

DRAFT ENVIRONMENTAL ASSESSMENT WITH DRAFT FINDING OF NO SIGNIFICANT IMPACT

**Wappapello Lake Forestry Management
U.S. Army Corps of Engineers
Wappapello Lake Project
Wayne and Butler Counties**



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1.0. INTRODUCTION

1.1. Introduction

The U.S. Army Corps of Engineers (Corps), Mississippi Valley Division, St. Louis District, has prepared this Environmental Assessment (EA) to evaluate the environmental impacts of the proposed Forest Stand Improvement (FSI) actions in the forested areas surrounding Wappapello Lake. These FSI actions would be in accordance with the Wappapello Lake Master Plan. Wappapello Lake land managers propose to implement FSI strategies at the Wappapello Lake project. Forest Stand Improvement actions are needed in order to create conditions that promote the regeneration of oaks and other desirable trees in the understory. The lack of recent FSI actions at Wappapello Lake has degraded the health of the available forest stands, leading to reduced forest community diversity, reduced forest species diversity, reduced wildlife species diversity, and an increase in invasive species.

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended and the Council on Environmental Quality's Regulations (40 Code of Federal Regulations §1500-1508), as reflected in the USACE Engineering Regulation 200-2-2. Impacts on environmental resources are discussed in detail in this Environmental Assessment and summarized in the Finding of No Significant Impact (FONSI). The FONSI is unsigned and may only be signed after comments received as a result of this public review have been considered. A signed FONSI is required before implementation of the action could occur.

1.2. Authorizations

Federal laws provide that land and water areas of U. S. Army Corps of Engineers (Corps) water resource projects, constructed for the primary purposes of flood risk reduction management, navigation and/or power, shall be administered to encourage and develop collateral uses, such as recreation, conservation of fish and wildlife resources and other purposes in the public interest. The St. Francis Basin Project, which includes Wappapello Dam and Lake, was authorized for flood control by the Flood Control Act, approved 15 June 1936 (Overton Act), and amended by subsequent Flood Control Acts. Development and use of flood-control reservoir areas for recreational and related purposes was authorized by Section 4 of the Flood Control Act, approved 22 December 1944, and amended by the Flood Control Act approved 24 July 1946 and Section 209 of the Flood Control Act of 1954, approved 3 December 1954. The Fish and Wildlife Coordination Act, enacted 10 March 1934, as amended, provides authority for making project lands of value for wildlife purposes available for management by interested federal and state wildlife agencies. Section 7(a)(1) of the Endangered Species Act of 1973, as amended directs all federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for listed species.

1.3. Location

Wappapello Lake is located on the Upper St. Francis River in southeastern Missouri. The dam site lies 22 miles southeast of Greenville, MO, one mile southwest of Wappapello, MO, and 16 miles northeast of Poplar Bluff, MO. Although most of the lake is in Wayne County, a small southern portion extends into Butler County (Figure 1). Wayne and Butler Counties are in southeastern Missouri. St. Louis, MO, is approximately 144 miles to the north, Memphis, TN, approximately 159 miles to the south, Carbondale, IL, 127 miles northeast, Cape Girardeau, MO, 59 miles northeast and Jonesboro, AR, 97 miles southwest. The proposed FSI activities would take place in forested areas around the lake.

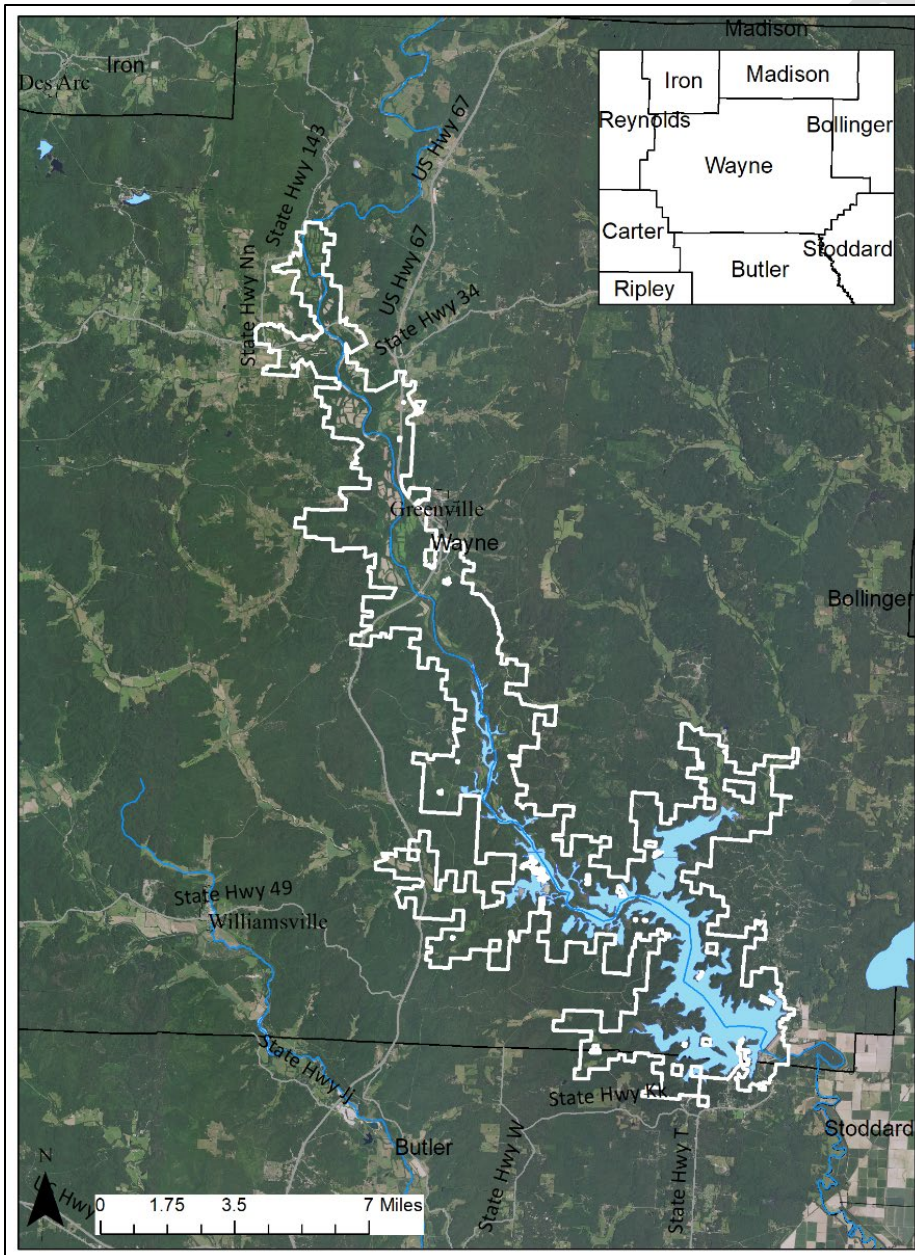


Figure 1. Map of the Wappapello Lake Project Area.

1.4. Purpose and Need

The purpose of the project is to enhance the Federally-managed forest communities at the Wappapello Lake project. The existing forest community types at Wappapello Lake have degraded over time and, without intervention, would continue to degrade. Undesirable conditions include low regeneration rates of desirable tree species, low species diversity, suboptimal species composition, and invasive species encroachment. Forest management intervention is needed to create conditions that promote the regeneration of oaks and other desirable trees in the understory and midstory. Having multiple age stages of oaks and other desirable species ensures long-term sustainability of the important upland and bottomland forest habitat types. Without a plan to address these undesirable forest conditions, there would be further degradation in the variety of forest community types available, reductions in tree species diversity, suboptimal tree species composition, loss of soil water-filtering capabilities, and a reduction in the usefulness of the forest community types to provide for wildlife.

1.5. Objectives

The goal of the proposed action is to:

- Restore and maintain forest diversity, health, and sustainability on Federal lands, in order to provide native vegetation communities sufficient to support wildlife habitat, including that used by federally listed species.
- Prescribe forest management techniques which support federal management goals and objectives for wildlife and fish management through Best Management Practices (BMPs).
- Reduce the impacts of invasive species on natural communities.

Objectives of these FSI actions are to manipulate the vegetation in the forested areas at the Wappapello Lake project in order to:

- Improve tree species diversity by removing trees and other vegetation that compete for resources with desirable tree species.
- Create a favorable composition of these desirable tree species.
- Increase the intensity of light in contact with the ground to promote regeneration of desirable tree species.
- Improve the structure of the forest stand by manipulating age-classes and density of trees.
- Preserve all dead snags for wildlife habitat except for those that pose a safety risk.
- Remove invasive and undesirable tree and herbaceous vegetation species.

2. TENTATIVELY SELECTED PLAN AND ALTERNATIVES

2.1. Alternatives Evaluated

This section describes the alternatives proposed to address the objectives laid out in Section 1.5. The action alternative would propose to conduct FSI actions at several stands at the Wappapello Lake project. As required by NEPA, the “No Action” alternative is also evaluated. The expected consequences of the two alternatives will be discussed in Chapter 3.

Alternative 1: No Action Alternative

The “No Action” alternative is the alternative for which no federal actions would be carried out to achieve FSI objectives. This alternative represents the baseline or reference against which to describe environmental effects of the action alternative. Under this scenario, the Wappapello Lake project would continue to perform its operation and maintenance responsibilities (including invasive species removal) but would not carry out any FSI actions.

Alternative 2: Forest Stand Improvement Implementation

The action alternative includes FSI actions intended to meet the objectives laid out in Section 1.5 in order to improve the quality of forest habitat at the Wappapello Lake project. These FSI actions would include soil disturbance and tree removal. The FSI actions would occur on 12 large forest compartments which are split into 73 smaller forest stands (Table 1, Figure 2). The full area of the project is 20,861 acres but only 6,431 acres would be treated with selective tree cutting. The commercial timber harvest would be used in 50 of the 67 stands. A priority list was drafted to rank each stand to maximize habitat productivity over the span of the project. Table 1 shows the planned year in which work would take place. In Table 1, the tree removal acreage identifies the area within which timber harvest activities would take place. The action alternative would include soil disturbance in the form of access and equipment staging area creation and use. Existing access roads and open areas would be used when possible, however, some new areas would be created as well (Figure 3). New access roads would be designed to avoid sensitive areas and minimize soil disturbance.

Section 2.2 - Development of Forest Stand Improvement Alternative describes the tree harvest process in greater detail.

Table 1. Description of the area and treatment for each forest stand. Tree removal identifies the area within which selective tree cutting would take place.

Compartment	Stand	Area (Acres)	Tree Removal (Acres)	Harvest (Y/N)	Proposed Treatment*	Year of Harvest
3	3.1	212	0	N	EF ¹	N/A
3	3.2	717	209	Y	STS ² ,TSI ³ ,EF	2
3	3.3	494	67	Y	STS,TSI,EF	5
3	3.4	499	197	Y	STS,TSI,EF	9
3	3.5	638	12	Y	STS,TSI,EF	12
3	3.6	580	179	Y	STS,TSI	16
4	4.1	504	183	Y	STS,TSI	1
4	4.2	400	256	Y	STS,TSI	4
4	4.3	354	160	Y	STS,TSI	7
4	4.4	217	148	Y	STS,TSI	10
4	4.5	127	85	Y	STS,TSI	15
4	4.6	262	146	Y	STS,TSI,EF	18
6	6.3	166	85	Y	STS, TSI	1
6	6.7	208	184	Y	STS, TSI	2
7	7.1	104	91	Y	STS,TSI	3
7	7.2	219	187	Y	STS,TSI	6
7	7.3	178	88	Y	STS,TSI,EF	8
7	7.4	191	0	N	EF	N/A
7	7.5	229	107	Y	STS,TSI	11
7	7.6	498	237	Y	STS,TSI,EF	13
7	7.7	353	157	Y	STS,TSI	15
7	7.8	398	180	Y	STS,TSI	17
7	7.9	142	0	N	TSI	N/A
8	8.2	344	168	Y	STS, TSI EF	3
8	8.3	245	40	Y	STS, TSI EF	4
8	8.4	194	51	Y	STS, TSI EF	5
9	9.1	223	81	Y	STS,TSI,EF	2
9	9.2	306	78	Y	STS,TSI,EF	5
9	9.3	224	97	Y	STS,TSI	7
9	9.4	293	137	Y	STS,TSI,EF	10
9	9.5	87	47	Y	STS,TSI	12
9	9.6	163	76	Y	STS,TSI	14
9	9.7	201	95	Y	STS,TSI	16
9	9.8	86	43	Y	STS,TSI	18
9	9.9	238	185	Y	STS,TSI	19
10	10.01	453	214	Y	STS,TSI	1
10	10.2	479	127	Y	STS,TSI,EF	4
10	10.3	366	0	N	TSE,EF	8

10	10.4	99	65	Y	STS,TSI	9
10	10.5	301	65	Y	STS,TSI,EF	12
10	10.6	207	0	N	EF	N/A
10	10.7	696	304	Y	STS,TSI,EF	14
10	10.8	245	0	N	EF	N/A
10	10.9	257	23	Y	TSI, EF	16
10	10.1	163	100	Y	STS,TSI,EF	19
10	10.11	268	117	Y	STS,TSI,EF	20
10	10.12	417	0	N	TSI	N/A
11	11.1	477	235	Y	STS,TSI	3
11	11.2	374	41	N	STS,TSI	6
11	11.3	292	10	N	STS,TSI	8
11	11.4	103	0	N	STS,TSI	11
11	11.5	227	163	Y	STS,TSI	13
11	11.6	165	0	N	STS,TSI	17
12	12.1	176	0	N	HTR ⁴	N/A
12	12.2	280	0	N	TSI	N/A
12	12.3	323	62	Y	STS,TSI	3
12	12.4	278	74	Y	STS,TSI	7
12	12.5	134	0	N	TSI	N/A
12	12.6	324	54	Y	STS,TSI	11
12	12.7	370	0	N	HTR	N/A
12	12.8	289	5	N	STS,TSI	15
12	12.9	280	0	N	HTR	N/A
14	14.1	216	182	Y	STS,TSI	1
14	14.2	159	34	Y	STS,TSI	4
14	14.3	294	71	Y	STS,TSI,EF	6
14	14.4	359	129	Y	STS,TSI,EF	10
14	14.5	121	35	Y	STS,TSI,EF	14
15	15.1	431	147	Y	STS,TSI,EF	2
15	15.2	329	80	Y	STS,TSI,EF	5
15	15.3	150	14	Y	STS,TSI,EF	9
15	15.4	185	24	Y	STS,TSI,EF	13
15	15.5	280	0	N	HTR	N/A
Total		20,861	6431			

¹EF-Edge Feathering, ²STS-Single Tree Selection, ³TSI-Cut and Spray Timber Stand Improvement, ⁴HTR-Hazard Tree Removal

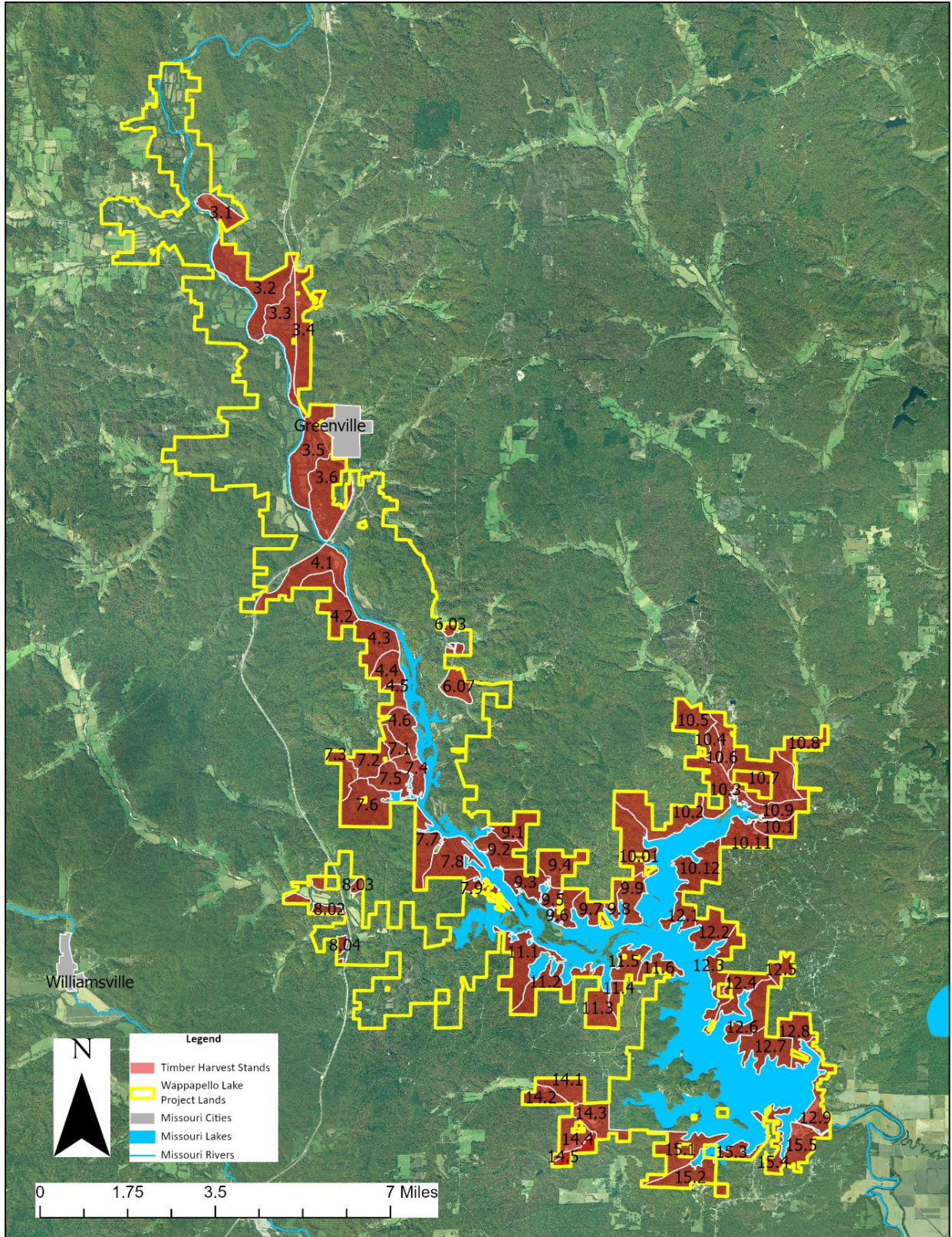


Figure 2. Location of the forested areas around Wappapello Lake where the FSI activities would take place over 20 years.

