2018). In southern Illinois, this species is found in marshes, wet prairies, around lakes, rivers and ditches, flatwoods, swamps, floodplain forests, and ephemeral pools.

According to NatureServe (2012), the primary threats to this species are loss of native wetland and grassland habitats. It is also threatened by encroachment from exotic species and succession from woody species in prairie areas where the historic fire regime is now absent (NatureServe 2018). Indiscriminate herbicide application along railroad and highway right-of-ways has also threatened populations located in these areas. The Nature Conservancy ranked this species G3G5 in 2013 (NatureServe 2018). Continued drainage and alteration of wet areas for agriculture, development and grazing areas have resulted in this species being listed as critically imperiled in Illinois, Iowa, Wisconsin, Minnesota, Ohio, Virginia, Tennessee, Georgia, Alabama, Kansas, and Texas. It is imperiled in Indiana, and vulnerable in Arkansas, Missouri, and Louisiana. It is also possibly extirpated in North Dakota and Oklahoma and listed as introduced (exotic) in New York. It is apparently secure in Nebraska. It is not ranked or under review in Mississippi, and Sasketuan, Canada (NatureServe 2018). The continued decline of *Eleocharis wolfii* is likely due to loss of wetlands and conversion/development of its preferred habitats.

In southern Illinois it is found in Gallatin (flatwoods 1.5 mi SE of Equality on private land – June

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29, 1992), Jackson (Oakwood Bottoms, 8 locations, collections by Rick Phillippe May 4, 5, and 6, 1993), Massac (flatwoods at Mermet Swamp State Nature Preserve – May 28, 1992), Pope (unknown locations at the time of this writing), Saline (flatwoods NE of Harrisburg on private land – June 5, 1956 and re-vouchered May 27, 1992), and Union (floodplain forest at LaRue-Pine Hills/Otter Pond Research Natural Area) counties. Historical populations are known from 20 counties in the state of Illinois but only 15 counties are known to have extant populations (Phillippe 2004b). Of the 41 discrete extant populations, 7 are known from Forest Service managed lands (Phillippe 2004b).

**Environmental Impacts:**

Alternatives 2 may have direct or indirect short-term or long-term negative impacts on known individuals or populations of *Eleocharis wolfii*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**6. *Glyceria arkansana* (Arkansas manna grass)**

***Glyceria arkansana*** is a perennial grass that roots at its lower nodes with culms reaching 2 meters in height. It is a species of the eastern United States and reaches its northwestern range limit in southern Illinois. It occurs in wet floodplain forests, low woods, shallow water, and swamps. In Illinois, this species flowers May through June.

The primary threat to this species is loss of native habitat. The spotty distribution, specific habitat requirements, and continued habitat destruction are leading to a decline of this species. It is historically known from 9 states and is listed as critically imperiled in Illinois and Oklahoma; imperiled in Mississippi; and apparently secure in Kentucky. It is not ranked or is currently under review in Tennessee, Missouri, Arkansas, Louisiana, and Texas. The Nature Conservancy assigned the Global Ranking of G5 in 1989 (NatureServe 2017).

In Illinois, there are reports that it occurs in Alexander, Jackson, Johnson, and Union counties. The Alexander County locations (roadside swamp; one clump at one site; “clumps” at second site) were found by Steve Hill on June 23, 1999 and May 3, 2000 within ¼ mile from each other; a different site is known from Clear Creek Swamp Ecological Area (discovered May 24, 2007 – collector unknown); a Jackson County location is at Oakwood Bottoms (bottomland woods; about 50 plants) and discovered by Rick Phillippe on May 27, 1993 and a separate Jackson County location is known from Cave Valley near Pamona Natural Bridge (Tom Sadowski on

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May 22, 1981); there was no information regarding the Johnson County report at the time of this writing; and the Union County collection was made in 1940 (unknown collector), then subsequent collections were made by Franklin Buser at LaRue-Pine Hills/Otter Pond Research Natural Area on June 24, 1956 (then later collections at LaRue were made by Robert Evers on May 21, 1957 and May 22, 1969). In southern Illinois it occurs in isolated patches within the swamps. It is known from Oakwood Bottoms. Opportunities for seed dispersal are limited with reduced numbers of protected swamps and permanent wetlands. This species requires high-quality conditions without hydrologic alterations, such as water drainage, or chemical pollutants.

**Environmental Impacts:**

Alternative 2 may have direct and indirect impacts on *Glyceria arkansana*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Glyceria arkansana* occurs in the project area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**7. *Malus angustifolia* (Southern crab apple)**

***Malus angustifolia*** is a tall shrub or short tree that can grow to 10 meters high. It occurs in the Southeastern United States. In Illinois it flowers during May. It is a species of floodplain forests and flatwoods and reaches its northern range limit in southern Illinois. It is rarely encountered but found in the low woods of Hardin, Jackson, Massac, and Pope Counties.

According to NatureServe (2018), this species was assigned a Rank of G5? in 1984 and was last reviewed in 1984. It is possibly extirpated in Ohio; critically imperiled in Illinois, imperiled in Missouri; vulnerable in Kentucky, West Virginia, North Carolina, and Maryland; and apparently secure in Virginia. It is not ranked or under review in Pennsylvania, New Jersey, Delaware, the District of Columbia, South Carolina, Tennessee, Alabama, Georgia, Florida, Mississippi, Arkansas, Louisiana, and Texas.

Robert Ridgway (#2528) collected this species on May 23, 1926, and (#2660) August 29, 1926 in Richland County. Ernest J. Palmer (#22581) collected it on rocky hillsides, open woods, at Golconda in Pope County on May 10, 1923. Eric Ulaszek collected it on the north side of Unionville blacktop in Massac County (#2346) on April 9, 1995. Eric Ulaszek and Elizabeth Shimp (#2397) collected a specimen from Azotus field and described this species as colonial small trees and shrubs on May 4, 1995 in Pope County.

Ernest J. Palmer also had collections from Johnson County (#16598, September 27, 1919, open upland woods), Gallatin County (#22599, May 12, 1923, low woods), Pope County (#15436, June 7, 1919, open glades, rocky hillside woods), and Massac County (#22745, September 16, 1923, Metropolis). G. Vasey collected it in 1866 in Illinois, however a county and location was not indicated. There is a report from Jackson County at Oakwood Bottoms, where two sites were found by Robert H. Mohlenbrock in 1977.

### **Environmental Impacts:**

Alternative 2 may have direct and indirect impacts on *Malus angustifolius*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

### **Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Malus angustifolius* occurs at the Oakwood Bottoms Project Area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## **8. *Spiranthes vernalis* (Spring Ladies' tresses)**

***Spiranthes vernalis*** is a perennial tuberous orchid reaching 60 cm in height. Its range is the southeastern and south-central United States, north into southern New England. It occurs in acidic soils in prairies, rich woodland barrens and old native fields in the southern third of Illinois. North of the Forest it is historically known from Wabash, Effingham, Menard, Madison and St. Clair Counties. NatureServe (2017) also has it listed for Bond, Clinton, and Edwards Counties.

In southern Illinois it is known from Johnson (on private along Rt 147 in 2000; north of Wildcat Bluff in 1994 by Tony Gerard), Union, Massac, Pope (southwest of Bay City by Robert Evers on July 23, 1970; Burke Branch RNA by Eric Ulaszek on September 20, 1995; a mile north of Eddyville on IL 145 by Eric Ulaszek on August 7, 1995; along roadside at edge of War Bluff Sanctuary – private – by Mark Basinger on August 14, 1993; Cretaceous Hills EA by Max Hutchison on June 24, 1977; near Hodge Cemetery on July 1987 by Lawrence Stritch; on private on August 3, 2009; Dean Cemetery East EA by Lawrence Stritch in 1994; Snow Springs EA by Jody Shimp, Bob Lindsay and Kari Foster on July 22, 2004), and Williamson (Crab Orchard National Wildlife Refuge by Eric Ulaszek on June 23, 1991) Counties. NatureServe (2017) also lists Jackson (at Rothrock residence by Chris Benda on June 23, 2011) and Saline (on private at the P & E Refuge found August 18, 2006 by Jody Shimp and Leslie Rodman) Counties. There is also a location of this species known from Oakwood Bottoms. This species blooms in Illinois from July to August.

The Nature Conservancy assigned this species the rank of G5 in 1984 (NatureServe 2017). It is

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critically imperiled in New York, Pennsylvania, Illinois and Iowa; imperiled in Indiana, South Dakota, Nebraska, Massachusetts, Rhode Island, and Delaware; vulnerable in West Virginia, New Jersey and North Carolina; apparently secure in Georgia; and secure in Virginia and Kentucky. It is not ranked or under review in Wisconsin, Michigan, Connecticut, Maryland, District of Columbia, Ohio, South Carolina, Florida, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Kansas, Oklahoma, Texas, and New Mexico.

**Environmental Impacts:**

Alternative 2 may have direct and indirect impacts on *Spiranthes vernalis*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Spiranthes vernalis* does occur in the Oakwood Bottoms project area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**9. *Torreyochloa pallida* (Pale false manna grass)**

***Torreyochloa pallida*** is a perennial grass known from swamps in Illinois. It is widespread in the United States and Canada except for the central states. In all locations it is considered uncommon or rare. The state of Illinois only has this species documented from Montgomery County in northern Illinois and Jackson and Union Counties in southern Illinois. It blooms from May to August.

NatureServe (2019) has this species listed with a Global Ranking of G5 (status applied 2005 and last reviewed 2016). It is possibly extirpated in Kentucky; critically imperiled in Illinois, Tennessee, Maryland, North Carolina, Georgia, and South Carolina; imperiled in West Virginia; and vulnerable in Vermont, Maryland, Minnesota and Wyoming. It is not ranked or under review by numerous states and Canadian provinces. It is also critically imperiled in 4 Canadian provinces, imperiled in 2 Canadian provinces, apparently secure in 2 provinces and secure in 1. *Torreyochloa pallida* is highly threatened by land conversion, habitat fragmentation, sedimentation, and to a lesser extent by forest management practices (NatureServe 2019).

This species is known from LaRue-Pine Hills/Otter Pond Research Natural Area in Union County (found by Ron Henry (#1220) on May 15, 1966, then redocumented by Rick Phillippe May 26, 1988) and at Oakwood Bottoms south of Hay Glade Ditch (found by Rick Phillippe on May 25, 1993) of Jackson County.

**Environmental Impacts:**

Alternative 2 may have direct and indirect impacts on *Spiranthes vernalis*; it is also important to keep in mind, that it is the very management of this Greentree Reservoir that is keeping this species, and eight other species, alive and their populations perpetuating.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Spiranthes vernalis* does occur in the Oakwood Bottoms project area. A map will be provided with the locations of this and the other 8 species so that the Army Corps of Engineers can do their best to avoid these locations. Once again, it is important to emphasize that it is the very management of Oakwood Bottoms that keeps these species perpetuating here.

These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

*/s/Elizabeth Longo*

Elizabeth Longo

Botanist

Shawnee National Forest

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## Appendix 1

### 1. *Actaea rubifolia* (Appalachian bugbane)

***Actaea rubifolia*** is a tall, slender perennial herb that occurs in portions of Virginia, Tennessee, Kentucky, Indiana, and Illinois. It flowers from July through October. This species is limited in range and there are approximately up to 80 occurrences known, approximately 50 of which, are extant.

*Actaea rubifolia* has been given a Global Heritage Status Rank of G3 by The Nature Conservancy in 2001 because of its rarity range-wide (NatureServe 2017) (<http://www.natureserve.org/>). Threats range-wide include logging, land-use change and unregulated recreational use. It is possibly extirpated in Alabama (1 county), critically imperiled in Indiana (2 counties), imperiled in Illinois (7 counties), Kentucky (4 counties), and Virginia (3 counties), and vulnerable in Tennessee (18 counties). Sightings in Pennsylvania are presumed to be exotic or introduced to the state. Many of the counties above list this species as extirpated or possibly extirpated. This species was considered "C2" by the US Fish and Wildlife Service and has been under review for federal endangered species status listing (NatureServe 2017).

*Actaea rubifolia* is found within Pope, Gallatin, Jackson, Johnson, Saline, and Hardin Counties. A report exists for Massac County on private property but the population may be extirpated because of cattle grazing; the threat is not so much of this species being eaten as it is in the trampling associated with grazing. At least 24 populations are located in southern Illinois and include Ferne Clyffe State Park. In these areas it is found in rich woods on talus slopes and is considered rare. It grows on sandstone and limestone.

The primary threat to this species in southern Illinois has been unregulated equestrian use, and more recently, illegal equestrian use in closed natural areas. In at least two cases, the threat is illegal all-terrain-vehicle use in closed natural areas. Another threat is the aggressive multiflora rose, autumn olive and amur honeysuckle that are quickly invading the Forest and threaten to

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take over the habitat required for this species.

At least 18 of approximately 24 populations in southern Illinois are currently unprotected on Forest managed lands, 6 being protected within natural areas. These populations will continue to be adversely impacted by equestrian use and ATV use unless trails continue to be designated and horses are restricted to these trails. There are at least 6 populations on private land, one is protected at Ferne Clyffe State Park, 3 appear to have no immediate threats, 1 has an unauthorized user-developed equestrian/ATV trail through the population at the railroad right-of-way, and the last population lost portions of its population from a private logging event in 1994. This species is globally rare but found locally abundant in a few of its populations on the Forest. Continued adverse impacts to unprotected populations will likely cause a trend to federal listing or loss of species viability. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Actaea rubifolia*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### **Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## **2. *Asplenium bradleyi* (Bradley's spleenwort)**

***Asplenium bradleyi*** is an evergreen, perennial fern found within the eastern and midwestern United States excluding New England and the states north of Illinois. It was historically documented from 19 states. It reaches its northern range limit in southern Illinois where it is very rare and occurs primarily on sandstone cliffs and chert outcrops.

Primary threats to *Asplenium bradleyi* in southern Illinois include drought conditions and over collecting. Drought conditions are associated by the destruction of habitat throughout much of the species' range. Examples of activities leading to drought conditions range-wide include strip mining activities, logging, rock climbing, and adjacent road and trail use. Japanese honeysuckle also poses a threat to this species and Nepalese browntop appears to be spreading down the cliff faces, which could also threaten this small fern by taking over its habitat. The Global Ranking by The Nature Conservancy was determined to be a G4 in 1993 (NatureServe 2019). This species is possibly extirpated in New York and West Virginia; vulnerable in Kentucky; imperiled in North Carolina, Virginia, Tennessee, Alabama, and Georgia; and critically imperiled in Illinois, Indiana, Ohio, Pennsylvania, New Jersey, Maryland, Oklahoma, and South Carolina. It is not ranked or is under review by Missouri, Arkansas, and Louisiana. Through the risk

analysis, this species was retained on the RFSS list by the Forest to aid in its protection.

*Asplenium bradleyi* has been found within Saline, Jackson, and Union Counties on the Forest. It may occur at the Crab Orchard Wildlife Refuge in Williamson County. It was first discovered in Illinois in Randolph County at Piney Creek, west of West Point by Robert H. Mohlenbrock in 1954. On March 6, 1955 he discovered another population (collection #4988) along the Jackson County extension of the creek (Mohlenbrock 1955). It is known to occur on the Forest within the LaRue-Pine Hills/Otter Pond (shaded, cherty slope, 15 to 20 individuals) and Cave Hill Research Natural Areas (bluff face, 1 to 3 individuals; discovered by Steve Olson on June 1, 1986), Panther Den Wilderness Area (bluff face, 9 individuals; first discovered by R.A. Evers September 15, 1964, then re-documented by Mark Basinger on October 29, 1993, collection #7852), and Garden of the Gods Ecological Area (R.A. Evers, June 29, 1966). Each of these sites has only a few plants per population. The Garden of the Gods population was last documented in 1980 as being scattered on the eastern cliff faces and overhangs. A recent discovery of one plant was found at Sand Ecological area during 2019 by Christopher Benda. A single plant was seen by Elizabeth Longo on September 12, 2019 at Sand Ecological Area (Pope Co) and may have been the same one. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Asplenium bradleyi*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### **Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

### **3. *Asplenium resiliens* (Blackstem spleenwort)**

*Asplenium resiliens* is a wiry evergreen fern (spleenwort) that occurs in south-central and eastern United States. It reaches its northwestern margin of its range in southern Illinois where it is now only known to still be extant at one location on a limestone ledge.

According to Herkert and Ebinger (2002) the primary threat to *Asplenium resiliens* in Illinois is over-collection. Japanese honeysuckle also poses a threat to this species and Nepalese browntop appears to be spreading down the cliff faces, which could also threaten this small fern by taking over its habitat. The Nature Conservancy assigned this species the Global Ranking of G5 in 1984 but it is unranked or under review in 11 southern states; presumed extirpated in Louisiana; possibly extirpated in Ohio; critically imperiled in Nevada, Utah, Colorado, Illinois, Indiana, Mississippi, South Carolina, Pennsylvania, and Maryland; imperiled in Kansas and

North Carolina; vulnerable in West Virginia; and apparently secure in Kentucky, Georgia, and Virginia (NatureServe 2019).