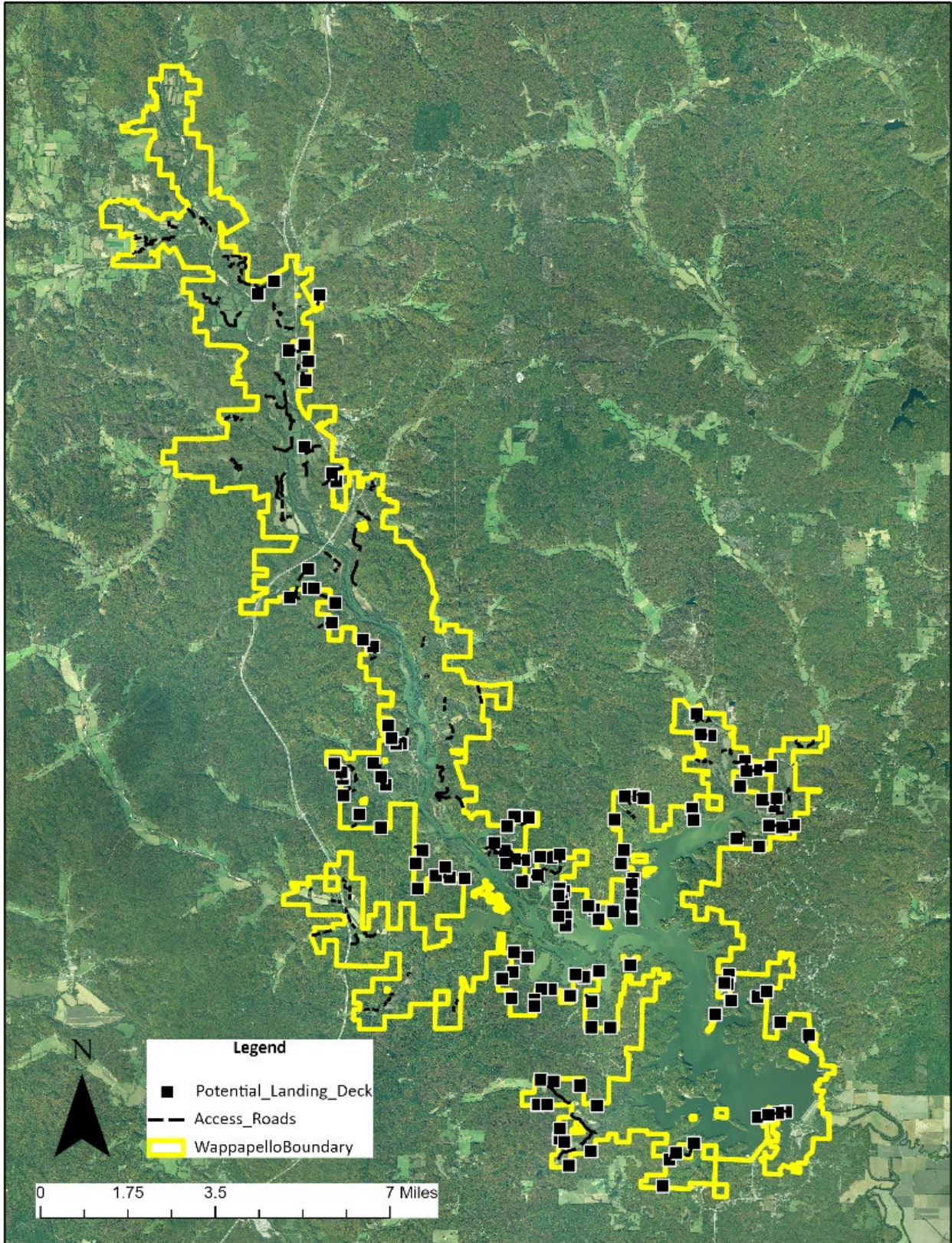


Figure 3. Location of existing access roads and landing areas.

2.2. Development of Forest Stand Improvement Alternative

The following forest management treatments are proposed to achieve the project objectives: uneven-aged, even-aged, and intermediate forest management. The treatment used at each forest stand would be based on the existing conditions at that stand.

2.2.1. Intermediate Treatments

Forest Stand Improvement is broadly defined as an intermediate treatment. It is further defined as any treatment or tending designed to enhance growth, quality, vigor, and composition of the stand. The following are typical intermediate type treatments that are included within the proposed action:

2.2.1.1. Overstory Tree Removal (Thinning)

Overstory trees are removed to reduce competition to desirable hardwoods and to promote oak regeneration. Oak cannot regenerate and survive under low light levels and are often shaded out of the forest without some type of overstory disturbance. Trees to be removed are undesirable overstory hardwood species consisting primarily of elm, honey locust, sassafras, boxelder, and hackberry.

2.2.1.2. Midstory Tree Removal (Thinning)

Thinning is a tree removal treatment performed to reduce stand density of trees. It is utilized primarily to increase growth, enhance forest health, or reduce potential mortality. Thinning of existing forest resources would be a focus of many of the prescriptions in order to establish early successional and oak-hickory forest communities and support uneven-age management of maple-ash-elm forest communities. Invasive species would be removed from the understory and midstory before midstory thinning of trees would take place.

2.2.1.3. Crop Tree Release

A desirable tree species (e.g. oaks, black cherry, hickories) in good health and form would be selected as a crop tree. Then, each tree that is touching or directly competing with the selected tree is felled or girdled. The crop tree can be released on one side (a light cut) or on up to all four sides (very heavy cut). Trees to be removed in the crop tree release are undesirable overstory hardwood consisting primarily of elm, honey locust, sassafras, boxelder, and hackberry. A crop tree release can be crucial when trying to develop slow growing species like oak, giving them the space and sunlight they need to reach a dominant position in the canopy.

Desirable tree species would include shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), mockernut hickory (*Carya tomentosa*), black cherry (*Prunus serotina*), cherrybark oak (*Quercus pagoda*), pin oak (*Quercus palustris*), shingle oak (*Quercus imbricaria*), white oak (*Quercus alba*), and northern red oak (*Quercus rubra*). Undesirable tree and other plant species would include red maple (*Acer rubrum*), silver maple (*Acer saccharinum*), sweetgum (Liquidambar spp.), elm (*Ulmus spp.*), hackberry

(*Celtis spp.*), any poorly formed midstory trees, regardless of species. Invasive plants that have become a problem in many of the stands include autumn olive (*Eleagnus umbellata*), multiflora rose (*Rosa multiflora*), bush honeysuckle (*Lonicera maackii*), Japanese honeysuckle (*Lonicera japonica*), and winter creeper (*Euonymus fortunei*).

The reduction in stocking would enhance the forest by meeting wildlife habitat and forest health objectives. An increase in open forest structure would enhance suitable foraging for various bat species. Individual tree removal would encourage wider variety of tree diameters while allowing for enhancement of desirable forest regeneration.

2.2.2. Tree Harvest Process:

Tree removal would be accomplished with mechanical methods over the 20-year period of FSI actions. Trees targeted for removal would include low quality, diseased, over-mature and/or undesirable tree species. The objective of the tree removal is for forestry stand improvement. The primary mechanism of removal would be by means of commercial timber harvesting within each stand. If commercial harvest is not feasible or available in a given year (due to no bids, etc.), tree removal would still take place via commercial tree removal contract, or other methods. Individual selection of single tree would be marked by USACE biologists/foresters and removal would be accomplished through means of a timber sale contract. Contractors would cut and harvest trees identified for removal through use of commonly used logging equipment like hand-held chainsaws, skidders, and mechanical cutters. Because the trees are being removed for FSI, there would be some trees identified for removal that would not be suitable for sale but the removal would benefit the goals and objectives of FSI.

The Operations Element would prepare the determination of availability for forest products to be sold on Wappapello Lake Project lands. The sale of forest products would be administered by the Real Estate Element, in accordance with ER 405-1-12. Minor sales may be accomplished by the Operations Project Manager on water resources development projects under the general guidance (ER 405-1-12) issued by the Real Estate Element. Determinations of availability would contain as a minimum:

- A statement of the purpose of the proposed sale.
- An estimate of the volume of the various products made available and the basis for the estimate.
- A statement on the accuracy of the estimate to serve as the basis for a lump sum sale (if forest products are intended to be sold on lump sum basis).
- A listing of Best Management Practices (BMPs) published by state forestry agencies would be included in the sales contract. Examples of BMPs include seasonal harvesting requirements, riparian protection zones, maximum log lengths, and allowable equipment size.
 - The terms & conditions in the Biological Opinion (BO) will be implemented.
- Mandatory implementation of all requirements of the USFWS Wappapello Lake Forest Stand Improvement Biological Opinion, dated 11 April 2023 (2023-0043677), including all Reasonable and Prudent Measures, Terms and Conditions, Conservation Measures, and Conservation Recommendations.

- Provisions for a final joint Operations Element-Real Estate Element compliance inspection before release of the contractor at completion of the contract, as required.

The single tree selection treatment would reduce the density/basal area within each stand. The amount of basal area reduction would be determined by existing stand conditions such as; tree stocking percentage, individual tree species health, and amount of desirable hardwood regeneration present. Black oak (*Quercus velutina*) and scarlet oak (*Quercus coccinea*) trees compose the majority of harvestable saw timber within the proposed treatment stands. A complex interaction of environmental stressors and pests contribute to the decline of oak in addition to biological maturity of individual trees. Specifically, oak decline has contributed to the widespread mortality of the red oak (*Quercus rubra*) species within the Ozark region over the past few decades. The red oak species would be targeted to reduce basal area, encourage desirable regeneration, and promote growth for intermediate size trees. White oak (*Quercus alba*) tree species are well distributed throughout their size classes. Tree removal within the white oak species group would be implemented to improve individual tree health while maintaining residual size class distribution within each diameter group, i.e. 10, 12, 14 inch, etc. Shortleaf pine (*Pinus echinata*) tree species groups within the treatment area would be thinned to promote growth of individual trees and improve overall forest health.

The reduction in stocking would enhance the forest to meet wildlife habitat and forest health objectives. An increase in open forest structure would enhance suitable foraging areas for various bat species. Individual tree removal would encourage wider distribution of tree diameters while allowing for enhancement of desirable forest regeneration.

Stand re-assessments or inventories would be utilized to monitor stand conditions post silvicultural treatments, as needed. Forest structural changes would allow an increase in light levels, thus increasing the understory growth of woody and herbaceous plants, in addition to individual mature tree growth. Tree regeneration surveys would be utilized to monitor the treatment effects on vegetation. The level of success would be determined through vegetation monitoring.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1. Physical Resources

3.1.1. Geology, Topography, and Soils

3.1.1.1. Geology

Wappapello Lake lies within the southeastern limits of the Salem Plateau section of the Ozark Plateau Physiographic Province (Missouri Department of Natural Resources, 2021). This province is frequently referred to as the Ozark Dome. The Ozark Dome refers to the eroded remnants of an ancient mountain range now known as the St. Francois Mountains which form the geological core of the highland dome. The Salem Plateau section contains most of the higher summits of the province. The underlying geology of the province include lower Paleozoic sedimentary rocks formations of Ordovician calcium and magnesium carbonates. Karst features like caves, springs and sinkholes are common in the province due to the fact that the carbonate rocks are soluble in groundwater. Surrounding the lake are moderately dissected outcrops of bedrock formations consisting of Ordovician cherty dolomite, interbedded finely grained dolomite of the Gasconade Formation, and sandstone and cherty and finely grained dolomite of the Roubidoux Formation.

Wayne County is geologically diverse with four distinct physiographic regions:

1. The St. Francois Mountains, which extend into the northwestern part of Wayne County and include several areas over 1,200 feet above sea level. Clark Mountain is the highest at over 1,400 feet above sea level,
2. The Patterson Basin, which is old valley fill material covered by a thin loess mantle,
3. The Salem Plateau, consisting of Ordovician age rocks, which covers most of Wayne County. It is an extensive land region surrounding the St. Francois Mountains,
4. The Mississippi River alluvial delta area, which is in the southeastern part of Wayne County, is primarily lowland produced by the Mississippi River during a previous era. It is level and made up of terraces and intra-terrace flatland. Swamps are predominant on the intra-terrace flatlands, unless they are drained. (Holbrook, 2005)

3.1.1.2. Topography

The topography of the lake is characterized by steeply sloping hills with dense forest cover. Smaller tributaries to the St. Francis River drain into the lake, cutting steep, narrow valleys into the bedrock. The level areas around the lake are typically cleared agricultural fields or other developed areas. The undeveloped level areas have grown into grassland or oldfields. The lake lies adjacent to the Southeastern Lowlands province, an area of flat, poorly drained land that occupies extreme southeastern

Missouri. To the immediate north of the lake lies the edge of the true Ozark Uplands, typified by the St. Francois Mountains which begin in Sam A. Baker State Park.

3.1.1.3. Soils

The USDA's WebSoil survey was used to describe the soil types found around Wappapello Lake (Natural Resources Conservation Service, 2021). The most abundant soil association at Wappapello Lake is that of the Clarksville-Fullerton-Lebanon series found on the cherty-stony uplands. They are developed from cherty limestones and occasionally interbedded sandstone and some shallow loess. The Clarksville is a cherty silt loam. It possesses a grayish brown cherty silt loam surface over a yellowish-brown cherty silt loam mid-layer with a light silty clay loam subsoil. The soil is excessively to moderately well-drained.

Soils of the Baxter-Dewleyville-Hagerston series are found on some gently to steeply sloping areas. These are red cherty soils developed from cherty limestone. The soils are similar to the above, being suited for forests, grassland, and orchards. Huntington silt loam occupies the first terraces of the bottomland. This is a deep, well-drained, silty alluvial soils. Enis soils may be found on the extreme bottomlands. These are similar to the above.

Alternative 1 – Passive Management (No Action; Future without Project Condition (FWOP))

In the FWOP condition, no FSI actions would be taken on the forested areas surrounding Wappapello Lake. The geological formations beneath Butler and Wayne Counties would not be altered from their present state in the FWOP condition. Soil types and soil composition at Wappapello Lake would not be altered. The overall topography of the area is unlikely to change from existing slope/relief of the land. Topography, Geology, and Soils would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

Similar to the No Action alternative, the FSI alternative would not permanently alter the topography, geology, or soils of the forest stands surrounding Wappapello Lake. The local relief and slope of the stands would remain the same as existing conditions. The underlying geology of Butler and Wayne Counties would not be altered from existing conditions. The FSI actions would not alter the soil types and composition in any way. Soil compaction could result from the use of vehicles and equipment during tree removal, but these impacts would be spread out over time and space as individual stands are treated. Existing access would be used when available to avoid unnecessary soil disturbance. Topography and geology would not be affected by the FSI alternative. Soils would be minorly, temporarily adversely impacted from disturbance caused by vehicle use during tree removal.

3.1.2. Land Use and Land Cover

Wayne County is primarily rural and wooded with much of the land owned and operated by the Corps of Engineers, Fish and Wildlife Service, Forest Service, Missouri Department of Natural Resources or Missouri Department of Conservation. These lands

all provide a variety of public recreation options. According to Missouri Department of Conservation woodland survey estimates, 78 percent (386,000 acres) of Wayne County is forested. Mark Twain National Forest covers a large part of Wayne County with 88,372 acres. Another 48,494 acres, mostly south of the lake, is located in Butler County. These woodlands are covered by oak-hickory, oak-pine, and eastern red cedar communities.

Approximately 45% (9,793 acres) of Mingo National Wildlife Refuge is located in Wayne County. The remainder of the refuge is located in adjacent Stoddard County. The refuge's boundary lies about one mile from Wappapello Lake Dam. The refuge contains the only remaining large tract of bottomland forest native to the Missouri Bootheel (15,000 acres). Mingo Wilderness is also located within the refuge. The refuge is important to the Wappapello area as it serves as a resting and feeding area for migratory birds. These birds spill over to Wappapello Lake providing hunting opportunities there.

Alternative 1 – Passive Management (No Action)

In the FWOP condition, the lack of Forest Stand Improvement would not alter the land use; it would remain as forest. Land uses at the Wappapello Lake Project would still be managed for public uses. The forest communities around the lake would not receive tree removal treatments but would still receive invasive species treatments in the FWOP condition. Land cover would include less invasive plant species as invasive treatments take place. The areas of forest land cover would remain forest, but the quality of the forest as habitat would be greatly reduced, leading to poor wildlife habitat. Land cover around Wappapello Lake would change to include less cover of invasive plants but also less cover of quality forest habitat, causing an adverse impact. Land use in the Wappapello Lake project as a whole would not change based on the lack of FSI improvements to the forested areas.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The FSI actions would not alter land use from existing land uses. Similar to the No Action alternative, the land cover would change slightly with the FSI alternative. The FSI actions would ultimately benefit the land cover through the creation of more diverse and healthy forest community types. Land use would not be affected by the FSI alternative, but land cover would benefit from the FSI alternative.

3.1.3. Prime Farmland

Approximately 25% of the Wayne County's land is in agriculture. Most of the agriculture land is in farms of 50 – 179 acres in size. About 44,900 acres in MDC's woodland survey of Wayne County, or 9% of the total acreage, meets the soil requirements for prime farmland. Most of this land is in the southern part, although there are scattered areas throughout the county. A recent trend in land use in some parts of the survey area has been the loss of prime farmland. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated. (Holbrook, 2005). USDA census data reports

that cropland use decreased between 1997 and 2012 while woodlands and pasture lands have increased slightly. Overall, there has been a slight drop in farmland totals.

Using the USDA's WebSoil Survey tool, the Wappapello Lake project boundary was used to examine for the presence of Prime Farmland (Natural Resources Conservation Service, 2021). The mapping tool shows the distribution of prime farmland overlapping with the area of interest, in this case, the Wappapello Lake Project Lands boundary (Figure 4). Of the portion of the area of interest that is in Butler County, approximately 0.4% is Prime Farmland. Of the portion of the area of interest that is in Wayne County, approximately 24.2% of the land is Prime Farmland.

Alternative 1 – Passive Management (No Action)

Some areas have plots of corn, wheat, and other crops to use as food for wildlife. Some plots are leased to farmers for commercial agriculture to the extent practicable and to maintain compatibility with the other authorized uses of the project. The Prime Farmland resource would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

Although roughly a quarter of the land in the Wappapello Lake boundary is Prime Farmland, the FSI alternative would not alter, disturb, or reduce the area of Prime Farmland in Butler and Wayne Counties. Prime Farmland would not be affected by the FSI alternative.

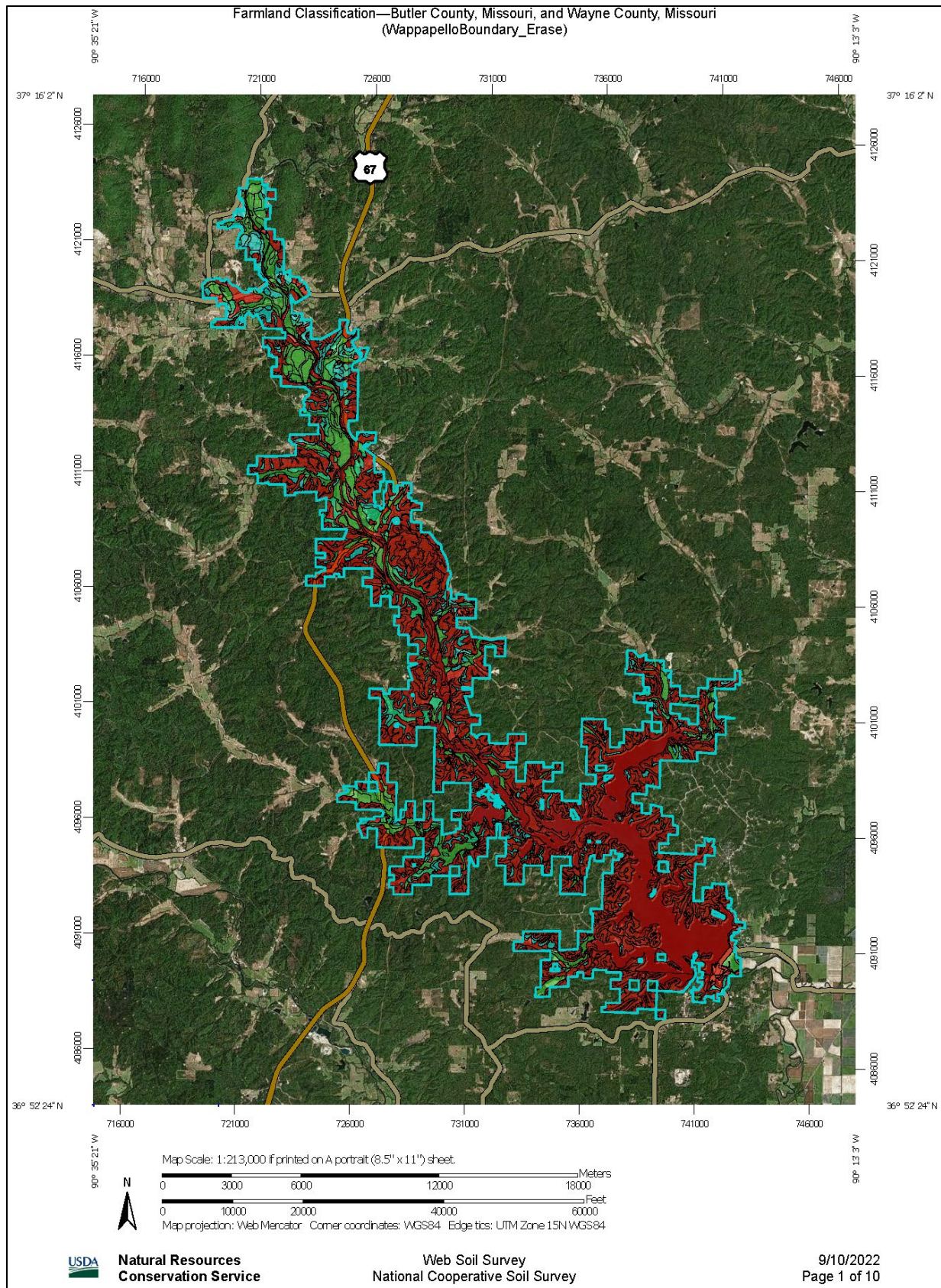
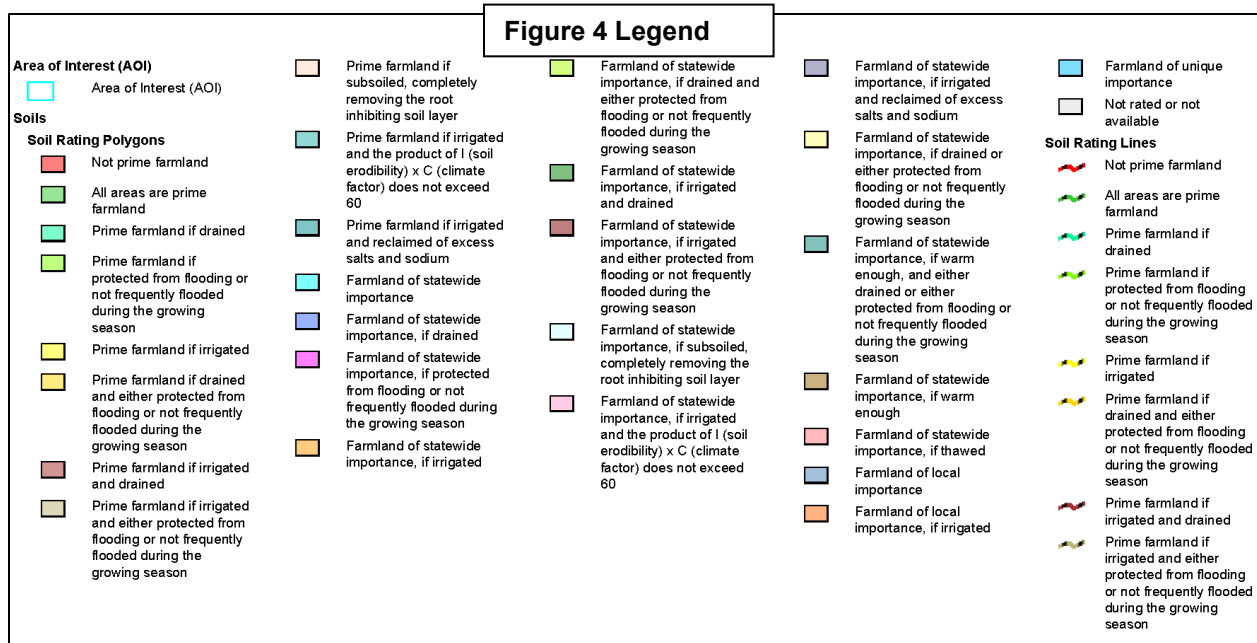


Figure 4. WebSoil Survey map of all areas of Prime Farmland near Wappapello Lake.



3.1.4. Noise

Inadequately controlled noise presents a risk for adverse impact to human and animals. Sound is measured in decibels (dB). A whisper is about 30 dB, normal conversation is about 60 dB, and a motorcycle engine running is about 95 dB. Noise above 70 dB over a prolonged period of time may start to damage your hearing. Loud noise above 120 dB can cause immediate harm to your ears. The U.S. Environmental Protection Agency (EPA) and the World Health Organization (WHO) recommend maintaining environmental noises below 70 dBA over 24-hours (75 dBA over 8-hours) to prevent noise-induced hearing loss. Furthermore, The National Institute for Occupational Safety and Health (NIOSH) has recommended that all worker exposures to noise should be controlled below a level equivalent to 85 dBA for eight hours to minimize occupational noise induced hearing loss (Occupational Safety and Health Administration, 2022).

Noise levels at the Wappapello Lake project would be characteristic of rural areas, but with a large contribution by recreational activities on and around the lake. Boating and vehicle traffic/use generate high noise levels, and large congregations of people can also contribute to higher noise levels. Compared to the surrounding rural area, the noise levels at the Wappapello Lake project would be expected to be greater than ambient levels during peak days of recreational use. These uses typically have noise levels in the range of 34-70dB (Figure 5).

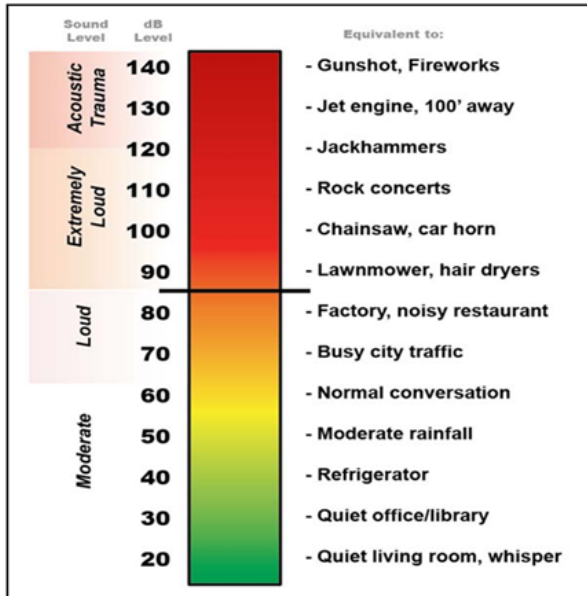


Figure 5. Examples of the sound level and decibel (dB) level of various sources.

Alternative 1 – Passive Management (No Action)

Recreation is one of the primary purposes/uses of Wappapello Lake, and USACE shall maintain recreational use areas for that purpose. Noise levels at the Wappapello Lake project would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

Noise levels would temporarily increase from ambient levels during the FSI actions. Equipment used to haul and move felled trees and the operation of chainsaws would create noise levels around 100 decibels in the immediate vicinity of the work. Best management practices would be used to reduce the impact to recreational visitors including quiet hours and work buffer zones. Noise levels would return to normal ambient levels following the work, leaving no permanent long-term noise impacts. Noise levels would be temporarily, minorly impacted by the FSI alternative.

3.1.5. Clean Water Act

Water Quality Standards (WQS) are the foundation of the Clean Water Act. Water pollution control programs are designed to protect the beneficial uses of the water resources of the state. Each state has the responsibility to set water quality standards that protect these beneficial uses, also called “designated uses.” Missouri waters are designated for various uses including aquatic life, wildlife, agricultural use, primary contact (e.g., swimming, water skiing), secondary contact (e.g., boating, fishing), industrial use, public and food-processing water supply, and aesthetic quality. These water quality standards provide the basis for assessing whether the beneficial uses of the state’s waters are being attained.

The Missouri Department of Natural Resources is responsible for setting water quality standards to protect designated uses (Missouri Department of Natural Resources, 2020). According to the 2020 Missouri 303(d) List, Wappapello Lake is listed under

Category 5 for Chlorophyll-a pollution from a nonpoint source. Category 5 is defined as having one discrete pollutant that has caused non-attainment with state water quality standards or other criteria. Category 5 waters are those that are candidates for the state's 303(d) List. The lake was first listed for this pollutant in 2020.

Alternative 1 – Passive Management (No Action)

Future water quality conditions are likely to change over time with contributions of pollutants from sources previously identified: lakeshore modifications, municipal point-source discharges, recreational pollution sources, crop production, urban runoff/storm sewers, and runoff from forest, grassland, and parklands. However, none of these sources would be expected to have an increased contribution to water quality pollution if the FSI actions are not carried out on the forested areas around Wappapello Lake. None of these pollution sources would increase or decrease in relation to the quality of the forest around Wappapello Lake. Water Quality would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The FSI actions would be in upland areas, limiting the amount of impact to the lake and streams in the project area. The FSI activities would not produce the pollutants identified/targeted by the 303(d) listings. Aside from chlorophyll, nutrients and mercury in fish tissue are common pollutants in large lakes. These pollutants are usually caused by urban and agricultural runoff. Pollutants in the form of herbicide drift/contamination are possible during invasive species control. However, all pertinent BMPs would be used to minimize the impact over-application, drift, and spills. Water Quality is not anticipated to be adversely impacted by the Forest Management alternative.

3.1.5.1. Section 404 Authorization

While some of the forested areas may be designated as forested/shrub wetland, this project does not propose to excavate or add fill to any area. No wetland habitat would be removed or destroyed because of the FSI activities. No Regulatory authorization is required because the project would be above the ordinary high-water mark of all waters and would not impact wetland habitat.

Furthermore, the Federal Clean Water Act, Section 404 (33 CFR Part 323.4 & 40 CFR Part 232.3), exempts normal established, ongoing silvicultural activities from the permitting process for discharges of dredged or fill material in wetlands, streams and/or other jurisdictional waters of the US (Appendix 3). However, fifteen (15) baseline provisions for forest road construction and maintenance in and across waters of the US (33 CFR Part 328.3 & 40 CFR Part 230.3) are mandated to qualify for the forest road exemption. The activities are part of an ongoing/established forest management effort within the Corps lake project that has strict adherence to BMPs relating to forest management activities, therefore, this exemption applies. The burden of maintaining silvicultural exemptions through historical activity, current activities and future plans falls on the landowner.

3.1.6. Air Quality

The Clean Air Act of 1963 requires the U.S. Environmental Protection Agency (EPA) to designate National Ambient Air Quality Standards (NAAQS). The USEPA has identified standards for six criteria pollutants: ozone, particulate matter (PM₁₀ = less than 10 microns; and PM_{2.5} = less than 2.5 microns in diameter), sulfur dioxide, lead, carbon monoxide, and nitrogen dioxide. The EPA Greenbook provides a list of which counties in Missouri are in nonattainment for these pollutant criteria. The project lies in Butler and Wayne Counties; both counties are in attainment for all pollutant criteria (U.S. Environmental Protection Agency, 2022).

Alternative 1 – Passive Management (No Action)

In the short-term, the air quality would not be adversely impacted via construction disturbance resulting from the FSI activities. However, the state of the forest stands around Wappapello Lake is not related to contributions of the six criteria pollutants. In the long-term, the air quality would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The FSI actions would involve the operation of equipment that would release emissions. This would result in a temporary minor impact to air quality. None of the proposed actions are expected to contribute substantially to the six criteria pollutants over the long-term.

3.1.7. Climate

The overall weather in the Wappapello Lake watershed is a mild continental climate. Summers are generally mild with daily highs occasionally reaching at least 100°F. The winters are short and moderate with temperatures occasionally reaching below zero. The hottest period of the year typically occurs in July and August, while the coldest period occurs from December thru February. Existing climate data was obtained from the Poplar Bluff area weather station operated by the National Weather Service (National Weather Service, 2021). Annual precipitation varies between a low of 3.4 inches in January and August, to a high of 5.6 inches in April. The annual precipitation, cumulatively, is 50.7 inches. Mean monthly average temperature (normal), predictably, is the lowest in January at 36.1°F and the highest in July at 79.7°F. The National Weather Service's online data was used to generate a graph that illustrates the monthly average precipitation and temperatures near Wappapello Lake (Figure 6).

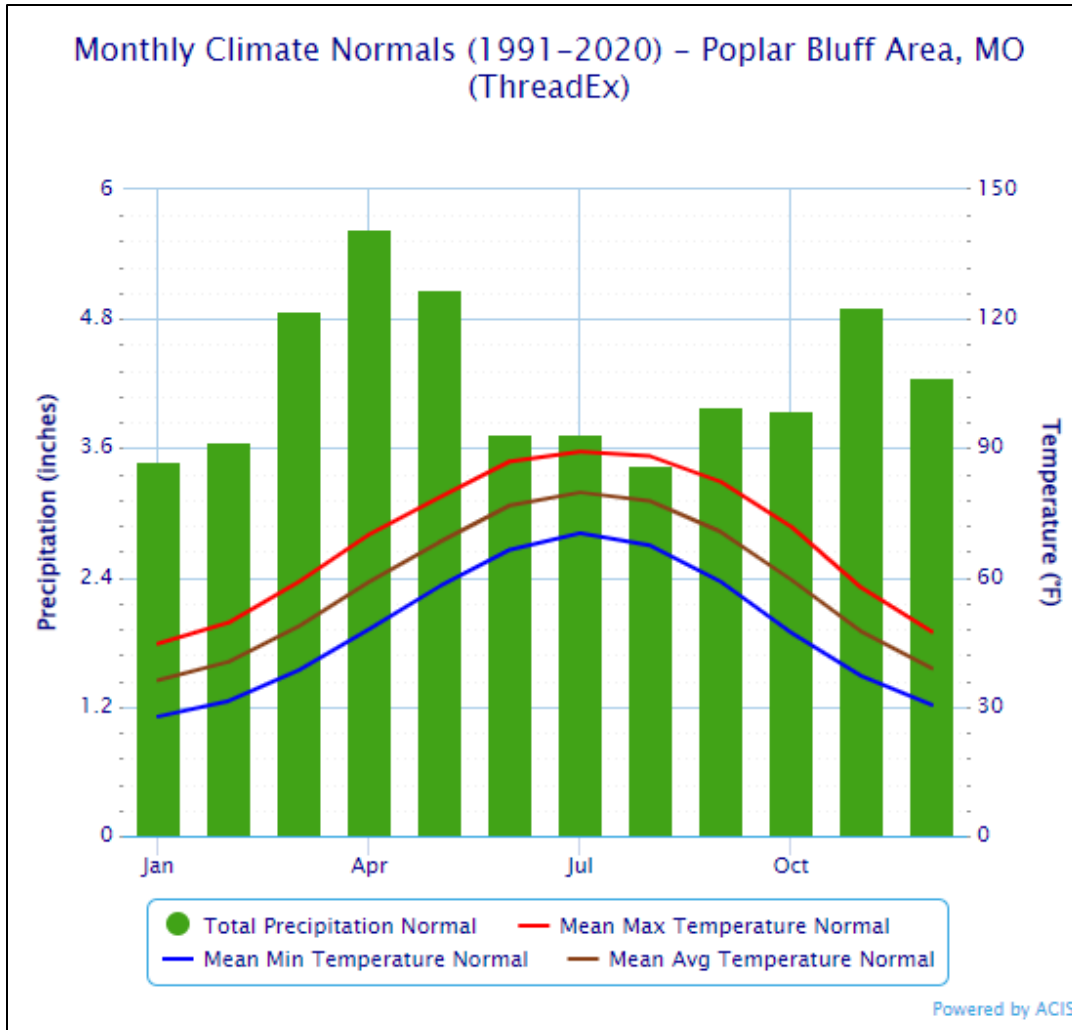


Figure 6. A line and bar graph of the monthly average precipitation (inches) and temperature (F).