In Illinois, *Asplenium resiliens* is historically known from Alexander, Jackson, and Union Counties. Records for these locations are scanty but information leads one to believe that the two Alexander locations have not been relocated for over 30 years, the Jackson County location at Devil's Bake Oven (another collection is noted as Grand Tower, however, the location is described for Devil's Bake Oven as being an exposure of Grand Tower Limestone and Lingle Formation), on thin soils of the limestone cliff, may still be present but has not been observed for over 10 years (private property), and the Union County locations at LaRue-Pine Hills/Otter Pond Research Natural Area (2 possible stations, shaded limestone cliff) have not been seen since 1985 and 1987, respectively (one population with 8 to 10 plants and another with only 1 individual near Otter Pond). One of the populations was first discovered by R.A. Evers on June 14, 1950; however, John Schwegman located a population across from Winter's Pond in March 31, 2005. This original population was not found but a single plant was seen in May 2010 on the limestone bluff face near this location. This is believed to be the only extant population (with only one individual) at LaRue-pine Hills/Otter Pond RNA pending further searches. This plant was seen again by Elizabeth Shimp. A collection by Robert H. Mohlenbrock was documented as being discovered December 26, 1954 (collection #4948) at Grassy Knob (Mohlenbrock 1956). If these populations are still present, they are, in fact, susceptible to over-collecting. It is also possible that these populations may already have been collected to extirpation with the exception of the newest population found. Further searches for these populations are needed and collections should be prohibited where restrictions are not yet enforced. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

#### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Asplenium bradleyi*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

#### **Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

#### **4. *Buchnera americana* (American bluehearts)**

***Buchnera americana*** is a hemiparasitic plant, living off the roots of several other plant species. It occupies the sandy or gravelly soil of upland woods or prairies. In Illinois, it is known from prairies and fields. It is known primarily in west central Illinois but with additional occurrences found in one extreme northern county and one in a southern county (Pope). It is historically known from 13 Illinois counties although most collections were made during the 1970's and

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earlier (Danderson 2004a). In Illinois, this species has been seen in flower from mid-June through September.

According to NatureServe (2018), the primary threat to *Buchnera americana* is habitat loss. The loss of prairie fires has led to successional changes where the sites convert to woodlands and become shaded. Without the natural regime of fires, open prairie areas will continue to close in and may lead to the demise of this species. The Nature Conservancy assigned this species the Global Ranking of G5? in 1994 and has historical occurrences listed for 25 states and Ontario but it is presumed extirpated from Michigan, Pennsylvania, New Jersey, and the District of Columbia; and possibly extirpated from New York, Delaware, and Maryland. It has been determined to be critically imperiled in Indiana, Virginia, Georgia, North Carolina, and Ontario, Canada; imperiled in Ohio and Texas; and vulnerable in Illinois, Kentucky, and Tennessee. This species has been extirpated from the periphery of its range but is apparently secure in Missouri, Arkansas, and Alabama. It is not ranked or is under review in Kansas, Oklahoma, Louisiana, Mississippi, Florida, and South Carolina.

In southern Illinois, *Buchnera americana* is very rare (e-mail communication from John Schwegman to Elizabeth Shimp April 5, 2001). It is a prairie/barrens annual-perennial and is restricted to the barrens communities of south Pope County. John Schwegman has monitored this species for several years and has determined that it is mostly an annual but has the capability to become a parasite on composite species, and if it does, it becomes a perennial. It is known from Cretaceous Hills Ecological Area on Forest-managed lands (Azotus Field) and from the adjacent Cretaceous Hills Nature Preserve managed by the State of Illinois. According to Mr. Schwegman, like so many annuals of the prairie, this species disappears without fire. The fact that it has not been seen in Azotus Field for over 20 years does not mean that it is still not in the seed bank. In order for this species' seeds to germinate, a light requirement must be met. In addition, the longer the photoperiods of light is exposed to *Buchnera americana* seeds, the higher the percentage rate of germinating seeds (Danderson 2004a). During a recent visit in July 2019, Elizabeth Longo and Jason Rose observed a great influx of Nepalese browntop and intense shading of young trees in the Azotus field. No American bluehearts were found. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Buchnera americana*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### **Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## 5. *Carex nigromarginata* (Blackedge Sedge)

*Carex nigromarginata* is a densely tufted perennial sedge with culms growing to 2.5 cm high. It is known from the southeastern United States, extending north to southern Illinois. It occurs at its northern range limit in Illinois, where it is known from Alexander County (Rick Phillippe May 5, May 26, and July 21, 1994 on dry cherty wooded slopes), Union (Ozark Hill Prairie Research Natural Area, Rick Phillippe and Jeff Olson, April 8, 1992; and a collection by Robert Mohlenbrock April 16, 1957 at Pine Hills), Hardin (Panther Hollow Research Natural Area, unknown person, July 12, 1994), and Gallatin (Thacker Hollow, Mark Basinger and Elizabeth Shimp, 2009) Counties. It was previously misidentified in Pope County, where it is not known to exist (1966 at Lusk Creek Ecological Area). It has not been seen in Jackson or Wabash counties for over 20 years and documentation for these occurrences was not available at the time of this writing. In southern Illinois it is known from ridge tops in dry to dry-mesic upland woodlands. This species generally flowers during April and May. It is also known, but rare from Cook (Keil, 1969) and Montgomery (Colin, 1991) Counties.

Threats to this species include canopy closure as a result of natural forest succession and fire suppression, and loss of habitat from clear-cutting. Clear-cutting allows shrubs to invade its typical open habitat and will outcompete this species. Non-native shrubs such as multiflora rose, autumn olive and amur honeysuckle are most likely to invade its habitat. It was assigned a G5 Global Ranking by The Nature Conservancy (NatureServe 2019) in 1994 (last reviewed in 2016). *Carex nigromarginata* is critically imperiled in Illinois and Ontario, Canada (only a single population exists in Ontario); imperiled in New York, vulnerable in West Virginia and North Carolina; possibly extirpated in Connecticut; apparently secure in Missouri, Kentucky, and Pennsylvania; and secure in Virginia, New Jersey, Delaware, Arkansas, and Mississippi. It is not ranked or under review in 11 states (NatureServe 2019).

*Carex nigromarginata* appears to prefer open, dry-mesic rocky woods, especially where light gaps are present. Observations indicate that this species is not found in closed canopy forests in southern Illinois. Further searches for this species should continue in order to determine its extent in the state. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

### Environmental Impacts:

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex nigromarginata*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### Cumulative Impacts:

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## 6. *Cirsium carolinianum* (Carolina thistle)

*Cirsium carolinianum* is a fibrous-rooted biennial, 0.5-1.5 m tall that occurs in the Southeastern United States. It is a species of dry acidic woodlands and reaches its northern range limit in extreme southern Illinois. It generally flowers from June through July in Illinois. It is found in dry, open woods in extreme southeastern Illinois, in Jackson, Hardin, Pope, Johnson, and Saline Counties.

According to NatureServe (2018), this species was assigned a G-Rank of 5 in 1985 and was last reviewed in 2003. It is critically imperiled in Virginia; imperiled in North Carolina, Ohio, Indiana, and Illinois; vulnerable in Kentucky and Georgia; and not ranked or under review in South Carolina, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Oklahoma, and Texas.

Elizabeth Shimp collected it at Dennison Hollow Research Natural Area (RNS) on 24 June 1992 in Saline County. Jody Shimp collected it at Simpson Barrens Ecological Area in Johnson County. This species is also known from a few plants at Cave Hill RNA in Saline County and Bell Smith Springs Ecological Area in Pope County. Plants have been seen at the Williams Hill tower site, however, mowing has forced this species to virtually disappear here. There are reports of this species occurring in Hardin and Jackson counties, but, there was not information at the time of this writing. For the most part, non-native species are not currently threatening this species at Cave Hill and Bell Smith Springs, however, it is inevitable that non-native species will gradually move into its habitat if not controlled or eradicated from adjacent areas. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

### Environmental Impacts:

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Cirsium carolinianum*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### Cumulative Impacts:

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## 7. *Dirca palustris* (Eastern leatherwood)

*Dirca palustris* is a perennial shrub from the Thymelaeaceae family. In Illinois it grows in rich, shaded woods and is rare throughout the state. It is known from a few northern counties and

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only from Jackson, Johnson, and Pope Counties in southern Illinois. In Pope County it is known from Millstone Bluff Ecological Area (first found by J. Schopf 1931; on trail to Indian Kitchen in Lusk Creek Wilderness by M. Basinger 2011; and Bell Smith Springs by H.E. Ahles in 1953). A study was done by a student in 2009 and he communicated to Elizabeth Shimp that the Bell Smith Springs population was healthy and thriving (Peterson 2009). At that time, he did not indicate if there were threats from non-native species.

The Nature Conservancy assigned this species the G4 Global Rank in 1986. It is presumed extirpated in the District of Columbia; critically imperiled in North Dakota, Oklahoma, Louisiana, Delaware, and Nova Scotia, Canada; imperiled in New Brunswick, Canada, New Jersey, Maryland, South Carolina, Florida, and Mississippi; vulnerable in North Carolina, Georgia, and Iowa; apparently secure in Virginia, West Virginia, Kentucky, Alabama, Quebec and Ontario, Canada; It is secure in New York. It is not ranked or under review in New Hampshire, Vermont, Maryland, Connecticut, Maine, Pennsylvania, Ohio, Indiana, Michigan, Illinois, Wisconsin, Minnesota, Missouri, and Arkansas. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Dirca palustris*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**8. *Dodecatheon frenchii* (French's shootingstar)**

***Dodecatheon frenchii*** is a perennial herb known from Illinois, Indiana, Missouri, Kentucky, Arkansas, and Alabama. It is found in close association to sandstone ledges, overhangs and bluffs, preferring north and east-facing exposures. French's shooting-star grows in habitats which yield little competition from other plant species, often growing alone in bare soil. It is documented from a 10-mile wide belt in southern Illinois in six counties, all within the Greater Shawnee Hills Section of the Shawnee Hills Natural Division. Generally, it blooms from April to May.

Primary threats to this species have been unregulated recreational use under sandstone overhangs, disturbances caused by artifact hunters, and other recreational activities such as rock climbing, ATV and equestrian use, and camping/campfires. Logging has also been considered a threat when sufficient buffer has not been afforded to populations. The Nature Conservancy assigned this species the Global Heritage Status Rank of G3 in 1990. Illinois

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appears to have the most occurrences and is well in southern Illinois possibly because of its endemic nature. It is listed as vulnerable in Illinois and Kentucky, imperiled in Indiana and Arkansas, and it is critically imperiled in Missouri and Alabama. It is currently not ranked or under review in Wisconsin (NatureServe 2017).

In Illinois, *Dodecatheon frenchii* is found within Pope, Johnson, Jackson, Saline, Union, and Williamson counties. It was first found by Southern Illinois University Professor George Hazen French in 1871. John Voigt, Julius Swayne and William Bailey searched and found the majority of the populations in southern Illinois. It is known to occur within several areas on the Forest including Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Canyon Wilderness Area, Jackson Hole Ecological Area (sandstone overhang, although it has not been relocated at this site for several years), Jackson Hollow Ecological Area (first documented by Franklin Buser on May 4, 1955), Jackson Falls Dispersed Recreation Area (first documented by Elizabeth Shimp in 2003), Bulge Hole Ecological Area, Little Grand Canyon/Horseshoe Bluff Ecological Area, Garden of the Gods Ecological Area, Schwegman Ecological Area (threatened by Nepalese browntop), Bell Smith Springs Ecological Area (base of bluff in mesic upland forest), and Double Branch Hole Ecological Area. This species is found beneath sandstone overhangs and along drip lines at the base of bluffs. This species has also been found in the immediate adjacent woods and associated sandstone boulders. During 2002, these populations were not threatened with extirpation because of habitat loss, but without protecting the forest and sandstone ledges and shelters that this species is dependent on, these populations could eventually become decreased or eliminated (Hill 2002a). Several sites of French's shooting star were visited over the last few years. Many of the sites have become over-run with Nepalese browntop and vines of Japanese honeysuckle have been moving down the bluffs to the populations. This project would have beneficial impacts to this species if these two non-native species were controlled at these locations. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Dodecatheon frenchii*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**9. *Dryopteris goldieana* (Goldie's woodfern)**

*Dryopteris goldieana* is a short-creeping, scaly fern with fronds up to 1 meter in length. It grows in moist, shaded woodlands. Its range is from New Brunswick to Ontario, south to Iowa, Tennessee, and North Carolina. Although it is known from several northern Illinois counties and

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Jackson, Johnson, Pope, Union, and Williamson counties in southern Illinois, its previously known locations in southern Illinois are rarely relocated and several may be extirpated.

*Dryopteris goldieana* has been given a Global Heritage Status Rank of G4G5 by The Nature Conservancy in 2011 because of its status range-wide (NatureServe 2017). Threats range-wide include logging, development and agriculture. It is critically imperiled in Arkansas, Alabama, Delaware, and South Carolina; imperiled in Iowa, Missouri, New Hampshire, Maryland, and Maine; and vulnerable in Minnesota, Georgia, North Carolina, New Jersey, Connecticut, Massachusetts, Illinois, and Quebec and New Brunswick, Canada. It is also listed as apparently secure in Ontario, Canada, Kentucky, West Virginia, Virginia, Vermont, and New York, and not ranked or under review in Wisconsin, Michigan, Indiana, Ohio, Pennsylvania, Rhode Island, and the District of Columbia.

In Illinois it is known from scattered counties in northern and southern Illinois. In southern Illinois, there are known locations within the Lusk Creek Wilderness and along Lusk Creek south of the Copperous Branch (John Schwegman collection August 18, 1967). There are also sites known from Williamson County (US Fish and Wildlife Service lands). It is unclear where it is known from in Johnson County. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Dryopteris goldieana*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**10. *Gentiana alba* (Plain gentian)**

*Gentiana alba* is a stout perennial herb that is found in the eastern United and adjacent Canada. It occurs in mesic prairies and open forests. *Gentiana alba* is scattered throughout Illinois and is known in southern Illinois from one site each in Alexander, Jackson, Massac, and Pope counties. In southern Illinois it has been found in mesic barrens remnants and open upland forests. It generally flowers from mid-August through October.

Threats to this species include fire suppression, canopy closure in open forests and barrens, land use conversion, habitat fragmentation, and forest management practices. It is listed as vulnerable in Iowa, imperiled in Indiana, Ohio and Kansas, critically imperiled in Kentucky,

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Michigan, Nebraska, West Virginia, Oklahoma, and Ontario, Canada, and possibly extirpated in North Carolina and Pennsylvania. It is apparently secure in Wisconsin and not ranked or currently under review in Minnesota, Illinois, Missouri, Arkansas, and Maryland. The Global Rank of G4 was assigned by The Nature Conservancy in 1984 (NatureServe 2018).

On the Forest it is known from the mesic barrens of Burke Branch Research Natural Area in Pope County and on the lower slope of Ozark Hill Prairie Research Natural Area in Alexander County (collected by Rick Phillippe September 15, 1992). Non-native species were not documented at the sites during the earlier years, but it is certain that they are present now. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Gentiana alba*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**11. *Hexalectris spicata* (Spiked crested coralroot)**

*Heteranthera reniformis* is a low growing perennial herb from a creeping rhizome found in shallow water or emerged in muddy soil from Connecticut and New York west to Iowa and Illinois south to Florida and Texas and into Tropical America. It reaches its northern range limit in southern Illinois where it is found in wetlands and floodplains of rivers.

A primary threat to this species is the diminishment of its native habitat, in particular the permanent alteration of the hydrology of its habitat. The Nature Conservancy has given this species the Global Heritage Status Rank of G5 in 1984 and last reviewed in 1994. It was given this rank because in general, this species is not threatened globally. It is possibly extirpated in Connecticut, critically imperiled in Illinois, Iowa, Ohio, South Carolina, and West Virginia, imperiled in North Carolina, and vulnerable in New York and Georgia. It is apparently secure in Kentucky, Virginia, New Jersey, and Delaware. It is not ranked or is currently under review in 12 states (NatureServe 2018).

In far southern Illinois it is known from Pope, and Union counties. Slightly north it is known from St. Clair, Lawrence and Wabash counties. There is also a specimen from Calhoun County further north. On the Forest it is known from LaRue Swamp at LaRue-Pine Hills/Otter Pond

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Research Natural Area. This site was observed September of 1977 by Robert H. Mohnlenbrock. It was not relocated in 2017 by Elizabeth Shimp and Scott Ballard. A population occurs at Homberg Spring in Pope County and was last monitored there in 1990 (private). Information regarding an Alexander County population is based on a collection made by Steve Hill along Rt 127 at a branch of the Cache River, near a flood control gate (15 Sep 1999). It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Hexalectris spicata*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**12. *Huperzia porophila* (Rock clubmoss)**

*Huperzia porophila* is an evergreen clubmoss with short, upright branches, scale-like leaves and is generally found on cool, damp, shaded ledges. It has been recorded on limestone and is usually found on shaded sandstone cliffs and ledges. It is a species of the eastern United States and is known from 3 northern Illinois counties as well as Jackson, Johnson, Pope, Gallatin, Alexander, Massac and Union counties in southern Illinois.

NatureServe (2017) determined this species to be a G4 in 1990. It is also listed as presumed extirpated in Maryland, critically imperiled in Pennsylvania, West Virginia, Virginia, South Carolina, Georgia, Alabama, Iowa, and Ontario, Canada; imperiled in Minnesota, Illinois, Missouri, and North Carolina; vulnerable in Wisconsin and Indiana; secure in Kentucky; and is not ranked or under review in Ohio, Tennessee, and Vermont. Overall threats include trampling or rock climbing activities, and highway construction and commercial development are low-level threats (Southern Appalachian Species Viability Project 2002 in NatureServe 2017).

*Huperzia porophila* was collected by Robert Evers on October 23, 1959 at Pounds Hollow Ecological Area (Gallatin County) and collected again by Florence Givens and Annette Parker in 1986, then again by Loy Rick Phillippe and John Ebinger on 13 Jul 2011. Evers also collected this species at Jackson Hollow Ecological Area in Pope County on April 8, 1963 and November 13, 1963. It is also known from Lusk Creek State Nature Preserve (Mark Basinger 21 Jul 1992), Lusk Creek banks, and Lusk Creek North Ecological Area (William Bailey and Julian Swayne on October 16, 1952). It was collected at Double Branch Hole Ecological Area on April 23, 1981 by Lawrence Stritch on a mesic north facing cliff. Loy Rick Phillippe found this species at Claridy



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Spring north of Cedar Grove Church and Cemetery on 14 Oct 1992. Phillippe, Paul Marcum and John Ebinger collected this species at Split Rock Hollow on 14 Aug 2014, where it was known from previously. Mike Homoya first documented this species in Jackson County on a vertical rock cliff on the south bank of Big Branch on May 18, 1974. Loy Rick Phillippe collected it at Piney Creek Ravine Nature Preserve in Randolph County. There was no information for the Alexander, Massac and Union County sitings at the time of this writing. The non-native Nepalese browntop and Japanese honeysuckle are the worst invaders for this clubmoss. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Huperzia porophila*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**13. *Hylotelephium telephioides* (Allegheny stonecrop)**

***Hylotelephium telephioides*** is a succulent perennial herb that occurs in the eastern United States and adjacent Canada. It is found in dry, rocky places typically in the mountains and is disjunct in Louisiana, western Kentucky, southern Indiana, and southern Illinois (Herkert and Ebinger 2002). On the Forest, it occurs in thin soil pockets on sandstone cliffs, ledges, and slide blocks. It generally flowers in southern Illinois from August to September (Mohlenbrock 2014), however, it has been seen to flower earlier in the season.

The Nature Conservancy assigned this species a rank of G4 in 1988 (NatureServe 2018). This species is currently listed as presumed extirpated in New Jersey, possibly extirpated in New York, imperiled in Indiana and Kentucky, and vulnerable in Pennsylvania. This species is apparently secure in West Virginia, Virginia, and North Carolina, and either not ranked or under review in Illinois, Ohio, Louisiana, South Carolina, the District of Columbia, Maryland, and Connecticut. Ontario, Canada lists this species as an exotic.

*Hylotelephium telephioides* is known from areas such as Jackson Hollow (Robert Evers in September 23, 1947), Lusk Creek Canyon (Robert Evers on September 16, 1954) and Belle Smith Springs Ecological Area (mesic upland forest – Robert Evers on April 15, 1949) of Pope County, Stoneface (Robert Evers on April 17, 1951), High Knob (J. Schopf on July 8, 1931), Still House Hollow (private – H.S. Pepoon on June 1932), and Wamble Mountain (private – Robert Evers on October 25, 1949) all in Saline County, and cliffs northeast of Karbers Ridge (Robert

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Evers on May 7, 1970) and Cave in Rock (Hardin County). It is also known from Pounds Hollow Ecological Area in Gallatin County (Florence Givens and Annette Parker 19 Oct 1986). Further to the northeast it is known from Wabash County. The primary threats to this species in southern Illinois is the loss of habitat because of recreational use on the cliff tops and cliff faces, and the threat of Japanese honeysuckle and Nepalese browntop that invade the cliff tops and faces. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Hylotelephium telephioides*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**14. *Lonicera dioica* var. *glaucescens* (Limber honeysuckle)**

***Lonicera dioica* var. *glaucescens*** is a twining, shrubby vine found in eastern Canada and adjacent northeastern United States, then, it is disjunct southward in southern Illinois

This variety, with a glabrous hypanthium, hairy leaf undersurfaces, and a glandular corolla tube, is often included in a broadly defined *Lonicera dioica* by some botanists. This disjunct population is several hundred miles from the nearest populations in Iowa, Michigan, and Oklahoma. In southern Illinois i

t generally flowers from April to May (Mohlenbrock 2014)

The Nature Conservancy has included this variety in *Lonicera dioica* and assigned this species the Global Heritage Status Rank of G5 in 1984 (last reviewed in 2016). This variety has been reported in 17 states (Hill 2003e). In Illinois it is found associated with *Berberis canadensis*, American barberry. Although the variety is not recognized by NatureServe and PLANTS database, Illinois maintains that the variety is distinct. Since there are taxonomic discrepancies, the variety does not have status listing in NatureServe (NatureServe 2019).

Two populations of *Lonicera dioica* var. *glaucescens* occur in Jackson County on north-facing sandstone ledges of a massive sandstone bluff-line. Both populations occur within the Greater Shawnee Hills Section of the Shawnee Hills Division at the rim of a dry sandstone cliff at Fountain Bluff Station and Little Grand Canyon/Horseshoe Bluff Ecological Area in Jackson County. The Fountain Bluff Station is not part of the Fountain Bluff Geological Area. Recent searches for this variety at these two locations yielded 2 separate sterile individuals, which the

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initial identification became questionable (Hill 2003e). Japanese honeysuckle poses the greatest threat at these locations and could easily outcompete the few individuals that are remaining. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Lonicera dioica* var. *glaucescens*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**15. *Lonicera flava* (Yellow honeysuckle)**

***Lonicera flava*** is a woody vine found from southern Illinois and Ohio south to Georgia, Alabama, and Oklahoma. It reaches its northern range limit on forested sandstone bluffs in the Shawnee Hills and Ozark Natural Divisions in southern Illinois. It is known from Jackson and Pope Counties, where it is found at the edge of forested sandstone bluffs and ledges where seepage is frequent and *Sphagnum* spp. is a common associate. These ledges vary from a few inches to several hundred feet. In southern Illinois it generally flowers from May to June (Mohlenbrock 2014).

The Nature Conservancy assigned this species a Global Heritage Status Rank of G5? in 1984. It is documented from 12 states. It is listed as possibly extirpated in Ohio, critically imperiled in Illinois and Tennessee; imperiled in Kansas and South Carolina, and vulnerable in Alabama, North Carolina, and Georgia. This species is apparently secure in Kentucky and is not ranked, or is under review, in Missouri, Oklahoma, and Arkansas. Threats to this species include loss of native habitat and droughty conditions (NatureServe 2018).

*Lonicera flava* is found within Pope and Jackson counties. On the Forest it is known to occur within Lusk Creek Canyon Ecological Area adjacent to the Lusk Creek Canyon Zoological Area, Belle Smith Springs (mesic north-facing rocky slope and upland forest) and Little Grand Canyon/Horseshoe Bluff Ecological Areas. The Fountain Bluff and the Reeds Canyon North populations in Jackson County are on private property. There is also a report that it occurs on a north-facing wooded slope at Bear Creek Relict Site, however it appears that it may also be on the sandstone cliff and it is unclear whether it is on National Forest or private land. This rare species is found associated with peat moss and in areas of wet bluffs and ledges, the ledges varying from a few inches to several hundred feet. Japanese honeysuckle and Nepalese browntop are its greatest non-native threats. It is not known to occur within the Oakwood

Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Lonicera flava*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**16. *Penstemon tubaeflorus* (White wand beardtongue)**

***Penstemon tubaeflorus*** is a perennial herb growing in prairies and dry woods. It flowers May-June. Franklin Buser collected plants along the roadside bank near Fayville in Alexander County (June 12, 1956, #6759). Robert Evers collected it at the base of a wooded bluff south of Thebes (June 12, 1968 #95086). Rick Phillippe, Jeff Olson and Sophia Gehlhausen collected it at Ozark Hill Prairie RNA on May 27, 1992 on a hill prairie. John Schwegman collected specimens at a cemetery along the road just east of Fayville on May 21, 2004 in Alexander County. There are also herbarium collections from counties to the north including Marshall, Shelby, Saint Clair, Madison, Jasper, Kankakee, and DuPage. Mohlenbrock and Ladd (1978) have Jackson, Johnson, Pope, Saline, and Union counties listed but there are no documents or specimens that support these occurrences at the time of this writing. There is a possibility that specimens are being curated at the Southern Illinois University Herbarium and should be verified for accuracy.

NatureServe (2019) assigned this species a Global Rank of G5 in 1993. It is listed as critically imperiled in Iowa, Indiana, and Tennessee, possibly extirpated in Ohio, apparently secure in Kentucky, and is listed as an exotic in a few far northeastern states and parts of Canada. At least 9 states don't have this species ranked or it's under review. The main threats to this species is the destruction of prairie and the encroachment of trees and their shade on areas that once had sunlight. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Penstemon tubaeflorus*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**17. *Plantago cordata* (Heartleaf plantain)**

***Plantago cordata*** is a perennial aquatic herb that is known from the eastern and central United States and Ontario, Canada. In Illinois it usually occurs in sand or gravel bars of shallow, clear-water streams under a forest canopy (Herkert and Ebinger 2002). It has a very narrow habitat preference but can be locally common. In southern Illinois, this species rarely blooms nor gets very tall in stature, most likely the result of excessive shading conditions. When it blooms, its generally from April to July (Mohlenbrock 2014).

This species has declined throughout its range because of stream erosion and siltation from various activities. The Nature Conservancy gave this species the Global Heritage Status Rank of G4 in 1994 (NatureServe 2017) because populations have declined dramatically everywhere and are on several watchlists. It has been historically documented in 20 states and Ontario, Canada but is presumed extirpated from Kentucky; possibly extirpated from Iowa, Virginia, Maryland, District of Columbia, and Florida; it is critically imperiled in Ontario, Wisconsin, Illinois, Michigan, Ohio, Indiana, Tennessee, Mississippi, Alabama, and North Carolina; and imperiled in Arkansas. New York, Missouri and Georgia list it as being vulnerable and South Carolina is the only state that has it under review but no documentation of occurrences is available there.

*Plantago cordata* is known from Jackson, Johnson, Pope, and Saline counties in Illinois. It has been documented as occurring at Lake Kinkaid, Cedar Lake, Cave Hill Research Natural Area, Simpson Township Barrens Ecological Area, north of Flat Rock Hollow (not relocated during 2004 searches; siltation evident in creek with horse trail and ATV use apparent, likely extirpated), state land at Lake Murphysboro, private land at Flat Lick Branch, Gyp Williams Hollow Ecological Area (not relocated, likely extirpated), and Copperous Branch Ecological Area. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Plantago cordata*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These

cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**18. *Poa alsodes* (Autumn bluegrass)**

***Poa alsodes*** is a tufted perennial grass that is known from eastern Canada and the northeastern United States west to Minnesota and south to Illinois, Tennessee, and South Carolina. This grass grows in mesic forests and is assumed from several widely scattered locations in Illinois. There are historical collections from Giant City State Park in Jackson County and Hayes Creek Canyon (mesic woodland, north-facing slope) in Pope County. Scott Ballard recently saw this species at Giant City State Park (personal communication 17 May 2018 with Elizabeth Shimp) about 6 or 7 years ago (element occurrence record, EOR submitted to State of Illinois) and it is suspected that it still occurs on the Shawnee National Forest. It is also known from a little further north in the state in St. Clair County. Gordon Tucker found it in 2012 in Vermillion County (determined by John Ebinger). It generally blooms in Illinois from May to June (Mohlenbrock 2014).

Threats include the loss of native habitat and natural succession. The Nature Conservancy gave this species a Global Heritage Status Rank of G4G5 in 1997 (NatureServe 2018). It is listed as critically imperiled in Illinois, South Carolina, and Prince Edward Island, Canada, imperiled in Indiana and Maryland, and vulnerable in Quebec, Canada. It is apparently secure in New Brunswick and Ontario, Canada, Kentucky, West Virginia, Virginia, North Carolina, New Jersey, and Delaware, and secure in New York. It is either not ranked or under review in Tennessee, Minnesota, Wisconsin, Michigan, Ohio, Pennsylvania, Connecticut, Massachusetts, Vermont, New Hampshire, and Maine. Trends for *Poa alsodes* are not reported in the available literature. The only trend from the available literature would be an inference of a declining population due to its absence in the last couple of decades. Management needs are also poorly understood and/or documented in the available literature.

In Indiana, it has been reported from dry soils in beech-maple woodlands as well as low woods (Deam 1940). In Illinois it is historically known from St. Clair County, Jackson County (Fern Rocks Nature Preserve, Giant City State Park 1953 by R.H. Mohlenbrock and last seen 1977; Scott Ballard saw it a few years ago, he stated there were only a few plants) and Pope (Hayes Creek Canyon/Fox Den Ecological Area) County. The last verified Element of Occurrence for *Poa alsodes* was at the Hayes Creek location in 1986 within a mesic forest on a north-facing slope. After extensive unsuccessful searches to find any voucher specimens from Illinois, Hill (2007) concluded that this species may not actually exist in the state but may instead be misidentifications, however, the Gordon Tucker collection in Vermillion County is evidence that it truly exists in Illinois as well as the Scott Ballard observations at Giant City State Park. This species is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

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Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Poa alsodes*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**19. *Polytaenia nuttallii* (Prairie parsley)**

*Polytaenia nuttallii* is a perennial herb that occurs in prairies, rocky woods and the barrens areas of southern Illinois. It generally flowers from April to June. It is historically known from Gallatin, Hardin, Jackson, Johnson, Pope, Saline, and Union Counties. In Pope County, R.A. Evers found it west of Herod (possibly Gibbons Creek or Williams Hill) in 1966. Mark Basinger found it near Williams Hill in a dry upland forest in 1992, then along Forest Road 598 in 1994 (Hardin County). Evers first found it at Stoneface Research Natural Area in Saline County in 1952. Elizabeth Shimp and Lawrence Stritch found it at Simpson Barrens in 1991 (Johnson County). Shimp and Chris Schultz also found it in 1991 along a creek in dry-mesic upland woods, and Stritch and Shimp found it in a dry upland forest in the Trigg Tower area (Johnson County). A Gallatin County collection was made by Jody Shimp and Mark O'Leary in 1992 in dry woods. Jody Shimp and Mark Basinger collected it along Forest Road 404 in 1992 in Pope County. This species is threatened by several different non-native species.

The Nature Conservancy gave this species a Global Heritage Status Rank of G5 in 1984 (NatureServe 2017). It is presumed extirpated in Michigan and Kentucky; possibly extirpated in Minnesota; critically imperiled in Indiana and Tennessee; imperiled in Wisconsin and Mississippi; vulnerable in Louisiana and Iowa; apparently secure in Nebraska; and not ranked or under review in North Dakota, Illinois, Missouri, Alabama, Missouri, Arkansas, Kansas, Oklahoma, Texas, and New Mexico. It is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Polytaenia nuttallii*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable

future actions taken by the agency or others.

## **20. *Quercus montana* (Chestnut oak)**

***Quercus montana*** is a tree that grows to about 30 meters in height. Its range is the Eastern United States and adjacent Canada. It's a species of dry, often rocky forests and ridgetops and in Illinois, occurs along the western margin of its range (Herkert and Ebinger 2002). There are 8+ known populations across the State of Illinois, all in southern Illinois on the Shawnee National Forest. Some of the populations have been cut but are doing well in re-establishing themselves.

Threats to this species include fire suppression, overgrazing, habitat destruction for development and mining activities. This species is declining within the northern portion of its range. It is listed as imperiled in Illinois, critically imperiled in Maine, It is apparently secure in Vermont and secure in New York, Pennsylvania, Virginia, North Carolina, West Virginia, Kentucky, and Indiana. It is currently unranked or under review by New Hampshire, Maryland, District of Columbia, Massachusetts, Rhode Island, Connecticut, South Carolina, Georgia, Alabama, Tennessee, Ohio, Mississippi, and Louisiana. Michigan has it listed as an exotic. The Global Rank of G5 was assigned by The Nature Conservancy in 1984 (NatureServe 2019), likely because of its relatively wide range in the east.

M. Bailey, R. Dimmick & D. Hankla s.n. collected the first specimen from Atwood Ridge on October 9, 1948. R.A. Evers and R.S. Dimmick #15618 collected it at Atwood Ridge in Union County on October 16, 1948.