Alternative 1 – Passive Management (No Action)

While the climate is likely to change over time, these general changes would not be related to the state or quality of the forest stands at Wappapello Lake. Local increases in seasonal temperature may result in an easier spread of insect pests that threaten the health of forest stands. The spread of invasive insect pests would decrease the sustainability of healthy forest stands at Wappapello Lake. However, as previously stated, the specific changes in climate patterns observed in the future would be unrelated to whether FSI actions were carried out at the Wappapello Lake project. The local climate would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The climate in the Wappapello Lake watershed would not be impacted by the proposed FSI actions. As with the No Action, changes in forest stand composition would not be expected to impact climate patterns directly or indirectly. The cumulative impacts from

the temporary GHG emissions produced during operations are discussed in the Cumulative Impacts section.

3.1.8. Hazardous, Toxic, and Radioactive Waste (HTRW) Concerns

The U.S. Army Corps of Engineers (USACE) regulations (ER-1165-2-132, ER 200-2-3) and District policy requires procedures be established to facilitate early identification and appropriate consideration of potential HTRW in feasibility, preconstruction engineering and design, land acquisition, construction, operations and maintenance, repairs, replacement, and rehabilitation phases of water resources studies or projects by conducting Phase I Environmental Site Assessment (ESA). USACE specifies that these assessments follow the process/standard practices for conducting Phase I ESA's published by the American Society for Testing and Materials (ASTM). The purpose of a Phase I ESA is to identify, to the extent feasible in the absence of sampling and analysis, the range of contaminants (i.e. RECs) within the scope of the U.S. Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products. Current policy is to avoid known HTRW sites. However, the Environmental Quality Section should be contacted immediately if HTRW material is encountered at any point during construction activities.

Alternative 1 – Passive Management (No Action)

There would be no construction or other work disturbances that would disturb known or unknown hazardous waste concerns. Therefore, HTRW concerns would not be affected by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

A Phase I study was not recommended for this project because the likelihood of hazardous substances adversely affecting the project area is very low. There is still a potential of encountering hazardous substances during the proposed actions. If HTRW material is encountered at any point during the FSI activities, an environmental contractor should be contacted to assess the conditions. USACE does not and cannot represent that the site contains no hazardous waste or material, including petroleum products. HTRW concerns would not be affected by the FSI alternative.

3.2. Biological Resources

3.2.1. Aquatic Habitat

River and Lake Habitat

Wappapello Lake is located within the St. Francis River watershed, which drains approximately 1,839 square miles in Missouri. The St. Francis River flows through Wappapello Lake, which is situated near the center of Missouri's portion of the basin. Major tributaries to the St. Francis River are the Little St. Francis River and Big Creek above the Wappapello Dam, and Mingo Ditch and Dudley Main Ditch below the Wappapello Dam. Wappapello Lake contains approximately 8,400 acres of lake habitat.

When Wappapello Lake was created, the rugged terrain and many small tributaries along the St. Francis River created an irregular shoreline. As a result, a variety of coves can be found around the lake, providing many micro-habitats. The reservoir lake drains 1,310 square miles. St. Francis River tributaries that enter Wappapello Lake include the East Fork Lost Creek, West Fork Lost Creek, Mink Creek, Asher Creek, Big Lake Creek, Clark Creek, Hubble Creek, Logan Creek, Perkins Branch and Hickory Flat Creek. At normal recreation pool, the lake is approximately 28 miles long, with an average width of 1.3 miles and average depth of 6.5 feet, although some areas are up to 45 feet deep.

Wetland Habitat

In addition to the lake habitat, there are numerous freshwater wetlands near Wappapello Lake. A review of the USFWS National Wetland Inventory found that the wetland habitats near the lake include freshwater emergent, freshwater forested/shrub, and freshwater pond (Figure 7, Figure 8).

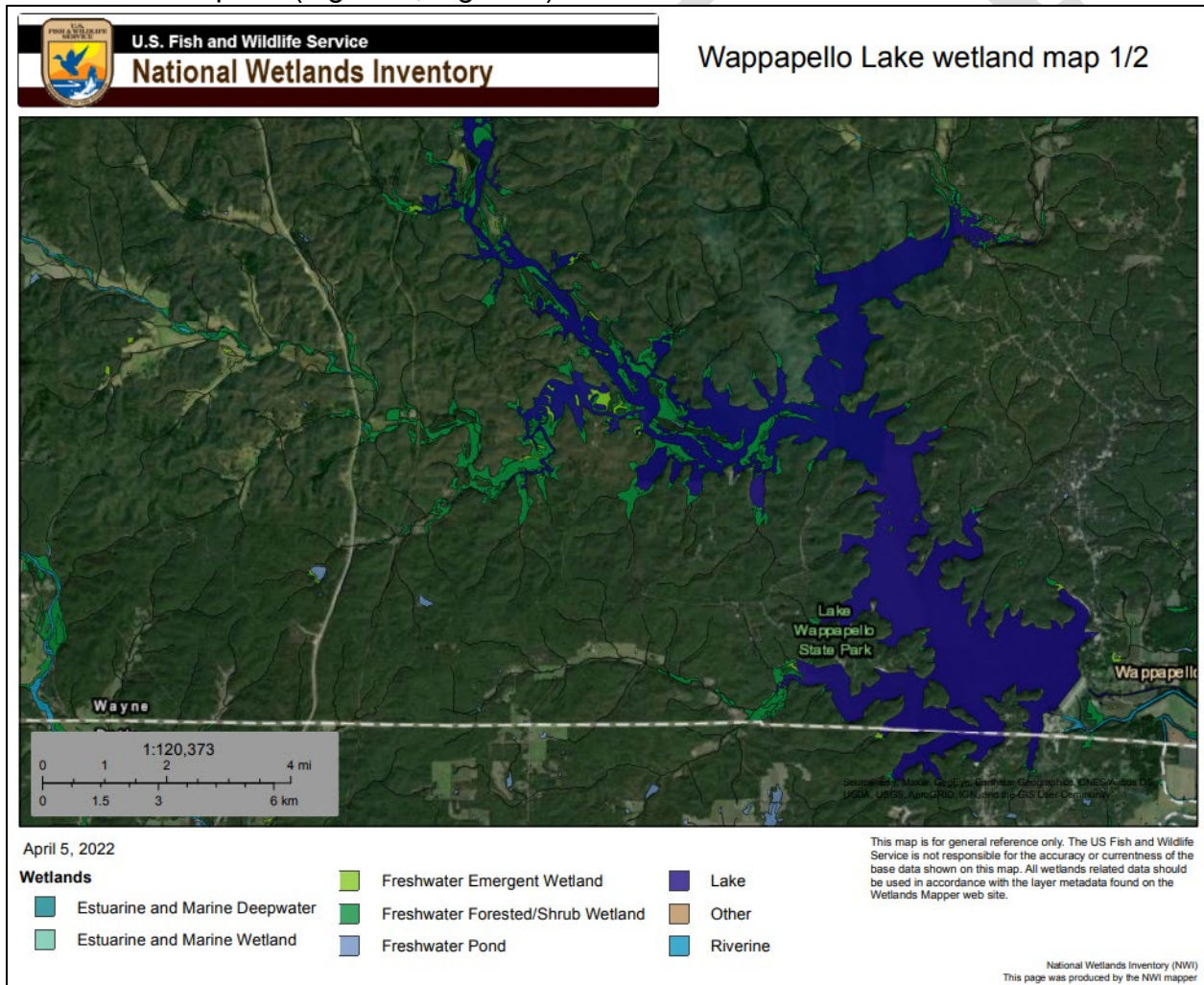
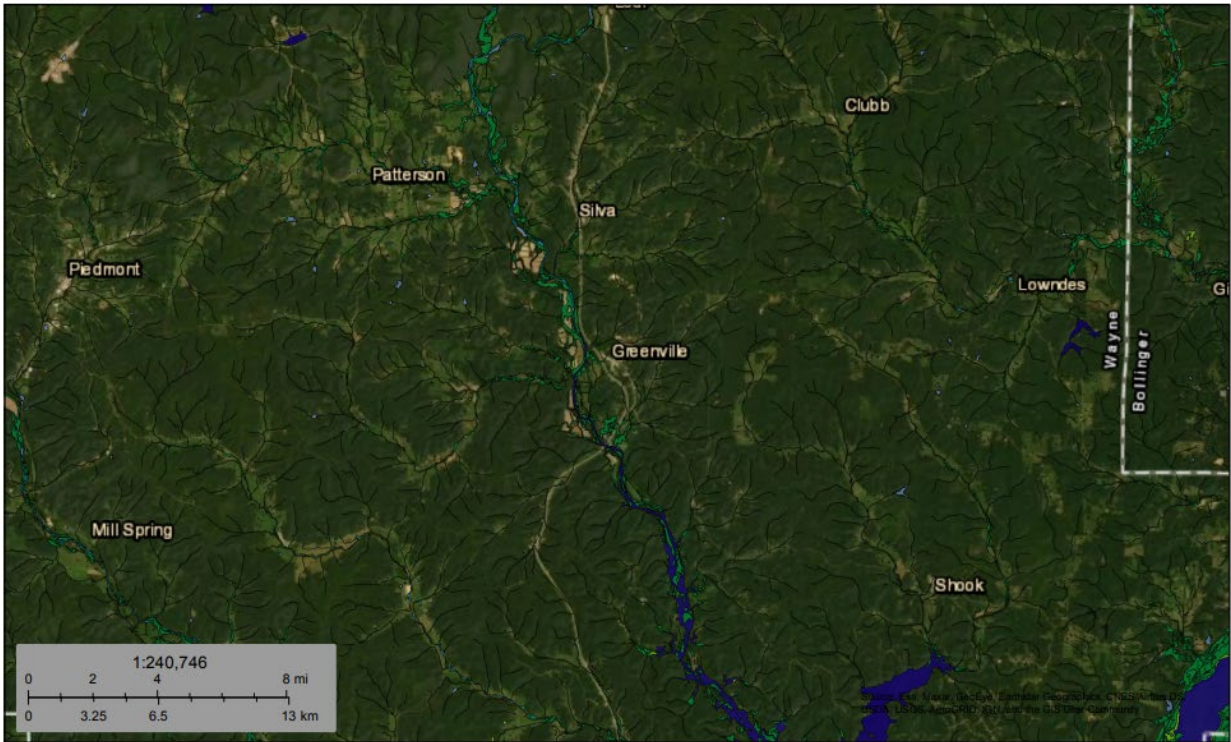


Figure 7. National Wetland Inventory map of the main portion of Wappapello Lake.



April 5, 2022

Wetlands

- | | | | | | |
|--|--------------------------------|--|-----------------------------------|--|----------|
| | Estuarine and Marine Deepwater | | Freshwater Emergent Wetland | | Lake |
| | Estuarine and Marine Wetland | | Freshwater Forested/Shrub Wetland | | Other |
| | | | Freshwater Pond | | Riverine |

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

Figure 8. National Wetland Inventory map of the upper reaches of the Wappapello Lake Project lands.

Aquatic Plants & Animals

Wappapello Lake supports diverse forms of phytoplankton, zooplankton, aquatic insects, crustaceans, amphibians, reptiles, fish, and mollusks. The U.S. Army Corps of Engineers and Missouri Department of Conservation (MDC) work in a collaborative effort to manage the lake for water quality and ecosystem sustainability. Aquatic habitat degradation is a normal process as lakes age. To refurbish some of the structural habitat that decomposes over time, the agencies have partnered to add brush piles to the lake and investigate new ways to re-establish aquatic vegetation. Additionally, the partners are investigating new ways to better manage water levels in the lake to provide and promote healthy and productive fish populations.

The St. Francis River and Wappapello Lake are home to over 50 fish species that are very popular with recreational anglers. Common sport fish species in the reservoir include white crappie (*Pomoxis annularis*), black crappie (*Pomoxis nigromaculatus*), white bass (*Morone chrysops*), largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctulatus*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*). The upper portion of the St. Francis River watershed provides for increased chances of catching walleye (*Sander vitreus*), smallmouth bass (*Micropterus dolomieu*), goggle-eye (*Ambloplites rupestris*) and suckers (Catostomidae spp.). The Missouri Department of Conservation (MDC) has been managing for quality fisheries in Wappapello Lake since its construction. Surveys are conducted each year in the spring and fall to monitor the population, assess existing regulations and determine future management practices. Long-term monitoring allows MDC to track changes over time in the quality of the fishery. MDC also conducts creel surveys, which produces specific fishing trip information from anglers as they are exiting the lake.

A variety of aquatic reptiles, amphibians, snakes, turtles, salamanders, frogs, and toads can all be expected to occur in the aquatic habitats in and around the lake. Common snapping turtles (*Chelydra serpentina*), river cooter (*Pseudemys concinna*) red-eared slider (*Trachemys scripta*) are common in many palustrine waterbodies, including large reservoirs like Wappapello Lake and in the smaller sloughs, farm ponds, and wetlands surrounding the reservoir. These aquatic habitats are also used by American toad (*Anaxyrus americanus*), spring peeper (*Pseudacris crucifer*), green frog (*Lithobates clamitans*), bullfrog (*Lithobates catesbeianus*), and northern leopard frog (*Lithobates pipiens*).

Alternative 1 – Passive Management (No Action)

The lack of FSI management actions would not cause an adverse impact to aquatic habitats. The health and function of the aquatic habitats in the project area are likely to change over time but are unlikely to be related to the condition of forest habitat.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The FSI actions propose to alter terrestrial habitats and would not require fills or disturbance below the ordinary high-water mark of Wappapello Lake or its associated streams. A minimum 50 foot forested buffer would be retained on each side of all

perennial and intermittent streams to prevent any soil, bank, or bed disturbance. In addition, FSI actions would typically be restricted to an elevation of 380' NADV or above. However, in rare cases, there would be FSI treatments below this elevation. While all habitats are ultimately connected, the FSI actions are not anticipated to detrimentally impact the overall health of aquatic habitats at Wappapello Lake. Best management practices would be used to minimize any runoff and avoid overspray by herbicides.

3.2.2. Terrestrial Habitat and Wildlife

Forest

There are many terrestrial habitats in the areas surrounding Wappapello Lake, including grassland, abandoned fields, croplands, bottomland hardwood forest, and upland hardwood forest. However, forested habitat is the primary terrestrial habitat type. Tree species in the bottomland hardwood forest are a mixture of white oak (*Quercus alba*), black oak (*Quercus velutina*), shagbark hickory (*Carya ovata*), and mockernut hickory (*Carya tomentosa*).

Upland forest along the ridge tops have pignut hickory (*Carya glabra*) and post oak (*Quercus stellata*), which thrive in the soils with low moisture content. Where the soils are mainly sandstone-based, the forest is a mix of oaks and pines, including shortleaf pines (*Pinus echinata*). Where soils are limestone-based, large stands of eastern red cedar (*Juniperus virginiana*) are common.

While the upland oak-hickory community type dominates the higher elevations, tree species such as red oak (*Quercus rubra*), chinquapin oak (*Castanea pumila*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), basswood (*Tilia americana*), black walnut (*Juglans nigra*) and bitternut hickory (*Carya cordiformis*) make up the majority of forest composition within the transition elevations, i.e. drainage and toe slope landscape features. Persimmon (*Diospyros virginiana*), blackgum (*Nyssa sylvatica*), butternut (*Juglans cinerea*) and sugar maple (*Acer saccharum*) occur within the transition elevation areas. Within the lowest poorly drained bottoms, American sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*), cottonwood (*Populus deltoides*) and river birch (*Betula nigra*) dominate the forest community. Upland understory tree species primarily include eastern redbud (*Cercis canadensis*), flowering dogwood (*Cornus florida*), sugar maple, and serviceberry (*Amelanchier spp.*).

Grassland and Oldfield

While the majority of the project lands are forested, there are some grassland and oldfield habitats as well. The project lands also include leased agricultural fields planted in rotational crops. Grassland and oldfield areas are covered in warm season grasses, forbs, and some patches of woody shrubs. These lands are maintained in early successional stages by prescribed fire, bush-hogging, and agricultural practices. Other minor plant communities found on project lands include small canebrakes growing within field edges, along river and stream corridors, in addition to willow and buttonbush thickets found within areas that contain poorly drained soils. Edge-feathering is also used in the transition zone between open habitats and forested areas.

Terrestrial Wildlife

Terrestrial wildlife species at Wappapello Lake are consistent with those of mixed forest habitats of the Ozarks. The area was heavily hunted in the 19th century, which reduced populations of big game species like white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), black bear (*Ursus americana*), mountain lion (*Puma concolor*), bobcat (*Lynx rufus*), gray wolf (*Canis lupus*), and eastern wild turkey (*Meleagris gallopavo*). In the past 50 years, conservation efforts restored healthy populations of these wildlife species in the habitats around Wappapello Lake.

Currently deer and turkey populations are thriving within the Wappapello Lake project area. Furbearers are found along riverbanks, streams and shoreline including river otter (*Lontra canadensis*), American mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), American beaver (*Castor canadensis*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), and raccoon (*Procyon lotor*). Small game such as the eastern cottontail (*Sylvilagus floridus*), fox squirrel (*Sciurus niger*), and gray squirrel (*Sciurus carolinensis*), are plentiful in and along the woodland edge habitat. Coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and grey fox (*Urocyon cinereoargenteus*) range between the forested and open field habitats. In addition to the hundreds of thousands of migratory waterfowl that use the lake, dozens of species of migratory birds use the forests and grasslands in the project area.

The reptiles, amphibians, and frogs mentioned in the Aquatic Habitat section can also be expected to use the terrestrial habitats, where appropriate. Eastern box turtle (*Terrapene carolina*), rat snake (*Pantherophis obsoletus*), eastern racer (*Coluber constrictor*), and northern water snake (*Nerodia sipedon*) are common at Wappapello Lake.

Alternative 1 – Passive Management (No Action)

Without the FSI improvements to forest stands at Wappapello Lake, the quality of the forested habitat would be adversely impacted. The existing conditions of terrestrial habitat require some amount of artificial intervention in order to improve the diversity and composition of tree species in the forest stands. The invasive species removal would continue in the No Action Alternative, opening up the understory, which would benefit wildlife. However, without the specific FSI actions that promote regeneration, the long-term sustainability of the forest habitat would be adversely impacted. In this way, the No Action alternative would cause adverse impacts to terrestrial habitats and wildlife.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The FSI actions are science-driven management principals designed to create resilient and diverse forest habitat. The FSI actions would result in substantial beneficial impacts to the condition of the forest stands around Wappapello Lake. During operations, the use of chainsaws, skidders, and other equipment would cause temporary minor adverse impacts resulting in wildlife avoiding the immediate area during FSI activities.