It was collected by R.A. Evers #91336 at Murray Bluff in Saline County on June 29, 1967 and determined by John White on October 22, 2018. Evers #110379 collected it again at this site on May 17, 1973. It was collected by E.F. Ulaszek and D. Spivey #2983 on September 27, 1995 at Reid's Chapel Bluff Ecological Area in Saline County. And it was found at Cave Hill RNA in Saline County by Steve Olson May 10, 1990. Dennison Hollow RNA is known for its large stands of *Q. montana*. It was found in Hardin County by Eric Ulaszek and Mark Basinger on June 13, 1995 in a dry-mesic and mesic upland forest, rocky, shaley, steep bluff facing the in NE direction on Ohio River. Earlier it was found at Hicks Dome during the 1970s by Max Hutchison in Hardin County. Eric Ulaszek found it approximately 0.75 mi NE of High Knob Rec Area on August 1, 1995 on a NW facing slope, sandstone outcrops and talus slopes in Gallatin County.

It was collected by Franklin B. Buser #5422 on September 25, 1954 in Alexander County, east slope of Hogskin Hills, above lower Tatumville quarry and determined by John Ebinger in 1981. Buser #5739 also collected it in Alexander County at Chestnut Oak Ridge, 1 mile NW of Tamms on September 25, 1954. Evers #27684 collected it in Alexander County on a rocky wooded bluff top NW of Tamms on September 20, 1950. Evers collected several from the Alexander County in this area. There is a 1993 collection at Big Brushy Ridge Ecological Area (1993), and Provo Cemetery Barrens (1987)



It was found in northern Illinois in Cook County by David Shepard at Oak Forest/Orland Park on October 27, 2001 and again on June 14, 2003. It is not known at the time of this writing where the Jackson and Williamson County locations are at. This species is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Quercus montana*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**21. *Trifolium reflexum* (Buffalo clover)**

*Trifolium reflexum* is an annual or biennial clover that is found in the eastern and central United States and adjacent Canada. It is typically found in open upland forests and prairies. It generally flowers from May through July.

Threats to this species include fire suppression of open woodlands and prairies, habitat destruction for agriculture and development, and invasion of non-native species. It is listed as presumed extirpated in Ontario, Canada, Pennsylvania, New Jersey, and the District of Columbia; possibly extirpated in Maryland, critically imperiled in Illinois, Kentucky, Nebraska, North Carolina, Ohio, Tennessee, West Virginia, and Virginia; imperiled in Kansas, and vulnerable in Missouri. This species is not ranked or is currently under review in Indiana, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Oklahoma, Texas, and Indiana. Iowa lists it as an exotic. The Global Rank assigned by The Nature Conservancy in 2004 is a G3G4 (NatureServe 2017). The decline of this and other native clovers may be attributed to habitat destruction, poor dispersal to new habitat, loss of a natural grazing regime (buffalo), competition from exotic plant species, and reduced fire frequency (Campbell et al. 1988).

*Trifolium reflexum* was once scattered throughout Illinois in dry-mesic savannas, upland forests, prairies, and flatwoods. It is now nearly extirpated in the state and occurs in less than half of the counties that it did historically. In southern Illinois it is known from extant populations in Jackson and Johnson counties. There is an unconfirmed report of this species from Gallatin County. It is known from a rocky, dry-mesic upland forest adjacent to limestone barrens at Simpson Township Barrens Ecological Area in Johnson County (collection by Elizabeth Longo Shimp, June 12, 1996) and at Little Grand Canyon/Horseshoe Bluff Ecological Area (discovered by

David King and collected by Jody Shimp in June 6, 1994, collection #5290) in Jackson County. This species is not known to occur within the Oakwood Bottoms area nor does known potential habitat occur at the project site.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Trifolium reflexum*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for both alternatives would be comparable to the environmental impacts. With no environmental impacts, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**Summary of Appendix 1 RFSS Plants**

The above 21 RFSS plant species are known from Jackson County but are not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor are they known from immediate adjacent lands. Habitat for these species generally does not occur within the Oakwood Bottoms area. Without direct or indirect short-term or long-term impacts, there will be no cumulative impacts to analyze for. This takes into consideration the past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

Appendix 2

**1. *Botrychium biternatum* (Sparselobe grapefern)**

***Botrychium biternatum*** is a perennial evergreen fern with fleshy to nearly fibrous roots, up to 35 cm tall. It's known from the southeastern United States. It reaches its northern range limit in southern Illinois where it has been found at open hillsides, edges of old fields, and within the woodlands, especially within mixed hardwood and pine woodlands. It is known from Alexander, Jackson, Johnson, Pope, Saline, and Union counties. In southern Illinois it is found mostly in pine stands but will appear in hardwoods as well. Suitable habitat occurs within the project area but this species has not been found there. Japanese honeysuckle and Nepalese browntop are the two aggressive non-native species that are found in its habitat. In pine plantations, there are often more non-native species.

The Nature Conservancy assigned *Botrychium biternatum* the Global Ranking of G5 in 1985 (NatureServe 2017). It is listed as critically imperiled in Illinois and Missouri; imperiled in Ohio;

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vulnerable in Indiana, apparently secure in North Carolina and Kentucky; and secure in Virginia, Georgia, and Delaware. It is not ranked or under review in 13 southeastern states. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal at best.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Botrychium biternatum*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats. However, there is potential habitat for this species to occur within any pine stands and along the woodland edges.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Botrychium biternatum* is not known to occur in the project area. Since there are no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**2. *Bromus nottowayanus* (Nottoway valley brome)**

***Bromus nottowayanus*** is a perennial grass that occurs in colonies. It is found in deep or partial shade of mature hardwood forests on rich bottomland terraces and floodplains or the rich adjoining slopes of streams. It is also found in moist, wooded ravines. In Illinois, this species flowers between June and August.

According to NatureServe (2018), the primary threat to *Bromus nottowayanus* is habitat loss through logging and land clearing. Other threats include equestrian use, other human recreational activities, and habitat encroachment by invasive species (both non-native and native, such as *Symphoricarpos orbiculatus* or coralberry shrubs). The Nature Conservancy assigned this species the Global Ranking of G3G5 in 2003. It has been determined to be critically imperiled in Illinois, Kansas, North Carolina, New York, and Maryland; imperiled in Arkansas and Tennessee; vulnerable in Missouri and Virginia, and apparently secure in Ohio and Ontario, Canada. This species is not ranked or is under review by Texas, Oklahoma, Alabama, Georgia, Iowa, Indiana, and New Jersey. It is also known from 2 counties in Michigan at one location in each county and is also not ranked there (USDA NRCS 2018).

In Illinois, *Bromus nottowayanus* is rare and known from Cook, Stark, Woodford, and Peoria Counties in northern Illinois, but specimens are reported to have been collected in Adams and Brown counties. In southern Illinois it is known from 3 collection sites near Cedar Lake in Jackson County and 1 in Pope County; Tom Heineke reported finding this species on May 10, 1976 (collection #1488) in mesic to dry woods in Jackson County. John Schwegman found a few plants on a north-facing limestone slope in the woods at Copperous Branch Ecological Area

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in Pope County on July 19, 2002. That site is currently being over-shaded and invaded by Nepalese browntop. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be occupied but this species has never been detected here.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Bromus nortowayanus*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Bromus nortowayanus* is not known to occur in the project area. Since there are no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**3. *Carex bromoides* (Brome-like Sedge)**

*Carex bromoides* is a sedge species of low woods, seep springs, swamps, and prairie bogs of Illinois but becomes very rare in southern Illinois. It is known from 7 northern Illinois counties and from 1 location in Jackson County, 2 in Johnson County (one on private property; the other at Granstburg Swamp – second population located by Mark Basinger and Elizabeth Shimp on May 2, 1994; Shannan Sharp photographed this species at Grantsburg Swamp on April 12, 2018) and 3 locations in Pope County. Information on the Jackson County population was not available at the time of this writing but the Pope County populations are known from a seep spring (Schwegman 1969) at Cretaceous Hills (re-collected by John Schwegman on May 10, 2005; Elizabeth Shimp, John Schwegman, and Martha Schwegman on May 30, 2007), at Snow Springs (John Schwegman located prior to 2006) and a seep spring area at Reddick Hollow (John Schwegman on May 17, 2005). Nepalese browntop is the main non-native invasive threat with Japanese honeysuckle running second. These two aggressive species are taking over the seep springs where they are not covered by the Invasive Species Management EA (2014). The seep springs that were included in the EA are benefitting from the use of selective herbicides by keeping the aggressive non-natives out of the seep springs, thereby protecting the rare species such as *Carex bromoides*. This species flowers from April to May.

The Nature Conservancy assigned *Carex bromoides* the Global Ranking of G5 in 1984 (NatureServe 2017) but it is critically imperiled in Delaware; imperiled in North Carolina, Illinois, and Arkansas; vulnerable in West Virginia and Quebec, Canada; apparently secure in Kentucky, Mississippi, Maryland, and New Brunswick and Nova Scotia, Canada, and secure in Virginia, New York, and Ontario, Canada. It is unranked or under review in 21 states. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal at best. This species requires naturally flowing clear spring water in order to exist. The water fluctuations at

the project site are not natural.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex bromoides*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Carex bromoides* is not known to occur in the project area. Since there are no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**4. *Carex cherokeensis* (Cherokee Sedge)**

*Carex cherokeensis* is a perennial monocot with short- to long-creeping, stout rhizomes forming dense colonies whose previous season's sheaths persist and are noticeable beneath the basal leaves (Yatskievych 1999). Flowering stems are 30-60 cm tall and bloom from April through June. This sedge is uncommon to southern Missouri and Illinois (Georgia to Texas north to North Carolina, Missouri, Illinois, and Oklahoma). It is a species of bottomland forests, acid seeps, margins of sinkhole ponds, openings of dry upland forests, dolomite glades, and roadsides (Yatskievych 1999) and within wet depressions of rarely used roads.

*Carex cherokeensis* was given the Global Heritage Status Rank of G4G5 by The Nature Conservancy in 1988. It is listed as critically imperiled in Kentucky and North Carolina, imperiled in South Carolina, apparently secure in Missouri, and secure in Arkansas and Mississippi. It is considered an exotic in Virginia. It is not ranked or under review by Oklahoma, Texas, Louisiana, Alabama, Florida, Georgia, and Tennessee.

In Illinois, this sedge was first found in Alexander County by Steven Hill (#32294) on May 3, 2000 on the east side of IL Route 127, south end of Tamms, on the west side of the original Cache River. The population was at least 50 feet long parallel to the road in a moist, but not wet, sandy loam drainage, in the wettest parts. Hill re-confirmed this population on June 6, 2002 and noted that the strip was 3-4 meters wide. David Ketzner and Dennis Keene found a population in Union County at the Union County State Conservation Area in a wet-mesic floodplain forest dominated by *Quercus palustris* and *Celtis occidentalis* on July 23, 2003 (#3301). Mark Basinger identified this plant in Hardin County in 2009 at the Lee Mine area (Jody Shimp, personal communication with Shannan Sharp). Elizabeth Shimp and Shannan Sharp found other locations of *Carex cherokeensis* in the Lee Mine area on August 4 and 7, 2015. In 2015, Shimp continued to find more locations along wet depressions in the Lee Mine area predominantly along and on infrequently used grassy roads. A few populations were within pine stands. Nepalese browntop (*Microrostegium vimineum*) is the main threat to this species at

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Lee Mine although, a majority of the population will be destroyed during timber harvest operations. On October 18, 2017, Elizabeth Shimp and Johnny Walker found a few clumps of this species in wet depressions along an infrequently used grassy road in Pope County just south of the Pleasant Valley Barrens Ecological Area (Pope Co.). According to Mohlenbrock (2014), this species is only known from Jackson, Union, and Williamson Counties. No information was found for Jackson and Williamson Counties at the time of this writing. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs within the project site. Some of this habitat may be termed marginal. This species has been found in clear seepy areas on the Forest where the water is not disturbed dramatically or with any signs of pollutants, however, it is very possible that this species could occur at Oakwood Bottoms.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex cherokeensis*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Carex cherokeensis* is not known to occur in the project area. Since there are no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**5. *Carex gigantea* (Giant Sedge)**

***Carex gigantea*** is a perennial cespitose sedge that can also be found growing singly, from fibrous roots with long connected rhizomes. It is a species of swamps and wet woods primarily on the coastal plain from Delaware south to Florida, east to Texas and north in the Mississippi Embayment to southern Illinois and Indiana. Its northern range limit is southern Illinois, where it is known from wet woods and swamps. In southern Illinois, this species flowers from May through September.

The primary threat to this species is loss of native habitat (habitat conversion and drainage). The spotty distribution, specific habitat requirements, and continued habitat destruction are leading to an accelerated decline of this species. It is historically known from 18 states and but is listed as critically imperiled in Illinois, Indiana, Arkansas, Kentucky, and Missouri, and vulnerable in Maryland and Delaware. It is apparently secure in Virginia and North Carolina, and secure in Mississippi. The states of Oklahoma, Texas, Louisiana, Tennessee, Alabama, South Carolina, Georgia, and Florida currently do not have a rank or it is under review. The Nature Conservancy assigned this species the Global Ranking of G4 in 1984 (NatureServe 2017).

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In southern Illinois it is historically known from Jackson, Johnson, Massac, Pulaski, and Union counties. On the Forest, this species is known from Grantsburg Swamp Ecological Area in a bottomland hardwood forest (Mark Basinger and John Rundle July 5, 1994; collection #8709 and #8725) in Johnson County and at LaRue-Pine Hills/Otter Pond Research Natural Area north of Otter Pond (Union County) in a wet woods near the swamp (last observed November 28, 1967). A population discovered at Sielbeck Woods (private) in Massac County by Mike Homoya in 1976 was relocated and vouchered by John Schwegman August 1, 1997 and again observed September 6, 2001 by Mark Guetersloh. The Pulaski County site at Post Creek Cutoff (private) was discovered on June 23, 1992 by John Taft. Documentation for the Jackson County occurrence was lacking at the time of this writing. Opportunities for seed dispersal are limited with reduced numbers of protected bottomland hardwoods, swamps and permanent wetlands. Similar to *Carex decomposita*, this species requires high-quality conditions without hydrologic alterations, such as water drainage, or chemical pollutants. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal at best. This species normally occurs in areas that has clean, natural water seeping up from the earth and is generally found growing in association with the swamps at LaRue-Pine Hills. These swamps are not artificially drained and provide a more undisturbed habitat for this species.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Carex gigantea*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Carex gigantea* is not known to occur in the project area. Since there are no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**6. *Chelone obliqua* var. *speciosa* (Red turtlehead)**

*Chelone obliqua* var. *speciosa* is a branching perennial in the figwort (snapdragon) family. It is a rare species of alluvial woods, swamps, low woods, and wet meadows, and ranges from Minnesota and Michigan south to Arkansas and Kentucky. There are accounts of historical populations of this species scattered throughout 25 counties in Illinois but only 12 are considered to be extant (Phillippe 2004a). This species flowers from August through September and bears fruit September through October (Ambrose et al. 1994).

According to NatureServe (2017) primary threats to *Chelone obliqua* var. *speciosa* include the physical destruction of habitat and artificial changes in hydrology. Succession may also threaten this species as it does not do well with competition from robust shrubs and vines under a closed canopy. It is found scattered throughout Illinois and has been reported from eight of

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the southernmost counties. Records from the Illinois Natural History Survey collections (specimen list provided to Elizabeth Longo Shimp from Loy R. Phillippe) and Iverson et al. (1999) indicate that the following specimens are available at the herbarium: Alexander (last seen 1931), Gallatin (last seen 1960), Hardin (last seen 1988), Jackson (last seen 1989), Johnson (separate locations 1931, 1931/1978, 1960, 1969, 1990/1992), Massac (1951), Pulaski (1931) and Union (1960) counties. The only extant population on the Shawnee National Forest may be the Johnson County collection of August 31, 1990 at Grantsburg Swamp Ecological Area by Rick Phillippe. It is unclear if the collection made in 1992 was actually on forest service managed land or on private property, nor is it clear if the section indicated on the record is accurate, however it was documented along the margin of a swamp.

The Nature Conservancy assigned this species a Global Ranking of G4T3 in 1994 and has determined it to be vulnerable in Illinois, Indiana, and Kentucky, critically imperiled in Michigan, and possibly extirpated in Arkansas. It is not ranked or is under review in Iowa, Missouri and Minnesota. Southern Illinois, southern Indiana and western Kentucky are considered to be strongholds for this species, however, trends are not well known and populations are likely declining across its range due to loss of habitat (Ambrose et al. 1994). Management activities including selective thinning, maintenance of a dynamic hydrological cycle and periodic disturbances may be necessary to protect suitable habitats (Ambrose et al. 1994). This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal. It is known from natural water flowing from biologically clean swamps. The wetlands of the Oakwood Bottoms area may or may not be conducive to the habitat requirements of this species.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Chelone obliqua* var. *speciosa*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Chelone obliqua* var. *speciosa* is not known to occur in the project area. Since there are no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**7. *Cypripedium parviflorum* var. *pubescens* (Greater yellow lady's slipper)**

***Cypripedium parviflorum* var. *pubescens*** is a rhizomatous perennial orchid found in most of the United States (less 2 of the southern and 5 of the western states) and adjacent Canada. In Illinois it is found in both dry and moist open woodlands and although not common, is found scattered throughout the state.