3.2.3. Bald Eagle

Although the bald eagle (*Haliaeetus leucocephalus*) was removed from the federal list of threatened and endangered species in 2007, it continues to be protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (BGEPA). The BGEPA prohibits unregulated take of bald eagles, including disturbance (U.S. Fish & Wildlife Service, 2020). Bald eagles (*Haliaeetus leucocephalus*) occur regularly in Missouri as both migrants and breeders, with some populations of year-round residents along major rivers and reservoirs in the state. There are five known bald eagle nests at Wappapello Lake that are monitored by biologists.

Alternative 1 – Passive Management (No Action)

The long-term sustainability of forest habitats would be limited in the No Action alternative. This could result in a reduction in the number of large, mature trees that eagles use for nesting. The foraging opportunities for bald eagles at Wappapello Lake are more tied to aquatic than terrestrial forest habitat, given the diet of bald eagles. Therefore, foraging needs for eagles would not be impacted by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The operation of loud equipment like chainsaws and the use of skid-steers and hauling trucks would cause a temporary minor adverse impact to nesting bald eagles within the vicinity of the work. While no trees with eagle nests would be removed, the removal of other large, mature trees would reduce the number of trees available for new nests. Typically, FSI actions would be restricted to above an elevation of 380' NADV, removing many potential nesting trees from the FSI treatments. In some cases, there would be FSI treatments below this elevation which could remove potential nest trees. However, the long-term benefits of FSI would increase the supply of potential nesting trees, which is a beneficial impact. In addition, the proposed FSI activities would not disturb prey using the lake or lakeshore (e.g. fish, waterfowl, small mammals, and reptiles). Prey using open areas would likewise not be disturbed by FSI activities. All bald eagle nests shall be afforded a 660-foot buffer, per BGEPA guidelines. If, for some reason, this buffer is not possible, coordination with the USFWS regarding a disturbance permit is required prior to the disturbance event.

3.2.4. Migratory Birds

The Migratory Bird Treaty Act (MBTA) of 1918 provides protection for bird species native to North America. The Wappapello Lake project is an important nesting and feeding area within the Mississippi Flyway for many migratory birds and waterfowl species. A variety of migratory birds might occur in the project areas, some as migrants and some as breeders. Waterfowl, wading birds, shorebirds, passerines, and raptors use the St. Francis River watershed for resting, feeding, nesting, and for other life-history needs.

The Missouri Birding Society has recorded 438 migratory birds species in the state (The Missouri Birding Society, 2022). In addition, the Upper St. Francis Watershed is one of The Audubon Society's Important Bird Areas (The Audubon Society, 2022). While exact

data for species observed on Wappapello Lake's project areas is lacking, a review of eBird checklists found that birders have seen or heard over 150 species at the Wappapello Lake project. Migratory waterfowl use the lake during the winter months alongside the county's year-round residents, like Canada goose and double-crested cormorants. Terns, grebes, and gulls also use the reservoir lake in good numbers. In late spring and early fall, shorebirds return to the open mudflats along the shore. In the summer months, a variety of warblers, vireos, flycatchers, and other perching birds use the forests in the project area during the summer breeding season. Several species of woodpeckers use the forests year-round. Birds-of-prey, like eagles, hawks, and owls, can be found throughout the year.

Birds of many varieties use the lake and the wetlands, sloughs, creeks, and other aquatic habitats surrounding the lake. Shoreline areas and exposed mudflats would be used by shorebirds when those habitats are available. Areas with emergent vegetation like cattails (*Typha spp.*), river bulrush (*Bolboschoenus fluviatilis*), or smartweeds (*Persecaria spp.*, *Polygonum spp.*) would attract herons, rails, egrets, blackbirds, and other marsh birds. Bird using the open water would include cormorants, gulls, terns, ducks, geese, swans, and other waterbirds. Migratory waterfowl can be found in the project area in the hundreds of thousands during migration.

Alternative 1 – Passive Management (No Action)

Similar to the terrestrial habitat resource, forest stands at Wappapello Lake provide for the life-history needs of migratory birds and would suffer adverse impacts in the No Action alternative. The long-term sustainability of forests in the project area would be limited in the No Action alternative. Invasive species removal, which would occur in the No Action, would provide substantial benefits. The decline in tree species diversity combined with an undesirable composition of those species would ultimately cause adverse impacts to migratory birds that rely on the lake as important migratory stopover or breeding habitat. Migratory birds would be adversely impacted by the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

As with the bald eagle, the operation of loud equipment like chainsaws and the use of log skidders and hauling trucks would cause a temporary minor adverse impact to migratory birds using the areas within the vicinity of the work. Additionally, direct adverse impact would result from trees felled that are currently used by birds. Per the USFWS guidance, incidental take can result from the taking or killing of migratory birds that results from, but is not the purpose of, an activity. Adverse impacts to birds using the wetlands, mudflats, and open water of the lake are unlikely. The June-July tree clearing restriction would mitigate adverse impacts to migratory birds that are using the forests during stopover events or for breeding during the summer. In addition, the work would be spread out over space and time, limiting the adverse impacts to specific stands and allowing the remainder of the forest to be undisturbed. Overall, the forest health benefits provided by FSI would result in substantial long-term beneficial impacts to migratory birds that rely on forests to complete their life history.

3.2.5. Invasive Species

An invasive species is one that is not native to an ecosystem and which causes, or is likely to cause, economic or environmental harm or harm to human health (U.S. Fish & Wildlife Service, 2012). Invasive species management efforts at Wappapello Lake are in accordance with the National Invasive Species Act of 1996 (PL 104-332), the USACE Invasive Species Policy (2009), and the Wappapello Lake Master Plan. These efforts seek to contain and reduce the spread and populations of established invasive species to minimize their harmful impacts. Invasive species control is a year-round effort at Wappapello Lake. There are several invasive woody shrubs and vine species that occur at Wappapello Lake, including: autumn olive (*Elaeagnus umbellata*) and multiflora rose (*Rosa multiflora*). Johnsongrass (*Sorghum halepense*) and sericea lespedeza (*Lespedeza cuneata*) which are widely distributed along the edges of roads and in open areas. In some forest stands, invasive shrubs dominate the understory, inhibiting the growth of more desirable trees, flowers, and forbs. In aquatic habitats, the primary concern are isolated patches of purple loosestrife (*Lythrum salicaria*). The invasive insect pest, the emerald ash borer (*Agrilus planipennis*), is widely distributed in the areas around the lake.

Acceptable invasive species control techniques include chemical, mechanical, biological, fire, cultural, and flooding. All of these alternatives would be evaluated prior to the implementation of a control technique. The control technique chosen would be based upon potential ecological impact, susceptibility of targeted species, cultural acceptability, and cost benefit analysis. A Pesticide Use Proposal (PUP) evaluating each control technique and justifying the use of chemical pesticides would be produced prior to the large-scale use of a pesticide. Treatment of invasive species would occur within the proposed treatment stands as part of FSI or as needed to ensure tree seedling survival and recruitment. Monitoring pre- and post-treatment would be conducted to determine the success of the treatment and adaptive management adjustments would be made based upon this analysis.

Alternative 1 – Passive Management (No Action)

Some of the stands would require invasive species removal, however invasive species removal is already part of the Wappapello Lake Master Plan. Therefore, invasive species removal would continue under the No Action Alternative. However, the long-term, permanent elimination of invasives is unlikely without the addition of some amount of accompanying FSI activities. The combination of direct invasive species control and FSI treatments that create a healthy forest community is more resistant to future invasive species spread. Furthermore, the current health of the forest communities on project lands is likely to deteriorate over time. Without some FSI treatments to accompany direct invasive species control, invasive species control efforts would be permanently adversely impacted in the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

As described in the No Action alternative, some invasive species control would be carried out under the No Action alternative. However, the proposed FSI treatments would improve the overall health of the forest communities on project lands. Healthy

forests are more resistant to invasive species encroachment. In a healthy forest community, the understory niches that become filled with invasives would instead be comprised of native saplings, young trees, and native shrubs, herbs, and flowers. When in combination with FSI activities like those proposed in the Forest Management alternative, invasive species threats are more likely to be permanently eliminated. Note that the FSI actions only propose to eliminate the invasive vegetation within the forest stands. Invasive fish, bivalves, insect, and other animal invasives would not be targeted by this alternative. Invasive vegetation in non-forested areas is not a component of the TSP. Invasive species concerns within forests would be substantially permanently benefitted in the Forest Management alternative.

3.2.6. State Listed Species

An automated Missouri Department of Conservation (MDC) Heritage Report was generated on 08 March 2022 (Project ID 10610, Appendix 2). A detailed Natural Heritage Review Report, which lists sensitive resources which may be located in the vicinity of by the proposed project, was provided by MDC on 02 September 2022 (NHR ERT ID: 10903). This report divides the resources into Level 3 (Records of federal-listed also state-listed species or critical habitats near the project site:) and Level 2 (Records of state-listed endangered species and/or state-ranked species and natural communities of conservation concern). MDC tracks these species and natural communities due to population declines and/or apparent vulnerability.

The Level 3 species included in this report included Indiana bat (IBAT), northern long-eared bat (NLEB), gray bat, St. Francis River crayfish, Big Creek crayfish, mussels (in general), alligator snapping turtle, and bald eagle. The bald eagle was discussed in Section 3.2.3. The bats, crayfishes, alligator snapping turtle, and several mussel species are discussed in Section 3.6.

The Level 2 species included Swainson's warbler (*Limnothlypis swainsonii*), western chicken turtle (*Deirochelys reticularia miaria*), mountain madtom (*Noturus eleutherus*), and longnose darter (*Percina nasuta*). Impacts to migratory birds, like Swainson's warbler, were discussed in Section 3.2.4, Migratory Birds. Impacts to aquatic species were discussed in Section 3.2.1, Aquatic Habitat.

The western chicken turtle can be adversely impacted by actions in either aquatic or terrestrial habitats near those waterbodies. In Missouri, these turtles are a bottomland, hardwood forest species that inhabit cypress-bordered shallow ponds, river sloughs, temporarily water-filled ditches and drainage ditches in spring and early summer. However, they spend considerable time on the forested lands, especially near wetlands (Missouri Department of Conservation, 2015). BMPs to reduce sedimentation/erosion, the stream and wetland buffers, and the relative lack of FSI work below 380' NADV would minimize the potential for adverse impacts to western chicken turtle. Overall, the FSI actions would increase the quality of forest habitat adjacent to the aquatic habitats used by the turtle, providing permanent long-term benefits.

The mountain madtom inhabits only a few large, clear rivers in the transition zone between the Ozark and Lowland faunal regions in the southeastern part of Missouri where they use gravelly riffles with thick growths of aquatic vegetation (Missouri

Department of Conservation, 2015b). The longnose darter inhabits the St. Francis River above Wappapello Reservoir where it uses areas of low current velocity near riffles and runs near large rocks or vegetation (Missouri Department of Conservation, 2000). These habitats would be avoided by the FSI activities. BMPs and stream and river buffers would minimize the potential for indirect adverse impacts.

3.6 Federally Listed Species Biological Assessment

In compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, official lists of species and critical habitats potentially occurring in the vicinity of the proposed work areas was acquired from the USFWS Information for Planning and Conservation (IPaC) website at (<https://ecos.fws.gov/ipac/>) on 30 January 2023 (Project Code: 2022-0043677; Table 2).

The following critical habitats are present: Big Creek crayfish (proposed), St. Francis River crayfish (proposed), and rabbitsfoot mussel (Final). Habitat requirements and impacts of the proposed action are discussed for each listed species.

The USFWS provided concurrence for the species determinations and a Biological Opinion on 11 April 2023. USFWS coordination is found in Appendix 1.

Table 2. List of federally threatened and endangered species and habitat potentially occurring in the vicinity of the proposed project, acquired from the USFWS Information for Planning and Conservation (IPaC) website.

Common Name (Scientific Name)	Classification	Habitat
Gray Bat (<i>Myotis grisescens</i>)	Endangered	Roosts in caves and forages along streams and open water bodies.
Indiana Bat (<i>Myotis sodalis</i>)	Endangered	Uses caves and mines for winter hibernacula; uses trees for summer roosting. Forages along small stream corridors with well-developed riparian woods and in upland forests.
Northern Long-eared Bat (<i>Myotis septentrionalis</i>)	Endangered	Similar to Indiana Bat, will use caves and mines for winter hibernacula; uses trees for summer roosting. Forages along large water bodies adjacent to forests.
Tricolored bat (<i>Perimyotis subflavus</i>)	Proposed Endangered	In summer, roosts in structures, trees, cliffs, and caves. In winter, hibernates in caves.
Alligator Snapping Turtle (<i>Macrochelys temminckii</i>)	Proposed Threatened	Occurs in large rivers, reservoirs, sloughs, oxbow lakes, and upland Ozark streams in southern and southeastern Missouri.
Rabbitsfoot (<i>Quadrula cylindrica</i>)	Threatened	Typically occurs in small to medium sized rivers of moderate current with clear,

		relatively shallow water and a mixture of sand and gravel substrates.
Snuffbox Mussel (<i>Epioblasma triquetra</i>)	Endangered	Typically occurs in small to medium sized streams with a swift current.
Western Fanshell (<i>Cyprogenia aberti</i>)	Proposed Threatened	Typically occurs in upland streams with slow to fast currents with mud, sand, gravel or rocky substrates.
Monarch Butterfly (<i>Danaus plexippus</i>)	Candidate	Uses milkweed plants as a reproductive host. Could occur anywhere in Missouri with host milkweed present.
Big Creek Crayfish (<i>Faxonius peruncus</i>)	Proposed Threatened	Occurs exclusively in small, high-gradient, rocky creeks in cavities that it excavates beneath rocks, on riffles, or in shallow, silt-free ponds.
St. Francis River Crayfish (<i>Faxonius quadruncus</i>)	Proposed Threatened	Occurs in clear, rocky streams, ranging from small headwater creeks to moderately large rivers. Prefers silt-free bottoms near or beneath dense beds of water willow or boulders.

3.6.1. Indiana Bat

During late fall and winter, Indiana bat (IBAT) hibernates in caves and mines. During the spring and summer, Indiana bats roost in trees. Suitable roosting trees can be alive or dead, but all would have loose, exfoliating bark, holes, and other damage that can be used by a roosting bat. These damages allow bats to crawl inside and be sheltered from predators and weather. Indiana bat roost trees are typically at least 5 inches diameter at breast height (dbh) with suitable roosting characteristics (U.S. Fish & Wildlife Service, 2022). Preferred roost sites are in forest openings, at the forest edge, or where the overstory canopy allows some sunlight exposure to the roost tree, which is usually within 1 km (0.6 mi.) of water. There are several Indiana bat maternity trees on the northern portion of the Wappapello Lake property. A single maternity tree overlaps with an area proposed for selective tree cutting. This tree would be avoided. Indiana bats forage for flying insects (particularly moths) in and around the tree canopy of floodplain, riparian, and upland forests. The most significant threat facing Indiana bat populations today is white-nose syndrome (WNS), a fungal disease. Other major range wide threats to the Indiana bat include habitat loss/degradation, forest fragmentation, winter disturbance, and environmental contaminants. Suitable Indiana bat summer habitat likely occurs in the forested areas adjacent to and within the proposed project sites.

Alternative 1 – No Action (Future without Project Condition)

Forest bat species using the forest stands at Wappapello Lake are expected to suffer permanent adverse impact without some FSI treatment. As the forest understory becomes even more overgrown with invasive shrubs and trees, regeneration of desirable trees would be greatly inhibited. Over time, as existing mature trees die, without regeneration from the understory, the overall number of suitable roosting trees

would decrease. The reduced quality and condition of forest stands as a result of the No Action alternative could result in long-term adverse impacts to Indiana bats.

Alternative 2 – Forest Management (Forest Stand Improvement)

The FSI activities, although they would provide permanent beneficial impacts in the long-term, they could cause adverse impacts in the short-term. The August-May tree cutting is anticipated to result in direct adverse impacts because bats could be roosting in the trees that are removed. The general construction disturbance is anticipated to cause indirect adverse impacts because of the noise and vibration generated by vehicles and equipment during treatment. The St. Louis District has made a “**may affect likely to adversely affect**” (MALAA) determination for the Indiana bat.

3.6.2. Northern Long-eared Bat

The northern long-eared bat (NLEB) is listed as a federally endangered species throughout its range. The northern long-eared bat is sparsely found across much of the eastern and north central United States and spend winter hibernating in caves and mines (U.S. Fish & Wildlife Service, 2022). They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. Within hibernacula, they are found in small crevices or cracks. During summer, NLEB habitat includes a variety of forested habitats and adjacent non-forested habitats such as emergent wetland, edges of agricultural fields, old fields, pastures, fencerows, strips of riparian forest, and linear wooded corridors (U.S. Fish & Wildlife Service, 2022). Trees that would serve as potential roosts would be at least 3 inches dbh and have exfoliating bark, cracks, crevices and/or cavities. Suitable forested areas would be either dense or loose aggregations of trees, relatively unfragmented compared to areas that are highly-fragmented or that have been clear-cut. The NLEB is more likely to use a single tree with roosting characteristics if it is within 1000 feet of other forest. Human-made structures, like houses, barns, and bridges have also been observed to host roosting NLEBs. Forest fragmentation, logging and forest conversion are major threats to the species. One of the primary threats to the northern long-eared bat is the fungal disease, white-nose syndrome, which has killed an estimated 5.5 million cave-hibernating bats in the Northeast, Southeast, Midwest and Canada. Suitable northern long-eared bat summer habitat likely occurs in the forested areas adjacent to and within the proposed project sites.

Alternative 1 – No Action (Future without Project Condition)

Forest bat species using the forest stands at Wappapello Lake are expected to suffer permanent adverse impact without some FSI treatment. As the forest understory becomes even more overgrown with invasive shrubs and trees, regeneration of desirable trees would be greatly inhibited. Over time, as existing mature trees die, without regeneration from the understory, the overall number of suitable roosting trees would decrease. The reduced quality and condition of forest stands as a result of the No Action alternative could result in long-term adverse impacts to NLEB.

Alternative 2 – Forest Management (Forest Stand Improvement)

Similar to the Indiana bat, the FSI activities are anticipated to cause temporary adverse impacts to northern long-eared bats from construction disturbance and the selective tree removal. The St. Louis District has made a “**may affect likely to adversely affect**” (MALAA) determination for the NLEB.

3.6.3. Gray Bat

The endangered gray bat occurs in several Missouri counties where it inhabits caves during both summer and winter. With rare exceptions, gray bats occupy caves year-round, a slight divergence from the behavior of the Indiana bat and northern long-eared bat. During the winter, they hibernate in deep, vertical caves (U.S. Fish & Wildlife Service, 2019). In the summer, they roost in caves which are scattered along rivers. Gray bats occasionally roost in human-made structures, including those at Wappapello Lake. Foraging occurs in a variety of common habitats that largely overlap with both the Indiana and northern long-eared bat, including in and around the tree canopy of floodplain, riparian, and upland forests. There are no caves or mines on project lands, but there are some in the surrounding area.

Alternative 1 – No Action (Future without Project Condition)

Gray bat is not typically associated with forest habitat, so the decline in forest health in the No Action is not anticipated to cause adverse impacts to gray bats. However, the decline in forest health could result in worse foraging habitat in the forested areas surrounding the lake. The No Action may cause permanent adverse impacts to gray bat by reducing the quality of available foraging habitat in the county.

Alternative 2 – Forest Management (Forest Stand Improvement)

The FSI activities, although they would provide permanent beneficial impacts to gray bat foraging habitat in the long-term, could cause minor adverse impacts in the short-term. While gray bats do not roost in forests, they do use forests near rivers and lakes during foraging. The reshaping of the forest stands following successful FSI treatments may cause a minor, temporary adverse impact as bats become acclimated to these changes. The St. Louis District has made a “**may affect, not likely to adversely affect**” (NLAA) determination for the gray bat.

3.6.4. Tricolored Bat

Tricolored bats were formerly called eastern pipistrelle. Tricolored bats are usually found roosting singly, only sometimes in pair or clusters of up to a dozen individuals (Missouri Department of Conservation, 2022b). In winter, Tricolored bats hibernate in caves. They prefer caves that are humid and warm. In summer, they leave their hibernation caves and roost in trees, in crevices in cliffsides, and human-made structures. They also sometimes roost in caves during summer. They forage for insects high in the air along forest edge and the boundary of streams or open bodies of water. Tricolored bats mate during spring, fall, and sometimes in the winter. Maternity colonies begin forming in mid-April and females bear 1 to 2 pups by late May to mid-July. Suitable Tricolored bat summer habitat likely occurs in the forested areas adjacent to and within the proposed project sites.

Alternative 1 – No Action (Future without Project Condition)

Forest bat species using the forest stands at Wappapello Lake are expected to suffer permanent adverse impact without some FSI treatment. As the forest understory becomes even more overgrown with invasive shrubs and trees, regeneration of desirable trees would be greatly inhibited. Over time, as existing mature trees die, without regeneration from the understory, the overall number of suitable roosting trees would decrease. The reduced quality and condition of forest stands as a result of the No Action alternative could result in long-term adverse impacts to Tricolored bats.

Alternative 2 – Forest Management (Forest Stand Improvement)

The FSI activities, although they would provide permanent beneficial impacts in the long-term, they could cause adverse impacts in the short-term. The August-May tree cutting is anticipated to cause direct adverse impacts because bats could be roosting in the trees that are removed. The general construction disturbance is anticipated to cause indirect adverse impacts because of the noise and vibration generated by vehicles and equipment during treatment. The St. Louis District has made a “**not likely to jeopardize the continued existence**” determination for the Tricolored bat.

3.6.5. Bat Monitoring Efforts

Since 2004, multiple mist net and acoustic surveys have been conducted across Corps lands at Lake Wappapello and adjacent Forest Service lands within the Mark Twain National Forest system. Bat survey information regarding threatened and endangered species has been collected within Compartments 2, 6, and 8 at Wappapello Lake Project lands (Figure 9). These three compartments were selected because USACE Foresters and Biologists consider them to be representative of all project lands. Note, that these three compartments are excluded from the proposed FSI treatments (Table 1). Although all forest stands have not been surveyed, each stand would be treated as though Indiana bats (and other forest bats) are likely present. No hibernacula caves or maternity caves have been documented within or adjacent to the proposed Project Area. Existing bat maternity trees, however, have been identified through survey efforts within compartments 2 and 8. Survey information will be discussed below only as it relates to those species evaluated in detail. Survey data described in this document was consolidated by USACE Biologists. Potential and known forest bat habitat has been defined by the USFWS within the Range-wide Indiana bat Protection and Enhancement Plan Guidelines (U.S. Fish & Wildlife Service, 2022) as:

“Suitable summer habitat for IBAT and NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags (≥ 5 inches dbh for Indiana bat and ≥ 3 inches dbh for NLEB) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat

when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat.”

Based on this definition, potential forest bat habitat exists in the forest stands at Wappapello Lake. The existing forest community types, structure, and tree species composition within and adjacent to Wappapello Lake project lands are consistent with the USFWS’s definition of forest bat habitat. Bat species monitored include Indiana bat, gray bat, and northern long-eared bat. The Tricolored bat was excluded from monitoring because, at the time of the data collection, the species was not yet identified as potentially needing ESA protection.

Acoustic surveys frequently identified calls of Indiana bats and mist netting efforts have resulted in Indiana bat captures. Captured bats were fitted with transmitters which led to the discovery of alternate roost trees and maternity colony locations. Past surveys have resulted in several NLEB captures and identification of maternity trees within riparian areas outside of the timber harvest units. NLEBs have been captured within the Mark Twain National Forest and on USACE lands. Maternity trees and multiple alternate roost trees have been identified as well.

The bat usage data has shown that any continued efforts to capture or locate bats within the timber harvest areas (upland slopes and ridges) is difficult. Mist net surveys have shown bats exclusively using riparian corridors primarily over water sources or open fields for foraging. Tracked and confirmed roost tree locations have also been confined to the riparian areas where timber harvest operations do not take place.

3.6.6. Alligator Snapping Turtle

Alligator snapping turtles are large aquatic reptiles that inhabit large rivers, loughs and oxbow lakes in southern and southeastern Missouri. They are also known to occur in reservoirs and upland Ozark streams. This species is completely aquatic and only rarely exits the water to bask in the sun. They spend most of their time submerged in deep water near structure like roots or sunken logs. According to the Missouri Department of Conservation, overharvesting, water pollution, bycatch from fishing gear, and extensive habitat alteration are the main reasons for the decline of this species in the state. This species is expanding its range, as evidenced by increased reports within reservoirs and upland Ozark streams in the southern part of the state.

Alternative 1 – No Action (Future without Project Condition)

The proposed construction would not occur and, therefore, any direct or indirect adverse impacts would also not occur. Alligator Snapping Turtle would not be affected by the No Action Alternative.

Alternative 2 – Forest Management (Forest Stand Improvement)

All of the proposed work would occur above the OHWM of the St. Francis River, its tributaries, and Wappapello Lake itself. There would be no direct impacts to aquatic habitats, but interrelated activities that cause soil disturbance may result in minor temporary indirect adverse impacts, such as a slight increase in turbidity. Ground

disturbance activities would occur within the stands that are bisected by aquatic habitats but would occur above the OHWM. The FSI treatments would only rarely occur below an elevation of 380' NADV and outside of the buffer zone around streams and wetlands. In addition, erosion-control BMPs would create only *de minimis* temporary indirect adverse impacts to aquatic species. The use of herbicides during invasive species management is another interrelated activity that could cause minor temporary adverse impacts. Again, these activities would take place away from streams and wetlands and the chemical would be stored and handled properly to avoid contamination. The St. Louis District has made a “**not likely to jeopardize the continued existence**” determination for the Alligator Snapping Turtle.

3.6.7. Rabbitsfoot Mussel

The rabbitsfoot is a threatened mussel with an elongate, rectangular shell covered in tubercles, knobs, and pustules. It typically occurs in small to medium-sized streams with moderate current velocities and relatively shallow water over sand and gravel substrates (Roe, 2002). Threats to rabbitsfoot populations include pollution in streams, declines in populations of their fish hosts, and introduction of non-native clams and mussels. Conservation efforts for rabbitsfoot should focus on reducing siltation and prohibiting impoundments in streams where they are known to occur. Any conservation effort that benefits the host minnow species would indirectly benefit the rabbitsfoot. Three species of minnows have been determined to be suitable hosts for rabbitsfoot: whitetail shiner (*Cyprinella galctura*), spotfin shiner (*Cyprinella spiloptera*), and bigeye chub (*Hybopsis amblops*). Efforts to limit the spread of asiatic clam (*Corbicula fluminea*) and zebra mussel (*Dreissena polymorpha*) would also indirectly benefit the rabbitsfoot.

Critical habitat for the rabbitsfoot mussel was officially designated by the USFWS, effective June 1, 2015, per ESA. Approximately 1,437 river miles were designated for protection, of which an approximate 40 river miles of the St. Francis River above Lake Wappapello in Missouri were included in the designation. This river reach (Unit RF13) extends from the Twelve Mile Creek confluence west of Saco, Madison County, MO, downstream to the upstream point of inundation of the lake, Wayne County (Federal Register v80, (n83) 2015). Critical habitat for the rabbitsfoot mussel also exists in the St. Francis River main channel as it runs through the Wappapello Lake project lands and compartments 3 and 4 which are adjacent to the St. Francis River (Figure 9). The proposed actions would take place in upland areas with a buffer around streams, wetlands, and open waterbodies.

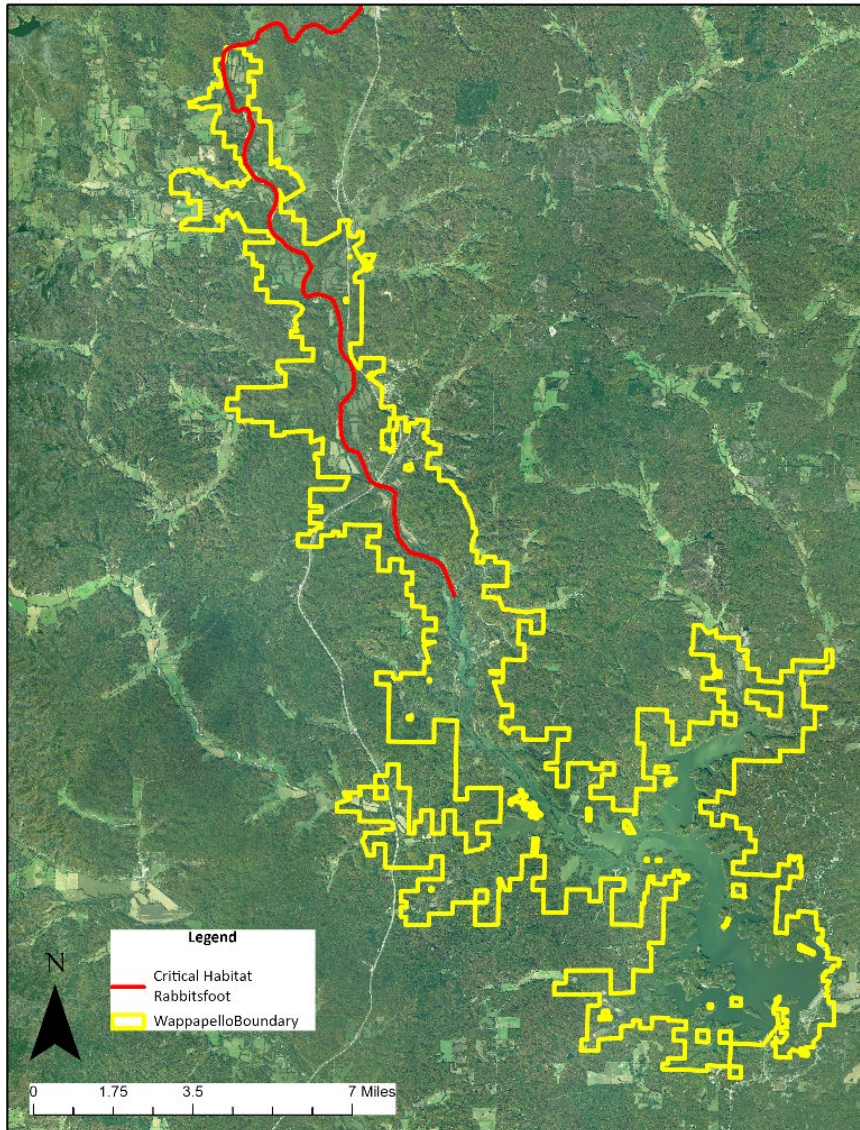


Figure 9. Location of Final Critical Habitat for rabbitsfoot mussel.

3.6.8. Snuffbox Mussel

The snuffbox is an endangered mussel with a yellow, green, or brown shell. The snuffbox typically occurs in small to medium-sized streams with a swift current over sand, gravel, and cobble substrates. It has also been found in Lake Erie and larger rivers. Conservation threats to snuffbox include dams both upstream and downstream of mussel beds. Dams cause adverse impacts by disrupting natural river flow patterns, scouring river bottoms, alterations to normal water temperature, and by creating lake habitat in place of stream habitat. Dams also block fish passage, which would disrupt the reproduction of mussels, which require host fish to reproduce. Pollution upstream of mussel beds is another major concern. Pollutants and sedimentation can directly kill mussels or indirectly harm mussels by reducing water quality. Like the rabbitsfoot, the introduction of invasive asian clams and zebra mussels poses another threat. Efforts to promote snuffbox populations should focus on eliminating sources of pollution,

preventing the spread of invasive bivalves, and prohibiting impoundments in streams with large populations of snuffbox and other mussels. The St. Francis River, and many of its tributaries, run through the Wappapello Lake project lands and are suitable habitat for snuffbox mussel. However, the proposed actions would take place in upland areas with a buffer around streams, wetlands, and open waterbodies.

3.6.9. Western Fanshell Mussel

The western fanshell is a proposed threatened mussel. Proposed threatened species are any species the Service has determined is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and the Service has proposed a draft rule to list as threatened. Proposed threatened species are not protected by the take prohibitions of section 9, consistent with any protective regulations finalized under section 4(d) of the ESA, until the rule to list is finalized. Under section 7(a)(4) of the ESA, federal agencies must confer with the Service if their action jeopardizes the continued existence of a proposed species.

The western fanshell is rhomboid in shape and is covered in concentric ridges and numerous wrinkles and pustules. It typically occurs in upland streams with slow to fast currents over mud, sand, gravel, or rocky substrates. Conservation threats to western fanshell are typical of those facing most freshwater mussels and include the habitat destruction, dams/impoundments, siltation, gravel mining, channel modification, pollution, and the spread of invasive bivalves. The St. Francis River, and many of its tributaries, run through the Wappapello Lake project lands and are suitable habitat for western fanshell mussel. However, the proposed actions would take place in upland areas with a buffer around streams, wetlands, and open waterbodies.

Alternative 1 – No Action (Future without Project Condition)

The proposed FSI activities would not occur and, therefore, no direct or indirect impacts would occur.

Alternative 2 – Forest Management (Forest Stand Improvement)

Adverse impacts to the three listed mussels are expected to be very similar. All of the proposed work would occur above the OHWM of the St. Francis River, its tributaries, and Wappapello Lake itself. There would be no direct impacts to these aquatic habitats, however interrelated activities that cause soil disturbance which may result in minor temporary indirect adverse impacts, such as an increase in turbidity, may occur. Ground disturbance activities would occur within the stands that are bisected by aquatic habitats but would occur above the OHWM and outside of the buffer zone around aquatic habitat. In addition, erosion-control BMPs are anticipated to result in only *de minimis* temporary indirect adverse impacts from sedimentation in streams used by mussels. The use of herbicides during invasive species management is another interrelated activity that could cause minor temporary adverse impacts. Again, these activities would take place away from aquatic habitats and the chemical would be stored and handled properly to avoid contamination. The spread of invasive bivalves is another threat to

native mussels, but the type of work proposed would not contribute to the spread of invasive bivalves nor would it harm populations of host fish.

The St. Louis District has made a **“may affect not likely to adversely affect” (NLAA)** determination for the rabbitsfoot mussel, the snuffbox mussel, and the Western Fanshell mussel. The St. Louis District also made a **“not likely to destroy or adversely modify”** determination was made for the designated critical habitat for the rabbitsfoot mussel.

3.6.10. Big Creek Crayfish

The Big Creek crayfish is proposed threatened and occurs only in Iron, Madison, St. Francois, Washington, and Wayne counties in southeastern Missouri. The Big Creek crayfish appears most abundant in Big Creek and other streams on the west side of the watershed and primarily Twelvemile Creek sub watersheds on the east side. It is moderately small, with brown coloration with black spots across its surface. It occurs in Big Creek, Clark Creek, Twelve Mile Creek, and in the tributaries of these streams. Generally, it is most common in the west side of the St. Francis River watershed. Preferred streams are small, high-gradient rocky creeks, where it inhabits cavities excavated beneath rocks. It can also be found in riffles and shallow, silt-free ponds. The main conservation threats to Big Creek crayfish are habitat loss, habitat fragmentation, and the spread of the invasive woodland crayfish. Conservation efforts focus on reintroduction to suitable streams and preventing adverse modifications to streams within their range.

The Big Creek crayfish Critical Habitat unit consists of approximately 1,069 river miles (1,720 km) in the Upper St. Francis River watershed upstream of Wappapello Dam in Iron, Madison, St. Francois, Washington, and Wayne counties in Missouri (U.S. Fish and Wildlife Service, 2020). The St. Francis River itself is excluded because it is only intermittently used by the Big Creek crayfish. The Proposed Critical Habitat for the Big Creek crayfish overlaps with the Wappapello Lake boundary (Figure 10). Many of the forest stands in the northern portion of the lake’s project lands are bisected by streams designated as Critical Habitat for Big Creek crayfish. However, the proposed actions would take place in upland areas with a buffer around streams, wetlands, and open waterbodies.