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The Nature Conservancy assigned this species the Global Heritage Status Rank of G5T5 in 2002 but all of the states it occurs in do not have their statuses ranked and available information suggests that this species is still in a decline (NatureServe 2017). Although there are more than a thousand populations of this species range-wide, most are small in size. Primary threats to this species include loss of native habitat, horticultural collecting, and medicinal collecting. Most populations have fewer than 30 individuals and no known populations have more than 400 individuals. This species is currently critically imperiled in Idaho, Arizona, Delaware, Maryland, Utah, and Rhode Island; and imperiled in New Hampshire, Mississippi, Wyoming, New Mexico, North Dakota and 3 Canadian provinces. It is considered as vulnerable in Illinois, Indiana, North Carolina, Alabama, South Carolina, New York, Vermont and 4 Canadian provinces. It is apparently secure in Ohio, Pennsylvania, West Virginia, Kentucky, Virginia, and New Brunswick, Canada, and secure in 2 Canadian provinces. It is currently not ranked or is under review in 18 states and 1 Canadian provinces.

In southern Illinois it is considered rare with few individuals within a population reaching the flowering stage. Populations on the Shawnee National Forest are generally less than a dozen individuals each. Known populations on the Forest have been dug up by orchid enthusiasts for their beauty only to be extirpated from their native habitats. *Cypripedium parviflorum* var. *pubescens* has been historically documented from 52 Illinois counties including Alexander (Ozark Hill Prairie Research Natural Area, collected by Rick Phillippe April 30, 1992), Massac, Pope, Johnson, Jackson, Williamson, and Union (Collected near Bluff Lake by Mrs. Baker in 1930 – it is uncertain if this collection was made on national forest managed land) counties in southern Illinois. In Illinois and Indiana it is described as rare or uncommon at each of these sites (Danderson 2004). It is known to occur on an oak-hickory wooded slope within Lusk Creek Canyon Ecological Area and in Thacker Hollow (Mark Basinger and Elizabeth Shimp in July 2009; E. Shimp in July 2009) on a rich mesic ravine area and on a rocky wooded slope. It is mostly known from unprotected sites across the Forest. This species has become increasingly hard to find in its past known locations. Non-native species that could threaten this species are Nepalese browntop, Japanese honeysuckle, Amur honeysuckle, Autumn olive, and multiflora rose. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed extremely marginal. It is highly unlikely that we would find this species in this consistently disturbed habitat.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Cypripedium parviflorum* var. *pubescens*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Cypripedium parviflorum* var. *pubescens* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## 8. *Hottonia inflata* (American featherfoil)

*Hottonia inflata* is an aquatic winter annual that occurs in quiet water of swamps and permanently wet ditches from Maine west to Illinois and Missouri and south to Texas and Georgia. This species germinates and grows in the fall and develops in the winter protected under the water, then reaches the water surface and flowers in the spring (NatureServe 2017). According to Mohlenbrock (2014), it blooms from June to August in southern Illinois, and NatureServe (2017) states it decays from mid-June to August dependent on its locality. In southern Illinois it is known from Jackson, Johnson, Saline, and Union counties. It is known from swamps at LaRue-Pine Hills/Otter Pond Research Natural Area.

According to NatureServe (2017), the primary threats to this species are the loss/conversion of wetlands, alteration of hydrology and deteriorating water quality. Invasive species, severe floods and removal of beaver populations are also listed as threats to *Hottonia inflata*. The Nature Conservancy assigned this species a rank of G4 in 1994 (NatureServe 2017). This species is currently listed as presumed extirpated in Pennsylvania, possibly extirpated in Ohio, critically imperiled in West Virginia, Maine, Rhode Island, New Jersey, Maryland, Georgia, South Carolina, North Carolina, New Hampshire, and Mississippi, imperiled in Illinois, Missouri, Indiana, Oklahoma, Tennessee, New York, Delaware, and Alabama, and vulnerable in Connecticut, Massachusetts, Virginia and Texas. This species is apparently secure in Kentucky, and either not ranked or under review in Arkansas, Louisiana, and Florida. *Hottonia inflata* populations are in decline over much of its range (NatureServe 2017). Populations in southern Illinois currently appear to be stable as most locations are protected, but many of the primary threats to this species including exotic species encroachment, severe fluctuations in water levels, wetland drainage and siltation remain a threat (NatureServe 2017).

In southern Illinois it has been collected from: Cave Valley (Silvey Pond) in Jackson County, Heron Pond, Little Black Slough and other private land near West Vienna in Johnson County, Round Pond in Pope County (private - this pond borders and drains into Massac County), near Carrier Mills in Saline County, and several locations from LaRue-Pine Hills/Otter Pond Research Natural Area (pool of water at base of cliff, LaRue Swamp and Winter's Pond) in Union County. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal since it is unnaturally disturbed. This species requires clean, natural flowing water, which is not consistent with the use of the controlled water structures at Oakwood Bottoms.

### Environmental Impacts:

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Hottonia inflata*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Hottonia inflata* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

### 9. *Hydrastis canadensis* (Goldenseal)

*Hydrastis canadensis* is a perennial dicot with simple leaves, palmately lobed. It has been found throughout Illinois with the exception of about 30 to 35 counties. It is found in all of the southern Illinois counties where the Shawnee National Forest is and appears fairly secure. Here it occurs in rich woods and generally flowers from April to May. Specimens have been collected from Ozark Hill Prairie RNA (1992, Alexander County), Lake Egypt (1985) and Grantsburg Swamp EA (1990, Johnson County), Jackson Hollow EA (1987, 1997) and north of Millstone Bluff EA (2011, Pope County), and LaRue-Pine Hills/Otter Pond RNA (1955, 1966, 1983), Bald Knob Cross Road (1988), and Atwood Ridge RNA (1955, 1988, and 1991, Union County). It is widespread across the Forest but is in small populations. There are several non-native species that threaten goldenseal, however, shrubs and Nepalese browntop are the worst invaders into its habitat.

*Hydrastis canadensis* has been given a Global Heritage Status Rank of G3G4 by NatureServe in 2012 because of its rapid disappearance from lands across the United States. This species is a medicinal herb and is threatened primarily by the destruction of habitat, decline in habitat quality, wild herb collections, and obvious deer browsing. It is critically imperiled in Vermont, Massachusetts, Connecticut, New Jersey, Minnesota, Kansas, and Mississippi; imperiled in Ontario, Canada, New York, Michigan, Maryland, Georgia, and Alabama; vulnerable in Iowa, Wisconsin, Indiana, West Virginia, Virginia, North Carolina, and Delaware; apparently secure in Illinois, Ohio, Pennsylvania, Kentucky, Tennessee, and Arkansas; and secure in Missouri (NatureServe 2018). This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be found along the wooded, more undisturbed areas of the project area. If this species were known from this area, it is very likely that it would have been already found.

#### Environmental Impacts:

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Hydrastis canadensis*, since no or little potential habitat exists; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

#### Cumulative Impacts:

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Hydrastis canadensis* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable

future actions taken by the agency or others.

#### **10. *Hydrolea uniflora* (One-flowered false fiddleleaf)**

***Hydrolea uniflora*** is a decumbent perennial herb from southern Illinois, Indiana, and Missouri south to Florida and Texas. It occurs in swamps (Herkert and Ebinger 2002), wet shores, and roadside ditches. It reaches its northern range limit in southern Illinois. It generally flowers from June to September (Mohlenbrock 2014).

*Hydrolea uniflora* has been given a Global Heritage Status Rank of G5 by The Nature Conservancy in 1988 (NatureServe 2017). Threats range-wide include loss of swamp habitat. It is critically imperiled in Illinois and Kentucky, and not ranked or under review in Indiana, Tennessee, Alabama, Mississippi, Missouri, Arkansas, Louisiana, Oklahoma, and Texas.

This species is known from LaRue-Pine Hills/Otter Pond Research Natural Area in Union County (LaRue Swamp and Winters Pond), Route 3 ditch (clear seep spring fed) in Jackson County, Grantsburg Swamp in Johnson County, and on private property at Black Bottoms in Massac County. It is unclear where the Alexander County siting was documented from. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site.

#### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Hydrolea uniflora*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

#### **Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Hydrolea uniflora* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

#### **11. *Juglans cinerea* (Butternut)**

***Juglans cinerea*** is a deciduous, nut-bearing tree of the northeastern United States and adjacent Canada. It is a species of rich woodlands and is found scattered throughout the state of Illinois.

The Nature Conservancy assigned this species the Global Heritage Status Rank of G4 in 2006

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reflecting occurrences from at least 17 states. The abundance and condition of this species are in rapid decline due to butternut canker disease, with no remedy at this time. It is listed as critically imperiled in Alabama and the District of Columbia; imperiled in Georgia, Illinois, Missouri, Mississippi, North Carolina, Kentucky, and Maryland and Ontario, Canada; and vulnerable in Minnesota, Wisconsin, Arkansas, Indiana, Michigan, West Virginia, Virginia, New Jersey, Tennessee, South Carolina, New Hampshire, Vermont, Delaware and 2 Canadian provinces. It is listed as introduced (exotic) in Washington and 2 Canadian provinces, and is either not ranked or currently under review in Iowa, Connecticut, Rhode Island, and Maine (NatureServe 2017).

*Juglans cinerea* is known from all of the counties on the Forest except for Gallatin County. This species achieves its best growth on well-drained soils of bottomlands and floodplains, but rarely occurs in pure stands. It is seldom found on dry, compact, or infertile soils, and is shade-intolerant, growing best in full sunlight. Although butternut canker is the primary global threat to this species, *Juglans cinerea* is also threatened by plant succession where open conditions no longer exist. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal at best since the majority of trees along the levees must be removed periodically in order for the project area to function properly.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Juglans cinerea*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Juglans cinerea* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**12. *Lilium superbum* (Turk's-cap lily)**

*Lilium superbum* is a bulbous perennial occurring in the eastern United States. It is a species of the eastern half of the United States. Range-wide it is known from peaty meadows, swales, wet sand and swampy woods.

The Nature Conservancy has given this species the Global Heritage Status Rank of G5 (1990) because of its historically wide distribution within 26 states and the District of Columbia, but it is critically imperiled in Missouri, Arkansas, Kentucky, Louisiana, New Hampshire, and Florida. It is imperiled in Illinois and Alabama and is considered vulnerable in Indiana, Ohio, Georgia and Mississippi. This species is apparently secure in New York, New Jersey, North Carolina, and

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secure in Delaware, West Virginia, and Virginia. It is currently not ranked or under review in Minnesota, Tennessee, Pennsylvania, Vermont, Massachusetts, Rhode Island, Connecticut, Maryland, and District of Columbia (NatureServe 2017). In Illinois, this species rarely blooms, most likely the result of excessive shading conditions.

*Lilium superbum* is a species of mesic woods and streambanks in southern Illinois. It is found within Gallatin, Pope, Johnson, Jackson, Williamson, and Hardin counties. It is known to occur within Lusk Creek Canyon, Jackson Hollow, Bell Smith Springs, Martha's Woods, Hayes Creek/Fox Den Creek (mesic woodland, north-facing slope), Fink Sandstone Barrens, Simpson Township Barrens, and Bulge Hole Ecological Areas, Ozark Hill Prairie Research Natural Area, Lusk Creek Canyon Zoological Area, and Lusk Creek Canyon Wilderness Area. It is also known from outside the Burke Branch Research Natural Area, east branch of Cedar Creek, Iron Furnace, along a tributary of Big Creek, Lake Kinkaid area, near Beaver Creek, on private land near Caney Creek, The Nature Conservancy's Gibbons Creek, State land at Lake Murphysboro, US Fish & Wildlife land at Devils Kitchen Dam, and within the Lee Mine Project Area. Rarely do the populations reach a mature growth on the Forest. Typically, populations are non-flowering and remain in a juvenile stage, primarily because they are found in excessively shaded areas. At one site where a clear cut took place on private property, approximately 51 flowering individuals and 147 juveniles appeared in a 200 square meter area during June 1991. These plants were exposed to full sunlight and appeared to be very healthy. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs occasionally at the project site. Normally this species is found along creeks on floodplains or in shallow ravines, which receive a moderate to full amount of sunlight.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Lilium superbum*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Lilium superbum* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**13. *Melothria pendula* (Guadeloupe cucumber)**

*Melothria pendula* is a climbing herbaceous vine with tendrils that occurs in the southern United States and adjacent Mexico. It reaches its northern range limit in southern Illinois and is often found in damp thickets and gravelly stream beds (Herkert and Ebinger 2002). It has also been found along powerline right-of-ways and trailways. In Illinois it is known from Alexander, Hardin, Jackson, Johnson, Massac, Pope, and Union Counties. In southern Illinois it generally flowers from June to September (Mohlenbrock 2014)

According to NatureServe (2017), this species was determined to be a G5? In 2000. It is critically imperiled in Illinois, Indiana, West Virginia, Maryland, and the District of Columbia; it is imperiled in Kansas; apparently secure in Virginia, North Carolina, Kentucky and Georgia; and not ranked or under review in Pennsylvania, South Carolina, Tennessee, Florida, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Oklahoma, and Texas. Delaware has it listed as an exotic. This species is not known to occur within the Oakwood Bottoms area although potential habitat occurs frequently at the project site. Although this annual plant has not been found within the project site, it has been seen in nearby powerline right-of-ways and wooded areas, which were rich, moist and with sunlight coming through the canopy. It is possible that this plant could occur here, however, it has yet to be detected.

### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Melothria pendula*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### **Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Melothria pendula* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## **14. *Oxalis illinoensis* (Illinois woodsorrel)**

***Oxalis illinoensis*** is a perennial herb that occurs in rich mesic forests often overlying limestone or other calcareous substrates from southern Illinois, southern Indiana, and western Kentucky (Herkert and Ebinger 2002). It is known from extreme southeastern Illinois where it occurs in Hardin and Pope counties. It is also known from Wabash County outside of the Shawnee National Forest. In southern Illinois it generally flowers from June to September (Mohlenbrock 2014).

The Nature Conservancy assigned this species a Global Heritage Status Rank of G4Q in 2004 (NatureServe 2018). It is listed as critically imperiled in Illinois, imperiled in Indiana, and apparently secure in Kentucky. Schwegman (1982) cites specimens from Tennessee but other sources do not report this species as occurring in Tennessee. Threats to this species include loss of native habitat and droughty conditions.

It occurs within Martha's Woods, Reddick Hollow, and Copperous Branch Ecological Areas, East Fork *Oxalis illinoensis* Botanical Area, and along Lusk Creek Zoological Area in Pope County and Big Creek Zoological Area in Hardin County. This species was relocated at these sites during 2003 by Bob Edgin (Edgin 2003). This species was first described in 1982

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(Schwegman 1982) and was distinctly separated from the closely related *Oxalis grandis*. This species is threatened the most by Nepalese browntop and Chinese yam. Both of these non-native species can out-compete or displace the Illinois wood sorrel. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal at best. This species normally occurs along clean flowing creeks and is concentrated in Pope County, although has been detected elsewhere infrequently. It has never been seen at Oakwood Bottoms, but there is a highly unlikely chance that it could occur in locations that are not terribly disturbed along some of the more natural creek pathways.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Oxalis illinoensis*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Oxalis illinoensis* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**15. *Panax quinquefolius* (American ginseng)**

***Panax quinquefolius*** is a perennial herb of the eastern United States and adjacent Canada. This species has a fleshy rootstock with medicinal value found and is frequently dug up for its roots. In Illinois it blooms during June and July and fruit is typically ripe in mid August (Fiebig et al. 2001). Throughout its range, it is found in rich mesic woods under the closed canopy of deciduous hardwoods. This species is scattered throughout Illinois in rich dry-mesic to mesic upland and mesic floodplain forests and in southern Illinois it is known from Alexander, Hardin, Jackson, Johnson, Massac, Pope, Saline, Williamson, and Union counties. It is known from LaRue-Pine Hills/Otter Pond Research Natural Area, and Bulge Hole and Double Branch Hole Ecological Area of the project area.

According to NatureServe (2017) the primary threats to ***Panax quinquefolius*** are commercial overharvest and logging of mesic hardwoods. Exotic species, although not mentioned specifically on NatureServe, could decrease the amount of suitable habitat and potentially outcompete *Panax quinquefolius*. Even in protected areas such as National Parks and Forests, there is a great deal of poaching due to its valuable root in overseas markets and the difficulty of enforcing existing laws (NatureServe 2017).

The Nature Conservancy gave this species a Global Heritage Status Rank of G3G4 in 2000 and its status was last reviewed in 2005 (NatureServe 2017). It is possibly extirpated in the District



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of Columbia, critically imperiled in Rhode Island, South Dakota, Nebraska, Kansas, Oklahoma, and Louisiana, imperiled in Ontario and Quebec, Canada, Michigan, New Jersey, Delaware, Connecticut, and New Hampshire, and listed as vulnerable in Illinois, Indiana, Iowa, Minnesota, Kentucky, Tennessee, Mississippi, Georgia, West Virginia, Virginia, Maryland, New York, Massachusetts, Vermont, and Maine. It is apparently secure in Wisconsin, Pennsylvania, Missouri, Arkansas, Alabama, South Carolina, and North Carolina and is not ranked or currently under review by Ohio. This species occurs at generally low densities over a very broad range. Population sizes of this plant have decreased significantly primarily because of the extensive root digging for commercial sale. Although various regulations are in effect to protect this species (including CITES listing), populations continue to decline because of noncompliance with these regulations and insufficient enforcement.