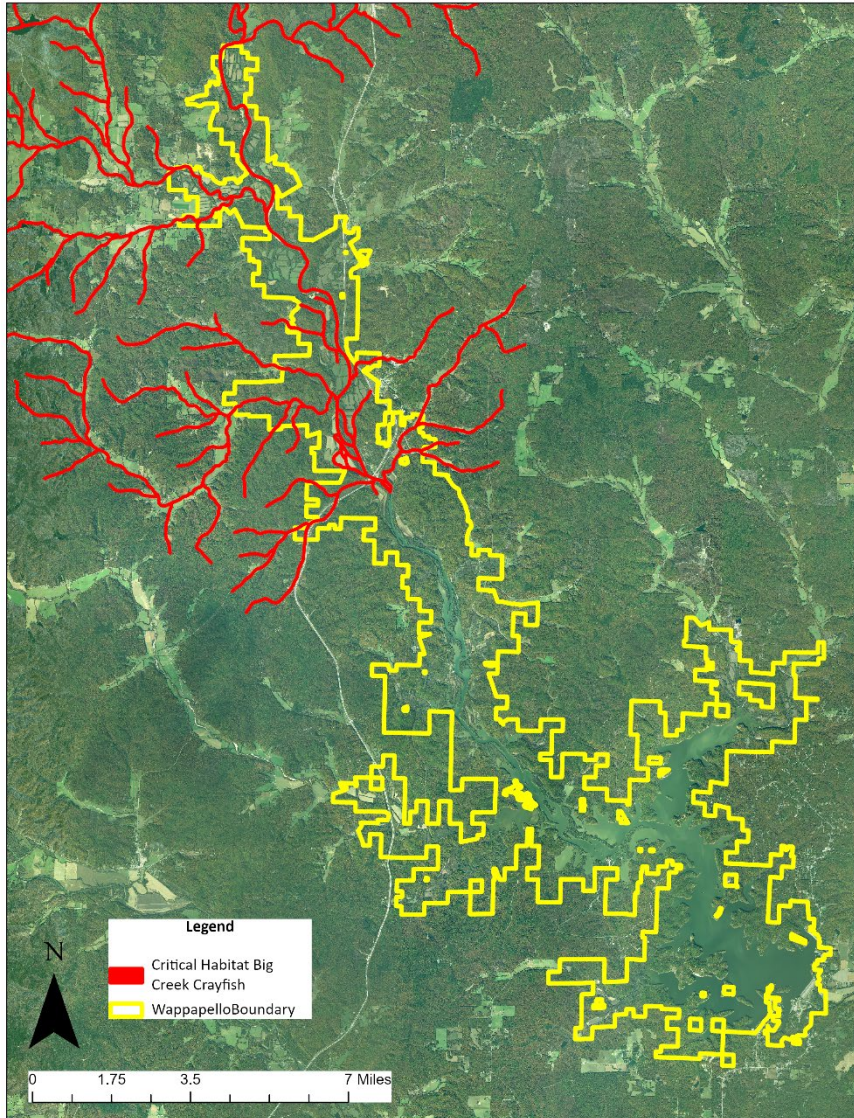


Figure 10. Location of the proposed critical habitat for the Big Creek crayfish.

3.6.11. St. Francis River Crayfish

The St. Francis River crayfish is proposed threatened and occurs only in Missouri. It is a medium-small crayfish with black spots along its surface and pincers trimmed in red. It cannot be visually distinguished from the Big Creek crayfish without close examination of the male reproductive organs. The St. Francis River crayfish typically occurs in clear, rocky streams between the sizes of small headwater creeks to moderately large rivers. It occupies areas in these streams that are silt-free and have dense beds of water willow or boulders. It digs its burrow beneath boulders set in gravel substrates. Conservation threats to the St. Francis River crayfish are similar to the Big Creek crayfish, and include habitat loss, fragmentation, and competition with the woodland crayfish, which is invasive where it occurs with Big Creek and St. Francis River crayfish. As with the Big Creek crayfish, conservation efforts focus on reintroduction and habitat preservation within the species' existing range.

The St. Francis River crayfish Critical Habitat unit consists of approximately 1,043 river miles (1,679 km) in the Upper St. Francis River watershed upstream of Wappapello Dam in Iron, Madison, St. Francois, Washington, and Wayne Counties in Missouri (U.S. Fish and Wildlife Service, 2020). The St. Francis River itself is excluded because it is only intermittently used by the St. Francis River crayfish. The Proposed Critical Habitat for the St. Francis River crayfish overlaps with the Wappapello Lake property (Figure 11). As with the Big Creek crayfish, many of the forest stands on project lands have streams running through them that are designated Critical Habitat for the St. Francis River crayfish.

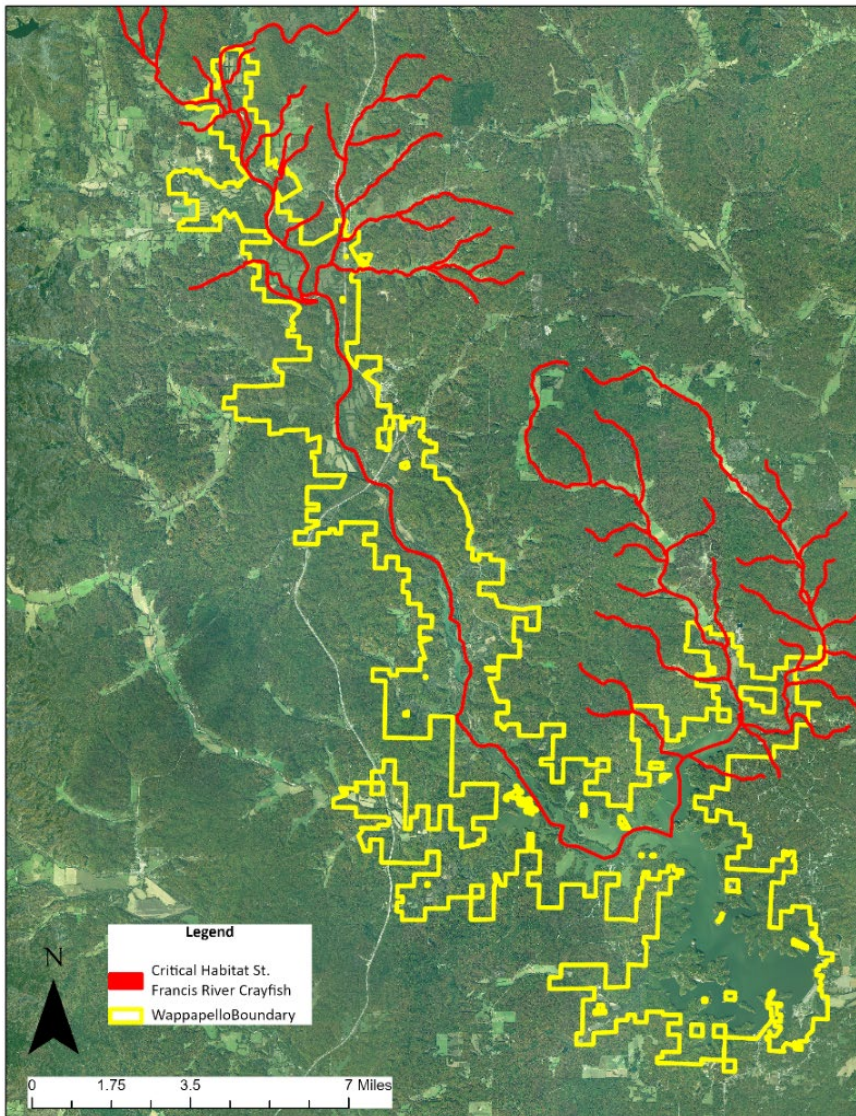


Figure 11. Location of Proposed Critical Habitat for the St. Francis River crayfish.

Alternative 1 – No Action (Future without Project Condition)

The proposed construction would not occur and, therefore, no direct or indirect impacts would occur.

Alternative 2 – Forest Management (Forest Stand Improvement)

Adverse impacts to the two listed crayfish are expected to be very similar. All of the proposed work would occur above the OHWM of the St. Francis River, its tributaries, and Wappapello Lake itself. There would be no direct impacts to these aquatic habitats, but interrelated activities that cause soil disturbance may result in minor temporary indirect adverse impacts, such as an increase in turbidity. Ground disturbance activities would occur within the stands that are bisected by aquatic habitats but would occur above the OHWM and outside of the buffer zone around aquatic habitat. In addition, erosion-control BMPs should create only *de minimis* temporary indirect adverse impacts to crayfish. The use of herbicides during invasive species management is another interrelated activity that could cause minor temporary adverse impacts. Again, these activities would take place away from aquatic habitats and the chemical would be stored and handled properly to avoid contamination. The spread of invasive woodland crayfish is another threat to native crayfish, but the type of work proposed would not contribute to the spread of invasive crayfish.

The St. Louis District has made a “**may affect not likely to adversely affect**” (NLAA) determination for the Big Creek crayfish and the St. Francis River crayfish, and a “**is not likely to destroy or adversely modify**” the designated critical habitat for the Big Creek crayfish and the St. Francis River crayfish.

3.6.12. Monarch Butterfly

The monarch butterfly is a large orange butterfly that is a candidate for listing on the Endangered Species List. Monarch populations of eastern North America have declined 90%. Much of the monarch butterfly’s life is spent migrating between Canada, Mexico, and the U.S. Monarchs do not overwinter in Missouri (U.S. Fish & Wildlife Service, 2021). The monarch occurs in a variety of habitats where it searches for its host plant, milkweed. Of the over 100 species of milkweed that exist in North America, only about one fourth of them are known to be important host plants for monarch butterflies. The main monarch host plant is common milkweed (*Asclepias syriaca*) (Kaul & Wilsey, 2019). Other common hosts include swamp milkweed (*Asclepias incarnata*), butterflyweed (*Asclepias tuberosa*), whorled milkweed (*Asclepias verticillata*), and poke milkweed (*Asclepias exaltata*) (U.S. Fish & Wildlife Service, 2021). Three factors appear most important to explain the decline of monarchs: loss of milkweed breeding habitat, logging at overwintering sites, and climate change and extreme weather. In addition, natural enemies such as diseases, predators, and parasites, as well as insecticides used in agricultural areas may also contribute to the decline. The project area is likely to have some milkweed in the wetland areas and in more wet areas of the open fields.

Alternative 1 – No Action (Future without Project Condition)

The proposed construction would not occur and, therefore, no direct or indirect impacts would occur.

Alternative 2 – Forest Management (Forest Stand Improvement)

Loss of milkweed is a major threat to monarch butterflies at all life-stages (larvae and adult). Direct impacts to larvae and adults would involve the removal of host milkweed plants, and the use of herbicide on plants. Some milkweed may be found along the access roads and in the more open areas where invasive species management is proposed. Some milkweed may be accidentally destroyed as a consequence of the invasive species removal. However, the seedbank would not be impacted, and permanent losses of milkweed are unlikely. Indirect impacts to the butterfly could result from construction noise and other disturbances. Logging at over-wintering sites is another threat to monarch conservation but Wappapello Lake is not an over-wintering site for this butterfly. The invasive species removal should benefit the growth of milkweed and native forbs in the long term by reducing competition. The use of herbicide can cause a direct adverse impact, but with the proper storage and handling of the chemical, the likelihood of these adverse impacts is low.

The St. Louis District has made a “**not likely to jeopardize the continued existence**” determination for the monarch butterfly.

3.6.13. Overall Conservation Measures

Conservation measures are incorporated into the Proposed Action to avoid or minimize adverse impacts to specific protected natural resources. Additionally, these conservation measures are included as part of the stand prescriptions. The conservation measures below are focused on resources connected to the treatment actions.

Stream and Wetland Protection: Forested buffers a minimum of 50 feet would be retained on each side of all perennial and intermittent streams to prevent any soil, bank, and bed disturbance. There would be no temporary or permanent stream crossings that would be constructed over perennial or intermittent streams. In some cases, access roads would cross steep valley drainages, which can serve as ephemeral streams during major precipitation events but that do not have a defined bank otherwise. No wetlands would be crossed by access roads, have staging/landing areas placed within their boundaries, or have temporary or permanent fills added to them. Herbicide application would take place away from streams and wetlands and the chemical would be stored and handled properly to avoid contamination.

Soil Disturbance: Haul roads would consist of ridge tops, agricultural fields, and both new and existing roads. Landings and staging areas would be established where necessary on ridge tops and flat areas suitable for access and appropriate to minimize soil disturbance. Access roads and staging areas would not be used during periods of saturated soil conditions to prevent excessive rutting and compaction. Routes for new access roads would be designed to run along high elevation when possible and for minimal tree removal. Typical soil erosion prevention BMPs would be used throughout. Actions that could produce excessive soil disturbance, such as using access roads and staging areas during wet conditions, would be avoided.

Forest Bat Conservation Measures: Tree removal may take place during daylight hours in any month except June and July. The USFWS recommends tree cutting only between 1 November to 31 March but after coordination with the USFWS, this FSI activity may clear in any month except June and July. The USFWS has developed guidance for various land development and land use activities to reduce the loss, degradation, and fragmentation of Indiana bat habitat (USFWS 2011). Avoidance and minimization measures specific to forest bats that have been incorporated into the Proposed Action are presented below. In order to minimize adverse impact to forest bats the following measures would be implemented. These measures focus on snag creation and preserving trees that could become snags. In some cases, target numbers for snags and potential snags are discussed.

Maternity Roosts: The females of many forest bat species form large nursery colonies in caves, den trees, and buildings.

- Retain all known maternity roosts and leave intact a 1.62-acre patch of trees surrounding known maternity roosts. See Section 3.6.1.6 for Wappapello Lake bat survey information.

Snag and Den Trees: Den trees are live trees with a natural hollow in the trunk or limbs. A snag is a standing dead tree.

- All snags would be preserved except where public or worker safety concerns exist (e.g., prescribed fire line, catastrophic weather events) or disease/insect outbreaks in a stand constitute a threat to the health of the surrounding forest.
- As a general rule, seven snags or living den trees per acre provide an adequate number of cavities (Missouri Department of Conservation, 2022). While seven dens is optimal, in some cases the number would be less than seven if there are not enough available den trees of each dbh.
 - Leave at least one snag and one den tree larger than 20 inches at diameter at breast height (dbh) for every acre of woodland.
 - Keep at least four snags ranging between 10 and 20 inches dbh per acre.
 - Leave at least two snags and two den trees ranging between 6 and 10 inches at dbh.
 - Trees with cavities higher than 20 feet above the ground.
 - Prioritize roost trees with multiple types of roosting structures (e.g., cavities, crevices, exfoliating bark).
 - Prefer shagbark and shellbark hickory (*Carya ovata* and *C. laciniosa*).
 - On average, retain two to four super-canopy trees (trees that are taller than the surrounding trees), or those with potential to become such trees, per acre in to promote structural diversity and provide large leafy surfaces for foraging activities.
- If insufficient snags exist, create snags based on average per-acre targets. Concentrate on creating large diameter (16-inch or greater) snags with exfoliating bark for bat maternity habitat. Prefer shagbark and shellbark hickory, when available.

Caves and Structures: The MO DNR's cave density map overlays a number of equally sized map tiles over the state. These tiles indicate a relative cave density, as expressed by the value: cave count. Tiles with a higher density of caves would have a greater cave count. The Wappapello Lake project land overlaps with four tiles: Wappapello, Hendrickson, Greenville SW, and Greenville. The Wappapello, Hendrickson, and Greenville SW tiles each have a cave count of 1, while the Greenville tile has a count of 3 (Missouri Department of Natural Resources, 2021). However, there are no known caves found within the action areas or within the boundaries of the Wappapello Lake area. There exist several known caves in Wayne and Butler Counties, however none were identified within the action areas.

- The FSI activities would not remove or modify any natural caves and no cave entrances would be blocked or entered as part of the FSI work.
- No structures that could be used as roosting habitat would be removed or modified.
- Abandoned mines: Abandoned mines can provide habitat for wildlife. A review of the Missouri DNR Abandoned Mine Lands interactive web map determined that there are no such areas within Butler or Wayne County. The nearest known abandoned mine land is just south of Fredericktown in Madison County over 20 miles north of the northernmost action areas (Missouri Department of Natural Resources, 2022).

3.7. Social and Economic Resources

3.7.1. Aesthetics and Recreation

The primary mission of recreation is to provide a sustainable level of high-quality water-oriented outdoor recreation opportunities within a safe and healthful environment that meets the needs of present and future generations. Aesthetics at the Wappapello Lake project are important, given that Wappapello Lake is used by thousands of recreational visitors each day. It is for this reason that it is reasonable to consider both aesthetics and recreation together. Major activities are sightseeing, fishing, boating, waterskiing, camping, picnicking, swimming, hiking, and hunting. Park and recreation areas, which provide both extended-use and day-use opportunities, have been developed. Included in the 28 recreation areas are 449 campsites, 101 picnic sites, 19 playgrounds, 7 swimming areas, 24 boat ramps, beaches, 376 marinas, 4 fishing docks/piers, and 12 hiking trails covering 29 miles. According to the 2019 Recreation Report for the lake, these facilities drew nearly a million visitors in 2019 (United States Army Corps of Engineers, 2019).

Alternative 1 – Passive Management (No Action)

In the absence of FSI actions at Wappapello Lake, the quality of the natural habitats used by recreational visitors is expected to decrease. The decline in forest condition may make the campgrounds, trails, and wooded areas less desirable to recreational visitors. This could result in a long-term adverse impact to recreation. Similarly, the lack of FSI management would also decrease the overall aesthetics of the area, though aesthetics is subjective. Understories choked with invasive shrubs and trees may be

viewed as less aesthetically pleasing than diverse understories composed of regenerating trees, saplings, forest wildflowers, and other herbaceous flowering plants. Aesthetics and recreation would be adversely impacted by the No Action alternative. Water-related recreation would be unaffected.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The improved forest condition resulting from the FSI alternative could make the forest stands and recreational areas more desirable to visitors. Recreational opportunities provided by these areas include bird watching, camping, hiking, and interpretive nature experiences. For many recreational visitors seeking these experiences, the aesthetics are important, and would be tied to the natural beauty of their surroundings. A healthy forest presents a more diverse and aesthetic experience to visitors seeking these recreational opportunities at Wappapello Lake. In this way, recreation and aesthetics would benefit from the FSI alternative.

3.7.2. Economics

Wappapello Lake is important to the local economy in Wayne County. The money spent by visitors on trip expenses to USACE lakes adds to the local and national economies by supporting jobs and generating income. Visitor spending represents a sizable component of the economy in many communities around USACE lakes. According to the 2019 Recreation Report, visitation to Wappapello Lake accounted for over 38 million dollars in visitor spending, including over 17 million in sales of goods and services which involved 328 jobs within 30 miles of the lake (United States Army Corps of Engineers, 2019). These benefits included over 7 million in labor income and over 9 million in value (e.g. wages, salaries, payroll benefits, profits, rents, and indirect business taxes) added within 30 miles of the lake.