*Panax quinquefolius* is known to occur within Thacker Hollow, Lusk Creek Canyon Ecological Area, Lusk Creek Canyon Zoological Area, Lusk Creek Wilderness Area, Bulge Hole Ecological Area, Jackson Hollow Ecological Area, LaRue-Pine Hills/Otter Pond Research Natural Area, Burke Branch Research Natural Area, and Double Branch Hole Ecological Area among other areas on the Forest. This plant grows in rich woods, and low mesic woods. On the Shawnee National Forest, populations have been over-collected by illegal root-diggers. Population totals rarely exceed one or two dozen young plants. In Illinois, *Panax quinquefolius* is documented in 84 of 102 counties and is likely present in more (Anderson et al. 1993). Numerous non-native species threaten the various habitats that this species occurs in. This project would have beneficial impacts to this species where controlling or eradicating non-native species would occur. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs very infrequently at the project site. Some of this habitat may be termed marginal. Because of the frequent management and high likelihood of intentional human disturbance, it is highly doubtful that we would encounter this species in the project area.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Panax quinquefolius* this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats. This species is easy to identify, if it were to be found at the project site, it would have likely already been recorded.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Panax quinquefolius* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**16. *Rhexia mariana* (Maryland meadowbeauty)**

*Rhexia mariana* is a rhizomatous perennial herb of the southeastern United States. It reaches

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its northwestern range limit in southern Missouri and Illinois where it is occasionally found in wet meadows, around ponds, and in seep springs. This species is known from a few scattered southern Illinois locations including Kickasola Cemetery Barrens Ecological Area (Schwegman 1969), Dean Cemetery West Ecological Area (Schwegman 1969), Cretaceous Hills Ecological Area and Burke Branch Research Natural Area, all in Pope County. It was found August 12, 2011 by Jack Deaton on the bank of an acid creek (coming off of a coal mine) in Saline County south of Carrier Mills. It is also known from a few locations in northern Illinois. In 2001, Paul Marcum found it in Williamson County on private property.

The Nature Conservancy gave this species a Global Heritage Status Rank of G5 in 1985 (NatureServe 2018). It is presumed extirpated in New York, critically imperiled in Massachusetts, Pennsylvania, and West Virginia, apparently secure in Kentucky, secure in Virginia and North Carolina, and is not ranked or currently under review by New Jersey, Delaware, Maryland, the District of Columbia, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, Kansas, Missouri, Illinois, Indiana, and Michigan. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat is extremely marginal at best. This species is readily identifiable and noticed even by persons that cannot distinguish many of the native plant species. If this species occurs at Oakwood Bottoms, it would have been documented by now – and could still possibly be found in the future.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Rhexia mariana* this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Rhexia mariana* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**17. *Scleria pauciflora* (Fewflower nutrush)**

*Scleria pauciflora* is a small rush in the sedge family known from dry soil, in woods, and on bluffs. It appears common in the southeastern United States but becomes rare at its northern range limit. There are two varieties in Illinois: *S. pauciflora* var. *pauciflora* and *S. pauciflora* var. *caroliniana* (Mohlenbrock 2014). This species blooms in Illinois from June to September.

The Global Rank of G5 was assigned by The Nature Conservancy in 1984 and last reviewed in 2002 (NatureServe 2017). *Scleria pauciflora* is listed as critically imperiled in Texas, West Virginia, Michigan, Delaware, Rhode Island, Massachusetts, and Ontario, Canada; imperiled in

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Illinois, Ohio, and Pennsylvania; vulnerable in Arkansas, Indiana, and Maryland; apparently secure in Mississippi and North Carolina; and secure in Virginia. It is either not ranked or under review by Kansas, Missouri, Oklahoma, Louisiana, Alabama, Georgia, South Carolina, Florida, Tennessee, Kentucky, District of Columbia, New Jersey, Connecticut, New Hampshire, and New York. It also occurs in Cuba and Puerto Rico. Overall threats include its vulnerability to forest succession and development.

In Illinois, this species occurs in Henry, Iroquois (Rick Phillippe July 25, 2001) Kankakee (Marianne Hahn and Den Dritz on July 19, 2002; Dan Busemeyer and Rick Phillippe on July 26, 2002; Paul Marcum et al. on August 9, 2002; both sites in sandy areas) Lee (J.B. Long on July 17, 1958) and Will (sand prairie by Rick Phillippe on June 16, 2005) Counties in northern Illinois, and in Hardin (at Keeling Hill South EA by Lawrence Stritch, Elizabeth Shimp, and Jody Shimp on June 15, 1991, Johnson, Massac (in private fields, found by John Schwegman on June 30, 2004), Pope (Fink Sandstone Barrens EA by Jody Shimp and Lawrence Stritch on August 7, 1992; Hayes Creek Watershed, 1 mile south of Belle Smith Springs EA by Lawrence Stritch on July 26, 1981; found at Dean Cemetery East Ecological Area by C. Giedeman on July 9, 1991; at Dean Cemetery West EA – Klondike Spring - by Jody Shimp, Bob Lindsay and Kari Foster on July 22, 2004; at Cretaceous Hills EA, azotus field, by John Schwegman on June 16, 2004 and Elizabeth Shimp, John Schwegman, and Martha Schwegman on May 30, 2007; Kickasola – old field barrens – J. Shimp, B. Lindsay, and K. Foster on July 22, 2004), Union, and Williamson (on Crab Orchard National Wildlife Refuge by Eric Ulaszek on July 4, 1983) Counties in southern Illinois. There is also a Randolph County citation north of the Shawnee National Forest at Rockcastle Creek by Randy Nyboer on July 13, 2010. This species is not known to occur within the Oakwood Bottoms area although some potential habitat could be possible at the project site, although highly unlikely – the Oakwood Bottoms area is managed annually and that disturbance in the drier sites would not normally be conducive to this species.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Scleria pauciflora*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Scleria pauciflora* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**18. *Stenanthium gramineum* (Eastern featherbells)**

***Stenanthium gramineum*** is a bulbous perennial herb that occurs in moist woods, floodplains, meadows, and streambanks from Texas east to Florida north to Pennsylvania, Michigan, and Illinois. It is scattered in the southern ½ of Illinois where it

*Oakwood Bottoms HREP*

occurs in mesic floodplain forest and upland forests. In southern Illinois it is historically known from Gallatin, Jackson, Johnson, Massac, Pope, Pulaski, and Union counties. It is historically known from 13 counties in Illinois but is determined to be extant with 8 remaining populations in only 7 counties (Phillippe 2004d). Populations known to occur on Shawnee National Forest managed lands are 1 population in each of Gallatin and Johnson counties and 2 in Pope County (Phillippe 2004d). It generally blooms from June to August (Mohlenbrock 2014).

*Stenanthium gramineum* is widespread but infrequent throughout its range. The Nature Conservancy assigned this species the rank of G4G5 in 1995. It is critically imperiled in Illinois, Indiana, Oklahoma, Mississippi, Pennsylvania, and Maryland, is imperiled in Ohio and Kentucky, and is listed as vulnerable in North Carolina, West Virginia, Arkansas and Louisiana. It is apparently secure in Virginia, however it is extirpated from the District of Columbia. It is currently not ranked or under review in Texas, Alabama, Georgia, Florida, South Carolina, Tennessee, and Missouri. Michigan lists it as an exotic (NatureServe 2017). Primary threats in Illinois include creek bank erosion, road construction, and trampling by equestrian use (Edgin 2002).

It is documented from rich mesic floodplains on the Forest. It is known from an unprotected area in a gravel wash in an intermittent stream in Gallatin County (horse trail going through colony), along the edge of a pond in Jackson County (not relocated in 2002), a gravel wash area in Ferne Clyffe State Park (not relocated in 2002), at Grantsburg Swamp in Johnson County (Mark Basinger and Elizabeth Shimp on May 2, 1994), at Mermet Lake in Massac County (not relocated in 2002 and feared extirpated) (Edgin 2002), near Bay Creek at Bell Smith Springs (Bob Edgin on July 21, 2002), and in a mesic forest at Burke Branch Research Natural Area in Pope County, and a floodplain forest in Pulaski County. It is known from at least 7 counties north of the Forest. This species is not known to occur within the Oakwood Bottoms area although some potential habitat could occur infrequently at the project site if it were left undisturbed. Some of this habitat may be termed marginal at best and highly unlikely for this species to occur there.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Stenanthium gramineum*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Stenanthium gramineum* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**19. *Styrax americanus* (American snowbell)**

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***Styrax americanus*** is a branched shrub reaching up to 3 meters in height. It is known from the Southeastern United States, north in the Mississippi Embayment to Illinois and Indiana. In Illinois it occurs primarily in southern floodplain forests and swamps although there is a population in northern Illinois in Kankakee County and central Illinois in Wabash and Clinton Counties (USFS, NRCS 2017). NatureServe (2017) also lists this species for Crawford, Hamilton, Lawrence, Wayne, and White Counties but literature was not available for those counties at the time of this writing. In Illinois it blooms from April to May (Mohlenbrock 2014).

The Nature Conservancy assigned this species the rank of G5 in 1985 (NatureServe 2017). It is listed as critically imperiled in Oklahoma; imperiled in Illinois; vulnerable in Indiana, Kentucky, Virginia, and North Carolina; and not ranked or under review in Texas, Louisiana, Arkansas, Missouri, Mississippi, Tennessee, Alabama, Georgia, Florida, South Carolina, District of Columbia, and New Jersey. In southern Illinois it is known from Alexander (private property; roadside swamp found by Steve Hill June 23, 1999), Jackson, Johnson (private at Heron Pond; Grantsburg Swamp Ecological Area by Mark Basinger on May 2, 1994), Massac (private at Fort Massac), Pope (private at Round Pond), and Union (private) Counties in swampy woods. It is also on private property in Pulaski County. This species is not known to occur within the Oakwood Bottoms area although some marginal habitat may occur at the project site.

#### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Styrax americanus*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

#### **Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Styrax americanus* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

#### **20. *Synandra hispidula* (Guyandotte beauty)**

***Synandra hispidula*** is a biennial mint (herb) occurring in a few of the southeastern states. It reaches its northwestern range limit in southern Illinois in rich mesic forests in Jackson and Williamson counties. This species generally grows in a restricted habitat of dense shade, often in cool, moist places, usually at the bases of deep, wooded ravines. Its thin shallow root system is found immediately below the detritus layer of thick leaf litter. In Illinois this species generally flowers from May to June (Mohlenbrock 2014).

Range-wide, threats to *Synandra hispidula* include land-use conversion, habitat fragmentation, and forest management practices. The Global Rank assigned by The Nature Conservancy in

1988 is G4. It is known from only 10 states. It is critically imperiled in North Carolina, West Virginia, Illinois and Alabama, imperiled in Virginia and Tennessee, and vulnerable in Indiana. It is apparently secure in Kentucky. It is currently not ranked or under review in New Jersey and Ohio (NatureServe 2019).

In Illinois, it is known in Jackson County from a State Park and from private land (listed as Fern Rocks Nature Preserve and Devil's Den) and in Williamson County from US Fish & Wildlife managed land. Sites managed by Forest Service include the unprotected sites north of the Natural Bridge and two other sites in the Cave Valley/Cedar Creek area (near Silvey Pond) within Jackson County. Site descriptions at Cave Valley/Cedar Creek seem to indicate that this species tends to prefer the upper reaches of stream terraces with generally a northern aspect. Nepalese browntop is prominent at these areas and threatens this species in its habitat.

Management recommendations include isolation from trail construction, not allowing trampling to occur, no removal of the canopy layer, no logging (selective or clearcut), and no alteration of deer populations in the areas where *Synandra hispidula* occur (Moran 1986). Deer may act as dispersal agents most likely evolving with this species; plants are often observed browsed by deer and research has shown that the seed germinate readily upon artificial scarification (Moran 1986). This project would have beneficial impacts to this species by controlling or eradicating the aggressive Nepalese browntop. This species is not known to occur within the Oakwood Bottoms area although some extremely marginal potential habitat occurs infrequently at the project site. The high disturbance rate of this area does not lend to the habitat requirements of this species.

### **Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Synandra hispidula*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

### **Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Synandra hispidula* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

## **21. *Trillium viride* (Green trillium)**

***Trillium viride*** is a perennial rhizomatous herb with stems reaching up to 45 cm tall. Its range is southwestern Illinois and east-central Missouri. It is restricted to Illinois to the extreme western and southern counties, where it has been found in varied habitats: forested bottomlands, talus slopes, blufftops, and prairies. In southern Illinois it is known

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from Jackson (historic), Union, and Williamson (historic) counties. Further north it is historically known from Franklin, Macoupin, and Pike counties. It is presently known from Adams and St. Clair counties (Herkert and Ebinger 2002). It generally blooms from April to May (Mohlenbrock 2014).

This species was given a global rank of G4G5 by The Nature Conservancy on May 4, 1984 (NatureServe 2019). It is presumed extirpated in Michigan, is not ranked or is under review in Missouri, and deemed imperiled in Illinois. This species is known from the Pine Hills field station area and environs on the Forest. This species is not known to occur within the Oakwood Bottoms area although some potential habitat occurs infrequently at the project site. Some of this habitat may be termed marginal at best.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Trillium viride*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Trillium viride* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**22. *Triphora trianthophora* (nodding pogonia)**

***Triphora trianthophora*** is a perennial orchid occurring in the eastern half of the United States and adjacent Canada. It is scattered in the state of Illinois historically known in at least 19 counties, however, it appears that locations are historical or where only one to very few plants have been found. In southern Illinois it is known from Alexander (Horseshoe Lake Nature Preserve), Johnson (Heron Pond Nature Preserve), Jackson (near Lake Kinkaid – Ketzner 1988), Saline (on the Shawnee National Forest just west of the P & E Land and Water Reserve), and Union (private property) Counties in rich woods. It is also known just north of Jackson County at Swayne Hollow Nature Preserve in Randolph County. In Illinois it generally blooms from August to October (Mohlenbrock 2014).

NatureServe (2018) assigned this species a Global Ranking of G3G4 in 2000 (last reviewed 2002). The species is highly threatened by land-use conversion, habitat fragmentation, and forest management practices. In Ohio, threats include drying of forest humus from logging, trampling, and compacting of forest floor, and over-collecting (NatureServe 2018). *Triphora trianthophora* is listed as possibly extirpated in Pennsylvania and the District of Columbia; critically imperiled in Ontario, Canada, Nebraska, Maine, Vermont, Massachusetts, New Jersey,

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Connecticut, Delaware, Maryland, Virginia, and Michigan; imperiled in Oklahoma, Louisiana, Mississippi, Georgia, South Carolina, North Carolina, West Virginia, Ohio, New York, Wisconsin, and New Hampshire; and vulnerable in Iowa, Illinois and Florida. It is not ranked or is under review in Texas, Kansas, Missouri, Arkansas, Indiana, Kentucky, Tennessee, and Alabama. This species is not known to occur within the Oakwood Bottoms area although some marginal potential habitat occurs infrequently at the project site. It is highly unlikely that this species occurs here, it is most probable that it would have emerged by now but the area is extremely disturbed with the intentional fluctuations of water and that the drier lands continually are also continually mowed and disturbed.

**Environmental Impacts:**

Alternatives 1 and 2 should have no direct or indirect short-term or long-term negative impacts on known individuals or populations of *Triphora trianthophora*; this species is not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor is it known from immediate adjacent land with similar habitats.

**Cumulative Impacts:**

Cumulative impacts for all alternatives would be comparable to the environmental impacts. *Triphora trianthophora* is not known to occur in the project area. Since there will be no known environmental impacts to this species, there will be no cumulative impacts to analyze for. These cumulative impacts take into account past, proposed, present and reasonably foreseeable future actions taken by the agency or others.

**Summary of Appendix 2 RFSS Plants**

The above 22 RFSS plant species are known from Jackson County but are not known to occur within the Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project site nor are they known from immediate adjacent lands. However, potential habitat does occur for each of these species. The potential habitat varies from small infrequent areas to edges of the project area. This area has been looked at by several botanists and Forest employees and none have found any of these 22 species yet, although it could potentially happen.

Without direct or indirect short-term or long-term impacts, there will be no cumulative impacts to analyze for. This takes into consideration the past, proposed, present and reasonably foreseeable future actions taken by the agency or others. If any of these species is found prior to or during project implementation, the species will be avoided as much as possible and the project can proceed.



9 SPECIES OF VIABILITY CONCERN AND MANAGEMENT INDICATOR SPECIES

**Oakwood Bottoms Greentree Reservoir  
Habitat Rehabilitation and Enhancement Project**

Hidden Springs-Mississippi Bluffs Ranger District, Shawnee National Forest  
Jackson County, Illinois  
August, 2020

**Introduction and Proposed Management Action**

This species review includes effects determinations for forest animal species with viability concerns (SVC) (SNF Plan 2006, Appendix H). These site specific effects are determined, in part, using information located in 1) the Programmatic Biological Opinion for the Shawnee National Forest Plan (BO) signed by the U.S. Fish and Wildlife Service (FWS) on December 13, 2005; 2) the Shawnee National Forest Programmatic Biological Assessment for the Forest Plan Revision (BA) dated September 6, 2005; and 3) Chapter 3 of the Final Environmental Impact Statement for the 2006 Forest Plan.

The purpose of this species review is to identify the likely effects of the proposed actions in the Oakwood Bottoms Greentree Reservoir (OBGTR) Habitat Rehabilitation and Enhancement (HREP) project area to SVC and Management Indicator Species (MIS) animals for the Forest to ensure their continued existence.

The U.S. Army Corps of Engineers, St. Louis District (USACE) is preparing a Feasibility Report with Integrated Environmental Assessment for implementation of the Oakwood Bottoms HREP. The primary goal of this ecosystem project is to restore and improve the quality and diversity of bottomland hardwood forest and wetland ecosystem resources. The draft feasibility report presents a detailed account of the planning, engineering, construction details, and environmental considerations.

The need for this project is described fully in the draft feasibility report, and only briefly summarized here. Bottomland hardwood forest and emergent wetland have been identified as habitat needs for the Middle Mississippi River (MMR) (Theiling et al., 2000). Existing bottomland hardwood forest is currently in a state of decline with over 30% of the forest composition consisting of oak species that are over the age of 80 years. Without action, the existing bottomland hardwood forest quality would continue to decline impacting the overall forest health and resiliency. In addition, the continued degradation would lead to conversion of forest cover to swamp scrub/shrub translating to a quantitative loss of habitat (resting, foraging, and breeding) for migratory and resident wildlife. Furthermore, floodplain forest within the MMR have been adversely affected due to past land human-induced actions and have resulted in loss resource for resident and migrant wildlife. The need for this project is now since there is an opportunity to restore a diverse suite of habitats that have all been identified as a habitat need for the MMR within the project area. The restoration of ecosystem structure and function at the project would contribute to restoring ecological health and resiliency of

the Upper Mississippi River System. Refer to the main report for more details.

### **The Proposed Action**

The proposed Federal action involves selecting and recommending one of the alternatives for implementation to restore ecosystem structure and function at Oakwood Bottoms HREP. The proposed Federal action for this species review includes the feasibility level of design for the proposed project. For more details on the quantities for the feasibility level of design, see Appendix B – Civil Engineering of the feasibility report produced by USACE.

USACE is preparing to implement a HREP project at Oakwood Bottoms. The project area is approximately 4,500 acres of bottomland hardwood forest and emergent wetland habitat (Figure 1).

The proposed project involves degrading some berms within the project area that were unsystematically constructed beginning in the 1940s and continuing until approximately 20 years ago. Berm degrading would allow for more efficient and effective water transport throughout the project area. The water transport would be improved by the construction of a pump station to the Big Muddy River allowing the project area to be drained and filled more quickly during the spring and fall, respectively. Approximately 4,500 acres of bottomland hardwood forest would benefit from degrading berms and the construction of a pump station. Additionally, 69 acres would be reforested where the degraded berms occurred. Approximately, 94 acres of emergent wetland habitat would be improved with the degrading of several berms and the placement of new water control structures, allowing these emergent wetland areas to be effectively managed with water finite water level manipulations (Figure 2).

### **Details of the proposed project**

#### **Berm Degrades**

Approximately 94 acres of existing berms would be degraded and material would be placed into the adjacent borrow ditches from which it was originally excavated. The former berm area would then be reforested. This activity would restore natural contours to the landscape and would be considered wetland restoration and would have major effect on wetlands. Overland sheet flow and water conveyance would be restored through this action and the forested wetland community health would improve.

#### **Structure Replacement**

A total of 62 water control structures in the project area would be removed and a total of 30 water control structures that would be upgraded for additional capacity.

#### **Moist Soil Unit Enhancement**

Approximately 94.0 acres of wetland would be enhanced within the project area. The emergent wetlands currently do not have acceptable infrastructure to drain and fill at times appropriate for moist-soil unit management. Berm degrades and upgrading water

control structures will improve management capability. Disking of the area will reset the vegetation from non-desirable species. Additionally, approximately 24 acres would be cleared in Unit 14 to expand existing moist-soil unit habitat for migratory waterfowl. As this unit is currently managed as moist-soil, conflicting management dates exist. For example ideal time to remove water from a moist-soil unit is typically June to July to facilitate the growth of moist-soil vegetation. Whereas for a greentree reservoir management scenario, the ideal time to remove water is before the start of the growing season, which is typically early to mid-March in this area, to limit the impacts of the water on the trees. Since Unit 14 is already being managed for moist-soil, the trees present would not survive long term.

### **Pump Installation**

A pump would be installed within the lower portion of the greentree reservoir. This pump would allow the Forest Service the capability to remove water from the interior of the Grand Tower Levee when water levels in the Big Muddy River are higher than the gravity drains, preventing normal draining. The pump station would sit atop a concrete pad that is approximately 40 feet by 40 feet.

### **Reforestation**

Approximately 94 acres where berm degrades would occur, berms would be reforested with tree plantings. The species use would be dictated by the surrounding forest community and the specified by the Forest Service Silviculturist but would primarily consist of Oak (*Quercus* spp.) such as cherrybark oak and pin oak.

### **Berm Creation**

Approximately 6 acres of additional berms would be constructed. New berms will consist of placement of embankment to create berms for subunit boundaries. Embankment will be brought up to the required elevation so the subunits can be flooded to an elevation which allows for the needed depth of inundation within the subunits and to provide adequate freeboard to prevent overtopping of the berms. Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1 Vertical to 3 Horizontal to allow for maintenance equipment to traverse the slopes. 1 Vertical to 4 Horizontal slopes were assumed for quantities. The slope of the side slopes will be further refined when geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the new berm footprints along with grubbing of the foundation soils. New berm footprints will be stripped and the stripped material will be stockpiled for use as final dressing on the new berms. The new berms and other associated disturbed areas will be seeded.

Of this area, approximately 5 acres would need to be cleared of trees. The additional berms would serve as connecting pieces to the modified unit layout.

### **Berm Raises**

Berm raises will consist of adding additional embankment to existing berms to bring them up to the required elevation so the subunits can be flooded to an elevation which allows for the needed depth of inundation within the subunits and to provide adequate

freeboard to prevent overtopping of the berms. Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1 Vertical to 3 Horizontal to allow for maintenance equipment to traverse the slopes. 1 Vertical to 4 Horizontal slopes were assumed for quantities. The slope of the side slopes will be further refined when geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the berm raise footprint along with grubbing of the foundation soils. Berms will be stripped prior to raising and the stripped material will be stockpiled for use as final dressing on the raised berms. The berm raise footprint and other associated disturbed areas will be seeded. The total area of the berm raises would be approximately 55 acres. Of the 55 acres, approximately 14 acres currently have trees of various sizes and species growing upon them that would require removal in order to place additional material.

### **Channels to Increase Water Conveyance**

Channels, both new and with modifications, are required to increase water conveyance. Construction of channels will consist of excavation of material to the required depth and grades. Channels will vary in dimensions but will be either v-shaped or trapezoidal. Dimensions will be based on the required capacity of the channel. Assumptions were made for the dimensions of the channel based on output from the hydraulic model and engineering experience. Slopes will be 1 Vertical to 3 Horizontal or flatter to meet operation and maintenance requirements. Trees and other large diameter vegetation will be removed within the footprints along with grubbing of the foundation soils. This area includes approximately 5 acres of trees that are of various size and species. New channel footprints will be stripped and the stripped material will be stockpiled for use as final dressing. The channels will not be seeded as they will natural vegetate as seeding and other organic material is deposited when the management units are flooded.

Of this area, approximately 5 acres would need to be cleared of trees.

### **Timber Stand Improvement**

Timber Stand Improvement would consist of approximately 1,608 acres of forest improvement activities such as midstory removal, crop tree release, and gap formation with the use of cutting and herbicide. Planting of hard mast trees such as oaks would also be done to improve the forest composition and replace the hard mast seed source where oaks have been overtaken and are no longer existent. These activities have already completed the NEPA process and coordinated with the USFWS through the 2018 Big Muddy River Bottoms Habitat Improvement II Project, the 2014 Phase Two and Three-Oakwood Bottoms Moist Soil Openings and Shallow-Watered Areas Project and the 2013 Oakwood Bottoms Moist Soil Openings Mastication Project, which outline the proposed methods for understory thinning. This includes removing existing understory and mid-story vegetation up to 9 inches in diameter and grinding stumps to retard re-sprouting.

### **Forest Openings**

Forest openings currently exist in Units 11, 16, 19, 20, and 21 however they cannot be managed due to down woody debris. The woody debris would be removed and

additional removal of early successional scrub/shrub and non-desirable mid-story trees (i.e. TSI) would occur. This area would be approximately 57 acres total. These areas would be maintained to allow emergent wetland via mowing and potentially light disking.

Within Units 3, 5, 10, 10N, openings would be maintained and expanded to allow for emergent wetland management via mowing and potentially light disking. Within these openings downed trees, early successional scrub/shrub, and non-desirable mid-story trees (i.e. TSI) would be removed. Large desirable trees would be avoided or maintained unless it is necessary to remove in order to accomplish project objectives. Overall overstory tree removal would be minimal in these units. The area would be approximately 50 acres in size.

Within the Otter Slough area in Unit 25, historic aerial imagery from 1984 shows that the area was more open and did not have a closed canopy. The forest inventory data further supports this by showing that the stands within the open area in the photo are younger in age class than surrounding areas. A polygon was drawn in ArcMap using the aerial photo to determine the acreage of the previously open area, which is approximately 25 acres. Within this area, early successional scrub/shrub and non-desirable mid-story trees (i.e. TSI) would be removed. Large desirable trees would be avoided or maintained unless it is necessary to remove to accomplish project objectives. Overall removal of overstory trees would be minimal in this unit. Overall, this proposed action would fit under the 2013 Oakwood Bottoms Moist Soil Openings Mastication Project which has already completed the NEPA process and has been coordinated with the USFWS.

Feasibility Report with Integrated Environmental Assessment  
Oakwood Bottoms HREP

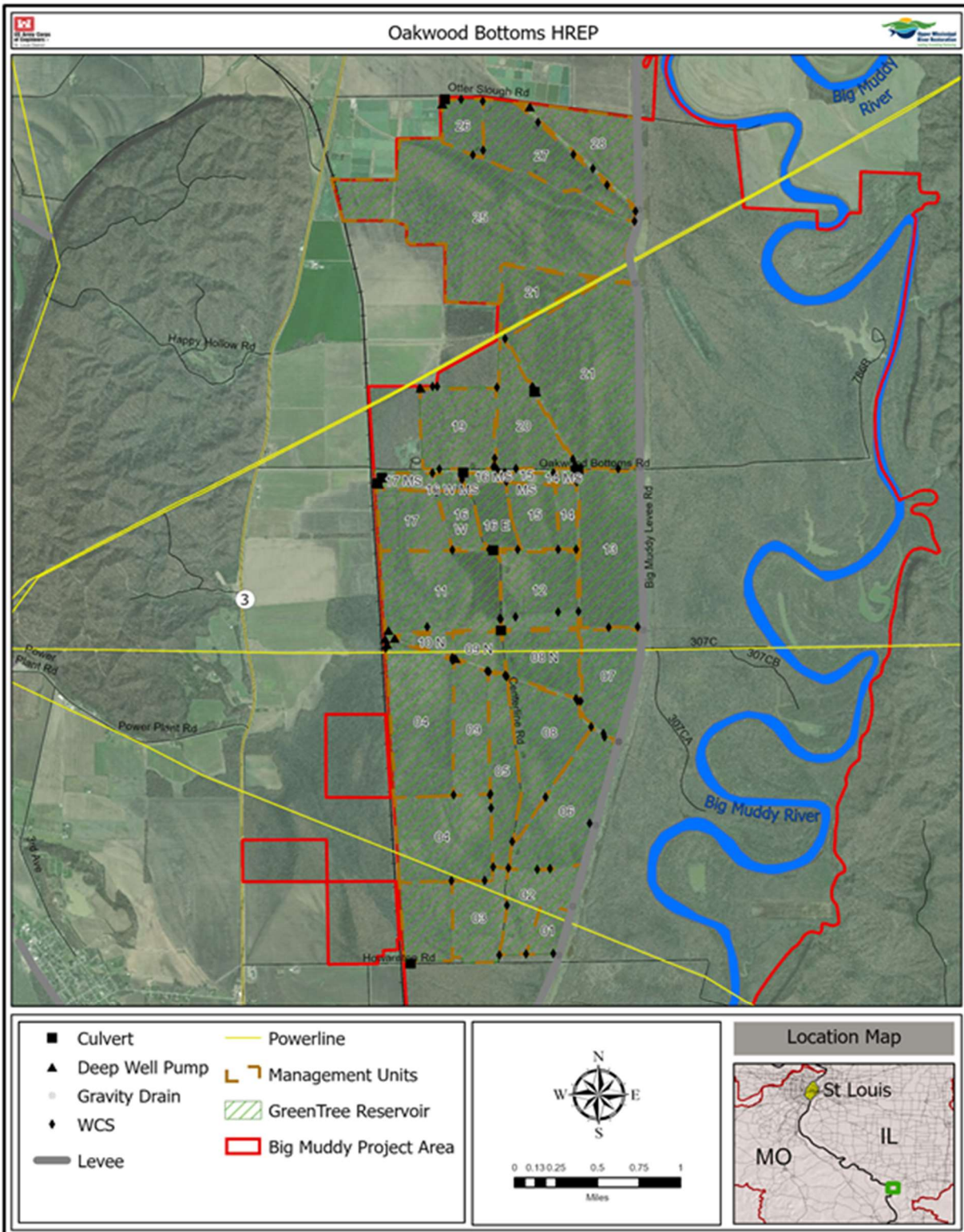


Figure 1. Oakwood Bottoms HREP project area with existing infrastructure.



Feasibility Report with Integrated Environmental Assessment  
Oakwood Bottoms HREP

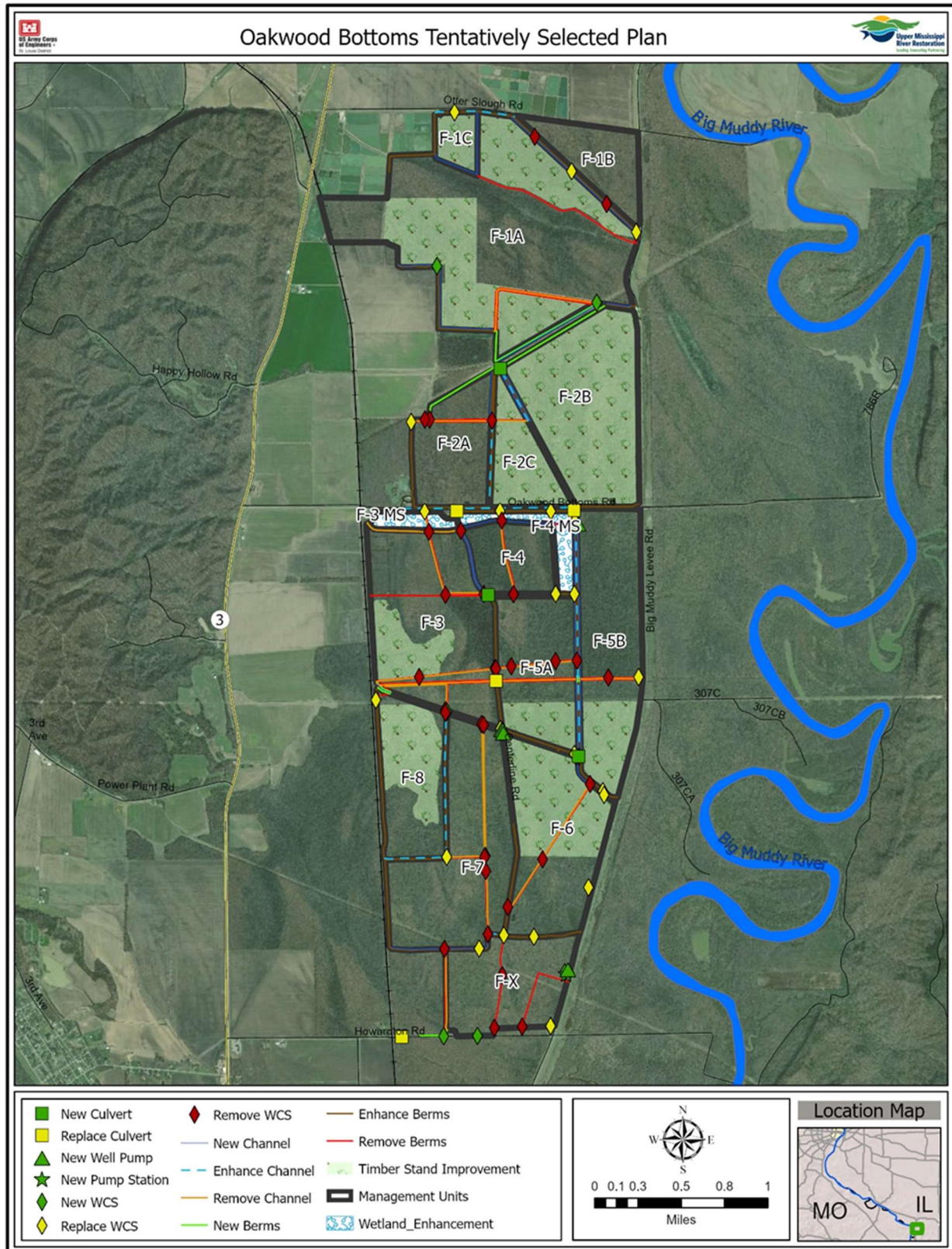


Figure 2. Proposed Plan at Oakwood Bottoms HREP

**Design Criteria**

Design criteria have been built into the proposed actions so as to meet Forest Plan standards and guidelines and comply with the Forest Plan BO; this to reduce the likelihood of incidental take and prevent adverse effects to federally and state-listed bat species, while also protecting other wildlife such as migratory birds and associated habitat.

5. All tree clearing resulting from the USACE proposed action will occur during the inactive season from November 16 to March 31 unless negative presence/probable absence survey results were obtained for the action area through appropriate surveys approved by the U.S. Fish and Wildlife Service (USFWS).
6. If the project is located in a karst area and will involve construction methods that may cause deep ground disturbance, the USACE will require a cave search be conducted to determine if any caves are present in the action area that would be considered suitable habitat for bats and/or are currently or formerly used by listed bats.
7. During clearing, dead trees, split trees, trees that have cavities, and trees with exfoliating bark would be favored for retention where possible.
8. Indiana bat habitat assessments and presence/absence surveys would be conducted as needed per USFWS requests.

**Species Reviewed**

The SVC list is from the Forest Plan (USFS 2006, Appendix H) and the MIS list from the Forest Plan. Table 1 lists the SVC and MIS species by animal class.

The species below are evaluated for the proposed project based on habitat associations and documented distribution. We give a brief description of distribution and habitat, documented occurrences and threats or limiting factors. This information will not be repeated throughout the document. The NatureServe website (<http://www.natureserve.org>) contains detailed information on each of these species.

Table 1. Species of Viability Concern and MIS designation

Scientific Name	Common Name	Habitat	Occurrence
<b>Fish</b>			
<i>Forbesichthys agassizii</i>	Spring cavefish	Subterranean but found in mouths of springs and cave streams and is occasionally washed out into streams or pools when water table is high. Swims in tiles or springs at night, hides under stones in spring runs by day. Spawns in underground waters. (USDA Forest Service-Species Literature Summary SVE 2003a, and NatureServe 2020).	Known from LaRue-Pine Hills RNA and from multi-locations in Clear Creek and Big Creek and one location in Lusk Creek (Bear Track Hollow) watersheds on the Forest (USDA Forest Service-Species Literature Summary SVE 2003a and NatureServe 2020).
<b>Amphibians</b>			
<i>Hyla versicolor</i>	Gray treefrog	Upland and bottomland hardwood forests under bark, in cavities, and	Known from the Forest in all counties (USDA Forest Service-Species



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		under leaves; and shallow woodland ponds and lakes, swamps, and potholes (USDA Forest Service-Species Literature Summary SVE 2003b).	Literature Summary SVE 2020b).
<b>Birds</b>			
<i>Colinus virginianus</i>	Northern bobwhite (also MIS)	Openland and forest-edge (USDA Forest Service-Species Literature Summary SVE 2003c)	Known to occur on the Forest in all counties (Shawnee National Forest Monitoring Reports 2005-2008).
<i>Helmitheros vermivorum</i>	Worm-eating warbler (also MIS)	Riparian areas, hardwood forests, and woodlands (USDA Forest Service-Species Literature Summary SVE 2003d)	Known to occur on the Forest in all counties (Shawnee National Forest Monitoring Reports 2005-2008).
<i>Hylocichla mustelina</i>	Wood thrush (also MIS)	Forested wetlands, riparian areas, hardwood and mixed forests, woodlands (USDA Forest Service-Species Literature Summary SVE 2003e)	Known to occur on the Forest in all counties (Shawnee National Forest Monitoring Reports 2005-2008).
<i>Icteria virens</i>	Yellow breasted chat (also MIS)	Shrubland, bottomland hardwoods (USDA Forest Service-Species Literature Summary SVE 2003f).	Known to occur on the Forest in all counties (Shawnee National Forest Monitoring Reports 2005-2008).
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	Riparian areas, open woodlands with scattered trees (NatureServe 2020).	Known resident in the Shawnee Hills and common migrant and resident in the Big Muddy and Mississippi River floodplains (Robinson 1996).
<i>Scolopax minor</i>	American woodcock	Riparian areas, hardwood/mixed forests, grasslands, old fields, and woodlands (NatureServe 2020).	Known to occur in all counties where habitat is present (Robinson 1996).
<i>Piranga olivacea</i>	Scarlet tanager (MIS)	Mature deciduous woodland, deciduous/mixed swamp, and floodplain forests (NatureServe 2020).	Known to occur in all counties where habitat is present (Robinson 1996).
<b>Mammals</b>			
<i>Lutra canadensis</i>	Northern river otter	Primarily along rivers, ponds, marshes, and lakes in wooded areas(USDA Forest Service-Species Literature Summary SVE 2003g)	Known to occur on the Forest in all counties (USDA Forest Service-Species Literature Summary SVE 2003g).

SVC animal species that may potentially be affected by this project were examined using the following existing available information:

1. Reviewing the list of SVC and MIS animal species known or likely to occur on the Shawnee National Forest, and their habitat preferences.
2. Consulting the most current element of occurrence records (EOR's) animal species as maintained by the Illinois Department of Natural Resources-Natural Heritage Program, and supplied to the Forest.
3. Reviewing the results of any past field surveys that may have been conducted in or near the project area.

Based on their known or likely occurrence within or in close proximity to the affected project areas, the following species were selected for further effects analysis:

**Gray treefrog**

Gray treefrogs inhabit various kinds of wooded and forested habitats and may occur on the ground or more often in shrubs or trees. Inactive individuals may be in tree holes, under bark, in rotten logs, under leaves, and under tree roots. Breeding sites include shallow woodland ponds and marshes, puddles, ponds in forest clearings, swamps, bogs, and many other kinds of permanent or temporary, natural or human-created waters lacking a significant current (NatureServe 2020). The gray treefrog is an amphibian species commonly occurring throughout most of the Shawnee National Forest. Gray treefrogs could be present in or adjacent to the proposed project area.

Implementation of the proposed project is expected to result in no or only minor localized direct effects to gray treefrog in the form of direct mortality from felling operations.

**Wood thrush**

This neo-tropical migratory bird inhabits deciduous or mixed forests with a dense tree canopy and a fairly well-developed deciduous understory, especially in more mesic sites. Bottomlands and other rich hardwood forests constitute prime habitats. Nests usually are placed in a crotch or are saddled on a branch of a shrub, sapling, or large tree (NatureServe 2020).

In the short-term, implementation of proposed project is not expected to impact individuals within the project area. In the long-term, restoring hardwood species as part of the dominant canopy should benefit wood thrush populations in the project area.

**Red-headed woodpecker**

This bird species is a common migrant and summer resident, fairly common to uncommon winter resident to Illinois. During the breeding season, the species prefers open woodlands, savannas, woodland edges, and parks but is also known to inhabit cleared woodlands and bottomland forests. This woodpecker feeds on acorns, nuts, and corn which it frequently stores, and sometimes insects. The numbers have fluctuated greatly over the past two centuries, perhaps due in part to the variation in mast. Competition with European starlings for nesting cavities and the loss of nesting trees and oak woodlands are considered factors causing population declines in the past century (NatureServe 2020).

Implementation of the proposed action is likely to improve the quality of habitat post-project implementation. Implementation of the proposed project is expected to improve habitat quality at least into the near future. Implementing project activities will reduce the number of trees per acre, which will create good quality. The establishment of mature hard-mast producing hardwoods is an important food source for red-headed woodpeckers.

**Northern river otter**

Although the Big Muddy River and Mississippi River occur adjacent to and within close proximity to the proposed project area, there have been no observations of River otters

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within the proposed project area. Suitable habitat does not exist within the proposed project area since the area is artificially flood and drained. No good food source exists within Oakwood Bottoms. If otters inhabit areas nearby or travel through the project area, they would more than likely move out of the area. Once the project is completed, there still would not be any suitable habitat within Oakwood Bottoms.

**Scarlet tanager**

Scarlet tanagers breed in deciduous forest and mature deciduous woodland, including deciduous and mixed swamp and floodplain forests and rich moist upland forests, often where oaks predominate. They are most common in areas with a relatively closed canopy, a dense understory with a high diversity of shrubs, and scanty ground cover, and are able to breed successfully in relatively small patches of forest. Breeding occurs in various forest stages but is most frequent in mature woods. Nests are placed in trees (commonly oaks), usually well out on limbs, 2-23 meters above ground (NatureServe 2020). Scarlet tanagers diet includes moths, bees, caterpillars, larvae of gall insects, wood- and bark-boring beetles, click and leaf-eating beetles, crane flies, and all stages of gypsy moths (NatureServe 2020).

Implementation of the proposed action is likely to improve the quality of habitat post-project implementation. Implementation of the proposed project is expected to improve habitat quality at least into the near future. Implementing project activities will reduce the number of trees per acre, which will create good quality.

**Required Mitigation**

The Forest Plan contains standards and guidelines to protect habitat, to sustain species diversity, to conserve biological diversity, and to ensure the sustaining of populations for the majority of the federal listed and proposed, as well as regional sensitive species known or likely to occur on lands within the administrative boundary for the Shawnee National Forest. These standard and guidelines would apply when and where needed during various stages of project implementation. These standards and guidelines were reviewed by the US Fish and Wildlife Service during formal consultation for the Amended Forest Plan. In the event any new information is derived that would indicate the presence of other federally listed or region sensitive species within the project activity area, project activities would be temporarily suspended, the information would be analyzed, and a determination rendered for any additional project stipulations or mitigation deemed necessary to protect species viability across the Forest.

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Prepared by:

/s/ Andy Chappell  
Andy Chappell  
Wildlife Biologist

August 3, 2020  
Date

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10 RFSS PLANTS EVALUATED

The Shawnee National Forest has 95 RFSS (sensitive or Regional Forester’s Sensitive) plants and recorded on its lands (Appendix A), 50 of which have been documented in Jackson County where the project area is located. An additional 11 of those species have been documented in adjacent counties (including counties in Missouri). These 61 RFSS plants were considered for the initial evaluation of this project. The following table lists those RFSS plants, as well as the counties where they are found on the Forest:

<b>Table 6. Regional Forester’s Sensitive Species (RFSS) Plants documented as present or historically present in Jackson County, Illinois or in adjacent counties, where there are lands managed by the Shawnee National Forest. Counties indicated as: A = Alexander, G = Gallatin, H = Hardin, Ja = Jackson, Jo = Johnson, M = Massac, P = Pope, S = Saline, U = Union, and W = Williamson.</b>											
Scientific Name	Common Name	A	G	H	Ja	Jo	M	P	S	U	W
1. <i>Actaea rubifolia</i>	Appalachian bugbane		X	X	X	X	*	X	X		
2. <i>Amorpha nitens</i>	shining false indigo	X						X	X		
3. <i>Asplenium bradleyi</i>	Bradley’s spleenwort				X				X	X	
4. <i>Asplenium resiliens</i>	blackstem spleenwort	*			*					X	
5. <i>Botrychium biternatum</i>	sparselobe grapefern	X			X	X		X	X	X	
6. <i>Bromus nottowayanus</i>	Nottoway Valley brome				X			X			
7. <i>Carex alata</i>	broadwing sedge				X		X	X			
8. <i>Carex bromoides</i>	brome-like sedge				X	X		X			
9. <i>Carex cherokeensis</i>	Cherokee sedge	X		X	X					X	
10. <i>Carex decomposita</i>	cypress-knee sedge		*			X		X		X	
11. <i>Carex gigantea</i>	giant sedge				X	X	X			X	
12. <i>Carex intumescens</i>	greater bladder sedge	X			X	X		X	X		
13. <i>Carex lupuliformis</i>	false hop sedge	*		*	X	*	*	*	*	*	
14. <i>Carex nigromarginata</i>	black edge sedge	X	X	X	*			*		X	
15. <i>Carya pallida</i>	sand hickory	X		X						X	
16. <i>Chelone obliqua</i> var. <i>speciosa</i>	red turtlehead	*	*		X	X	*	*		*	
17. <i>Cirsium carolinianum</i>	soft thistle			*	*			X	X		
18. <i>Cynoscadium digitatum</i>	finger dogshade				X						
19. <i>Cypripedium parviflorum</i> var. <i>pubescens</i>	greater yellow lady’s slipper	X	X		X	X	X	X		X	X
20. <i>Dichanthelium jorii</i> **	variable panic grass					X	*			X	
21. <i>Dichanthelium ravenelii</i>	Ravenel’s rosette grass			X				X		*	
22. <i>Dirca palustris</i>	Eastern leatherwood				X	X		X			
23. <i>Dodecatheon frenchii</i>	French’s shootingstar				X	X		X	X	X	X
24. <i>Dryopteris goldieana</i>	Goldie’s woodfern				X	X		X		X	X
25. <i>Eleocharis wolfii</i>	Wolf’s spikerush		X		X		X	X	X	X	
26. <i>Eryngium prostratum</i>	creeping eryngo	X					X	X	X		X

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**Table 6. Regional Forester's Sensitive Species (RFSS) Plants documented as present or historically present in Jackson County, Illinois or in adjacent counties, where there are lands managed by the Shawnee National Forest. Counties indicated as: A = Alexander, G = Gallatin, H = Hardin, Ja = Jackson, Jo = Johnson, M = Massac, P = Pope, S = Saline, U = Union, and W = Williamson.**

Scientific Name	Common Name	A	G	H	Ja	Jo	M	P	S	U	W
27. <i>Gentiana alba</i>	plain gentian	X			X		X	X			
28. <i>Glyceria arkansana</i>	Arkansas mannagrass	X			X	X				X	
29. <i>Heteranthera reniformis</i>	kidneyleaf mudplantain	*						X		*	
30. <i>Hexalectris spicata</i>	spiked crested coralroot			X	*			*			
31. <i>Hottonia inflata</i>	American featherfoil				X	X		X	X	X	
32. <i>Huperzia porophila</i>	rock clubmoss	*	X		X	X	*	X	X	*	
33. <i>Hydrastis canadensis</i>	goldenseal	X	X	X	X	X	X	X	X	X	X
34. <i>Hydrolea uniflora</i>	one-flowered false fiddleleaf	*			X	X	*				
35. <i>Juglans cinerea</i>	butternut	X		X	X	X	X	X	X	X	X
36. <i>Lilium superbum</i>	Turk's-cap lily		X	X	X	X		X			X
37. <i>Lonicera dioica</i> var. <i>glaucescens</i> **	limber honeysuckle				X						
38. <i>Lonicera flava</i>	yellow honeysuckle				X			X			
39. <i>Malus angustifolia</i>	southern crab apple				*		X	X			
40. <i>Melothria pendula</i>	Guadeloupe cucumber	X		X	X	X	X	X		X	
41. <i>Oxalis illinoensis</i>	Illinois woodsorrel			X	X			X			
42. <i>Panax quinquefolius</i>	American ginseng	X	X	X	X	X	X	X	X	X	
43. <i>Penstemon tubaeflorus</i>	white wand beardtongue	X			*	*		*	*	*	
44. <i>Phemeranthus parviflorus</i>	sunbright					X	X	X		X	
45. <i>Plantago cordata</i>	heartleaf plantain				X	X		X	X		
46. <i>Poa alsodes</i>	grove bluegrass				*			*			
47. <i>Polytaenia nuttallii</i>	Nuttall's prairie parsley		X		X	X		X	X		
48. <i>Quercus montana</i>	chestnut oak	X	X	X	X				X	X	
49. <i>Rhexia mariana</i>	Maryland meadowbeauty				X		X	X			X
50. <i>Sagittaria australis</i>	longbeak arrowhead							X		*	
51. <i>Scleria pauciflora</i>	fewflower nutrush			X		X	X	X		X	X
52. <i>Spiranthes vernalis</i>	spring lady's tresses				X	X	*	X	X	*	X
53. <i>Stenanthium gramineum</i>	eastern featherbells		X		X	X	*	X		X	
54. <i>Styrax americanus</i>	American snowbell	X			*	X	X	X		X	
55. <i>Synandra hispidula</i>	Guyandotte beauty				X						X
56. <i>Torreyochloa pallida</i>	pale false mannagrass				X					X	
57. <i>Trichomanes boschianum</i>	Appalachian bristle fern		X	X		X		X		X	
58. <i>Trifolium reflexum</i>	buffalo clover		*		X	X					
59. <i>Trillium viride</i>	wood wakerobin									X	X
60. <i>Triphora trianthophora</i>	threebirds	X			X	X			X	X	
61. <i>Vaccinium stamineum</i>	deerberry			X				X			

\* species extirpated in that county

\*\* Mohlenbrock's (2014) nomenclature; all other nomenclature from the PLANTS database (2018)

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