Alternative 1 – Passive Management (No Action)

As described above, the recreational opportunities at Wappapello Lake contribute substantially to the local economy in Butler and Wayne counties. Any damage to the recreational experience at Wappapello Lake could translate into declining visitorship. Declining visitorship would cause adverse impacts to the local economy in Wayne County. The local economy would be adversely impacted in the No Action alternative.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

Forest management is designed to result in forest stands with an improved condition over existing conditions. It is likely that the proposed FSI treatments to the forest stands would create safer, more enjoyable experiences for park visitors. These benefits may translate into increased visitorship over time. In this way, the local economy may benefit from the Forest Management alternative.

3.7.2. Cultural Resources

There are more than 400 known cultural properties at Wappapello Lake. Most of the sites at the Lake were identified during pre-impoundment surveys, but more recent cultural resource management activities continue to identify additional sites. As many as one-fifth of the site count total are comprised of historic sites, some dating back to

the founding and settlement of Wayne County. The remainder are prehistoric sites that may date to 10,000 B.C. or even earlier. However, the majority of the prehistoric sites in the area are probably more recent and represent Lake Archaic (ca. 1,000 B.C.), Woodland (ca. 500 B.C. to A.D. 900), and Mississippian sites (ca. A.D. 900 to A.D. 1,500). As these properties are in federal ownership, all historic properties are currently, and will remain, subject to the National Historic Preservation Act of 1966, as amended (NHPA).

Alternative 1 – Passive Management (No Action)

The absence of FSI actions would not be expected to result in adverse impacts to Cultural Resources at Wappapello Lake. No actions would be taken that would disturb existing known or unknown archeological sites or historic properties.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

A review of existing records indicate that the project area has not been formally surveyed for historic properties as provided for in the National Historic Preservation Act of 1966, as amended (NHPA). Therefore, archaeological surveys would be required to determine the existence of any cultural resources within each stand prior to the work being performed. The identification and evaluation process would be conducted on an annual basis as each stand is scheduled for cutting. After the identification of cultural resources, if any, each resource would require evaluation as an historic property as defined by the NHPA. Based upon the identification and evaluation of each resource, the USACE would establish buffers around historic properties to prohibit disturbance of the properties. Missouri State Historic Preservation Office (MOSHPO) would be consulted throughout this process and any determinations of significance and eligibility for nomination to the National Register of Historic Places would be fully coordinated with MOSHPO through the execution of a Memorandum of Agreement stipulating the specific procedures to be followed.

In the unlikely event that the personnel cutting the trees should encounter potentially significant archeological/historic properties that were not identified during the pre-work surveys, all actions in the immediate vicinity of the sites would be held in abeyance until the potential significance of the sites could be determined. The precise nature of such investigations would be developed by the Saint Louis District in concert with the professional staff of the Missouri SHPO. However, because the affected trees would be left as above ground stumps (or snags) the soil would receive minimal surficial disturbance, a Historic Properties Preliminary Review was completed on 25 February 2022 that made a “no historic properties affected” determination. In all cases, avoiding disturbance to cultural resources would be the primary means of preserving historic properties.

3.7.3. Tribal Resources

Consultation with federally recognized Indian Tribes is required for any undertaking on these properties to ensure compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. St. Louis District has previously established relationships and regularly consults with 23 Indian Tribes that have an interest in this

portion of the District's AOR. Any future actions or undertaking affecting these properties would be coordinated with all Tribes in the following manner:

- A letter to the Tribes would describe the location of the proposed action and the results of the Section 106 cultural resource survey. Maps of the areas and a description of the types of impacts resulting from the action would also be included.
- The tribes would be requested to contact the District if there are questions or concerns related to the project or survey results as well as known tribal areas of concern in any of the project areas and if they desire further consultation on each or any project.
- Depending on tribal response, the USACE would continue the consultation process until the completion of the project.
- Further, in the event of the discovery of any potential prehistoric human remains, the appropriate steps would be taken under the Native American Graves Protection and Repatriation Act.

Alternative 1 – Passive Management (No Action)

The absence of FSI actions would not be expected to result in adverse impacts to Tribal Resources at Wappapello Lake. No actions would be taken that would disturb existing known or unknown archeological sites or other prehistoric sites.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

This project does not propose to conduct deep ground disturbances and the land cover would remain the same. All relevant Tribes would be invited to comment during both the Section 106 and NEPA compliance processes.

3.7.4.Environmental Justice

Environmental justice refers to fair treatment of all races, cultures, and income levels with respect to development, implementation and enforcement of environmental laws, policies, and actions. Environmental Justice Analysis applies to both minority and low-income populations. For the analysis of Environmental Justice, minority populations are defined as any person who is Black, Hispanic, Asian American, American Indian, or Alaskan Native. Environmental justice analysis was developed following the requirements of: Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations," 1994), and "Department of Defense's Strategy on Environmental Justice" (March 24, 1995). This mandates that federal agencies identify and address, as appropriate, disproportionately high, and adverse human health, or environmental effects of proposed projects on minority and low-income populations. Environmental Justice builds on Title VI of the Civil Rights Act of 1964. Environmental Justice has three guiding principles:

1. Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental impacts, including social and economic effects on minority and low-income populations
2. Ensure full and fair participation by all potentially affected communities in the decision-making process

3. Prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

Demographic information for Wayne was obtained from the United States Census. The total population of Wayne County is 10,974, with 5,438 households, and a median household income of \$38,018 (U.S. Census Bureau, 2020). The employment rate is 40.9%, and 9.9% of residents have a bachelor's degree or higher (U.S. Census Bureau, 2020).

Existing environmental justice conditions were obtained in an EJSCREEN report obtained on 7 April 2022 (Figure 12). The selected area for the report included a 15-mile radius around the approximate center point of the Wappapello Lake Project Lands (lat 37.059617, long -90.392087). The report indicated that there were approximately 11,454 residents in this radius. Socioeconomic indicators for this radius are as follows: People of Color population of 6%, less than the state average of 21%. The low-income population is 44%, greater than the state average of 32%. The percent of residents without a high school education is 20%, greater than the state average of 10%. Environmental indicators like particulate matter, ozone, and lead paint are similar to the state average in some cases, and much less than the state average in the rest.

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EJScreen Report (Version 2.0)



15 miles Ring Centered at 37.059617,-90.392087, MISSOURI, EPA Region 7

Approximate Population: 11,454

Input Area (sq. miles): 706.66

Wappapello Lake Project Lands

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 ($\mu\text{g}/\text{m}^3$)	8.38	8.55	45	8.26	57	8.74	43
Ozone (ppb)	42.3	45.4	5	44.1	30	42.6	50
2017 Diesel Particulate Matter* ($\mu\text{g}/\text{m}^3$)	0.102	0.265	12	0.221	<50th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	30	94	26	95-100th	29	80-90th
2017 Air Toxics Respiratory HI*	0.4	0.4	83	0.33	90-95th	0.36	80-90th
Traffic Proximity (daily traffic count/distance to road)	7.1	400	7	410	9	710	6
Lead Paint (% Pre-1960 Housing)	0.16	0.29	47	0.33	40	0.28	49
Superfund Proximity (site count/km distance)	0.027	0.099	26	0.1	32	0.13	24
RMP Facility Proximity (facility count/km distance)	0.045	0.65	7	0.95	3	0.75	3
Hazardous Waste Proximity (facility count/km distance)	0.044	1.3	11	1	14	2.2	6
Underground Storage Tanks (count/km ²)	0.021	1.9	23	2.5	21	3.9	18
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.013	5.9	67	2.9	74	12	71
Socioeconomic Indicators							
Demographic Index	25%	26%	59	25%	61	36%	41
People of Color	6%	21%	27	20%	26	40%	12
Low Income	44%	32%	73	30%	77	31%	74
Unemployment Rate	7%	5%	80	4%	83	5%	74
Linguistically Isolated	1%	1%	74	2%	67	5%	46
Less Than High School Education	20%	10%	89	9%	89	12%	80
Under Age 5	4%	6%	31	6%	29	6%	33
Over Age 64	23%	16%	81	16%	82	16%	83

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: <https://www.epa.gov/haps/air-toxics-data-update>.

Figure 12. Results of EJSCREEN Report for Butler and Wayne Counties

Per Executive Order 14008, the Justice40 Initiative recommends a goal of 40 percent of certain Federal investments should flow to disadvantaged communities to achieve the overall benefits of the initiative. According to the Climate and Economic Justice Screening Tool (CEJST), the census tracts surrounding and making up Wappapello Lake are considered disadvantaged communities because they meet at least one burden threshold AND the associated socioeconomic threshold. Burden thresholds in the area include one or more of the following: climate change, energy costs, health (heart disease), transportation barriers, workforce development (unemployment), and low income.

Alternative 1 – Passive Management (No Action)

Under the No Action Alternative, no disproportionately high and adverse human health, or environmental effects on minority, low-income populations, or disadvantaged communities would occur.

Alternative 2 – Forest Stand Improvement (Tentatively Selected Plan)

The FSI alternative would not result in disproportionately high and adverse human health or environmental effects to minority or low-income populations, or disadvantaged communities, or cause other Environmental Justice concerns. The improved forest condition after FSI actions would result in many ecological benefits to the area, and could contribute to economic benefits over time.

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4.0. CUMULATIVE IMPACTS

4.1. Cumulative Effects Definitions

Cumulative effects as described by the Council on Environmental Quality (CEQ) for implementing the National Environmental Policy Act (NEPA) are “the impact on the environment which results from the incremental impact of the actions when added to other past, present, and reasonably foreseeable future action regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” [40 CFR § 1508].

4.2. Geographic (Spatial) and Temporal Boundaries

The geographic boundary for the action area was defined as all lands and waters in the Wappapello Lake Project Area boundary. The temporal boundary for the cumulative effects analysis is the past 10 years, the present, and the next 20 years. Proposed activities would be implemented within the next twenty years and effects of these actions would be most evident during implementation and immediately upon completion.

4.3. Description of Cumulative Effects Analysis Area

The Cumulative Effects Analysis Area would be the boundary of the USACE Wappapello Lake project lands. The Wappapello Lake project lands are primarily forested, with the exception of the reservoir lake itself. Some agricultural land is found within this boundary in the form of small, leased areas of pasture and cropland. The area is also crossed with many streams that drain into the reservoir. While the boundary does not include developed urban areas, there are numerous paved roads that provide access to the various features of the lake and the buildings and infrastructure associated with the lake recreational features are present as well.

4.4. Past, Present, and Reasonably Foreseeable Future Actions

Past activities that may affect resources within the Action Area include passive management of the forested areas around the lake. There would have been some fire management in the past ten years, as well as some invasive species control. Some areas of forest or other upland habitats like oldfield and pasture would have been converted into developed areas for the infrastructure and buildings needed for the various new recreational features around the lake. As the Wappapello Lake Master Plan was implemented, the forested areas would have received more invasive species control but still would not have received active FSI treatments.

Implementation of FSI treatments in the forested areas within the Action Area would provide immediate observable benefits to aesthetics and recreation. The open forest would provide better access for recreational visitors. The improved aesthetics of

the open understory would also be immediately apparent to visitors. The open corridors within the interior of the forests would likewise provide immediate benefit to many forest-dependent wildlife. However, the most substantial benefits to wildlife from the FSI treatments would be realized decades after implementation. The selective tree removal and the invasive species removal would allow hardwood regeneration to replace aged and dying mature trees. In addition, some of the existing mature trees would be turned into snags or form snags and/or fallen timber naturally, providing further benefits to wildlife. The benefits to aesthetics and recreation would persist into the future, with the FSI treatments ensuring that the resources and opportunities in the lands around Wappapello area would be available for decades to come.

4.5. Cumulative Effects Discussion

Adverse cumulative effects are not anticipated due to the implementation of this Project. The USACE determined no adverse cumulative effects due to implementation of this project because the FSI actions would create conditions within the forest stands that promote additional and higher quality habitat and better opportunities for recreation than is provided by existing conditions or future conditions without the project.

Examples of benefits include:

- Enhanced regeneration of hard mast trees that, over time, could become snag/den trees.
- Planting desirable trees to improve species composition of the forest.
- Creation of new snag trees.
- Tree removal and invasive species removal creates open flight corridors within the forest.
- More effective and long-lasting invasive species management.
- *De minimis* impacts to aquatic habitat within the cumulative effects geographical boundary.
- Better access to recreational opportunities in the interior of the forest areas
- Improved aesthetics of an open understory cleared of invasive shrubs and weeds.

In summary, the proposed forest management activities, and in past, present, and future projects in Analysis Area, are expected to provide substantial benefits to native plants, wildlife, and would continue to provide valuable opportunities for recreation.

5.0. COMPLIANCE WITH ENVIRONMENTAL POLICY

The relationship of the Tentatively Selected Plan to environmental requirements, environmental acts, and /or executive orders is shown in Table 3.

Table 3. Relationship of the Tentatively Selected Plan to environmental requirements, environmental acts, and/or executive orders.

Environmental Requirement	Compliance
Bald Eagle Protection Act, 42 USC 4151-4157	FC
Clean Air Act, 42 USC 7401-7542	FC
Clean Water Act, 33 USC 1251-1375	FC
Comprehensive Environmental Response, Compensation, and Liability Act, (HTRW) 42 USC 9601-9675	FC
Endangered Species Act, 16 USC 1531-1543	FC
Farmland Protection Policy Act, 7 (Prime Farmland) USC 4201-4208	FC
Fish and Wildlife Coordination Act, 16 USC 661-666c	FC
Food Security Act of 1985 (Swampbuster), 7 USC varies	FC
Land and Water Conservation Fund Act, (Recreation)16 USC 460d-4601	FC
National Environmental Policy Act of 1969, 42 USC 4321-4347	PC ²
National Historic Preservation Act, 16 USC 470 et seq.	PC ¹
Noise Control Act of 1972, 42 USC 4901-4918	FC
Resource, Conservation, and Rehabilitation Act, (Solid Waste) 42 USC 6901-6987	FC
Rivers and Harbors Appropriation Act, (Sec. 10) 33 USC 401-413	FC
Water Resources Development Acts of 1986 and 1990 (Sec 906 – Mitigation; Sec 307 - No Net Loss - Wetlands)	FC
Floodplain Management (EO 11988 as amended by EO 12148)	FC
Federal Compliance with Pollution Control Standards (EO 12088)	FC
Protection and Enhancement of Environmental Quality (EIS Preparation) (EO 11991)	FC
Protection and Enhancement of the Cultural Environment (Register Nomination) (EO 11593)	FC
Protection of Wetlands (EO 11990 as amended by EO 12608)	FC

FC = Full Compliance, PC¹ = Partial Compliance (on-going, would be accomplished prior to construction), PC² full compliance would be achieved upon signing of the NEPA document.

6.0 COORDINATION AND PUBLIC REVIEW

Notification of the DRAFT Environmental Assessment and unsigned Finding of No Significant Impact was sent to several relevant officials, agencies, organizations, and individuals for review and comment. Additionally, an electronic copy was available on the St. Louis District's website during the 30-day public review period at the following url:

<https://www.mvs.usace.army.mil/Portals/54/docs/pm/Reports/EA/2021WappapelloLakeForestry.pdf>

Please note that the Finding of No Significant Impact is unsigned during the public review period. These documents would be signed into effect only after having carefully considered comments received as a result of the public review. To assure compliance with the National Environmental Policy Act, Endangered Species Act, and other applicable environmental laws and regulations, coordination with these agencies would continue as required throughout the planning and construction phases of the proposed work.

DRAFT

7.0 ENVIRONMENTAL ASSESSMENT PREPARERS

Contacts Made:

- John Weber (Lead Biologist, USFWS, Columbia Field Office, MO)
- Kris Budd (Fish & Wildlife Biologist, USFWS, Columbia Field Office, MO)
- Christopher Hopfinger (Forester, USACE, St. Louis, MO)

Document Preparers:

- Evan Hill (Wildlife Biologist, USACE, St. Louis, MO)
- Eric Lemons (Biologist), USACE, Wappapello, MO)
- Eric Limanen (Biologist), USACE, Wappapello, MO)

DRAFT

8.0 REFERENCES

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9.0 FINDING OF NO SIGNIFICANT IMPACT

1. In accordance with the National Environmental Policy Act, I have reviewed and evaluated the documents relevant to the Wappapello Forest Stand Improvement (FSI) Project. The Action Alternative would improve upland forest habitat in the areas surrounding the lake and provide substantial ecological benefits to wildlife using these forests.
2. As part of this evaluation, I have considered the following project alternatives:
 - a. The “No Action” alternative is the alternative for which no federal actions would be carried out to achieve FSI objectives. This alternative also represents the baseline or reference against which to describe environmental effects of the action alternative. Under this scenario, the Wappapello Lake project would continue to perform its operation and maintenance responsibilities (including invasive species removal) but would not carry out any FSI actions.
 - b. The Tentatively Selected Plan (TSP) includes FSI actions intended to meet the objectives laid out in Section 1.5 in order to improve the quality of forest habitat at the Wappapello Lake project. These FSI actions would include soil disturbance and tree removal. The FSI actions would occur on 12 large forest compartments which are split into 73 smaller forest stands. The full area of the project is 20,861 acres but only 6,431 acres would be treated with selective tree cutting. A commercial timber harvest (or other contracting methods) would be the primary method of tree removal used in 50 of the 67 stands. A priority list was drafted that ranks each stand to maximize productivity over the span of the project. The action alternative would include soil disturbance in the form of access and staging area creation and use. Existing access roads and open areas would be used when possible but some new areas would be created as well.
3. The possible consequences of the two alternatives have been studied for physical, environmental, cultural, social, economic, aesthetic, and recreational effects. Significant factors evaluated as part of my review include:
 - a. The Proposed Action would meet the need for improved forest health at Wappapello Lake.
 - b. Wildlife and habitat resources would accrue benefits as a result of the project.
 - c. The proposed project would require tree cutting. Tree cutting would not occur in June or July of any year to minimize impacts to federally threatened or endangered bat species. No significant adverse impacts to

federally listed, candidate, or proposed mussel, turtle, or crayfish species or critical habitat are anticipated.

- d. Impacts to bald eagles and their nests would be avoided.
 - e. Incidental take of migratory birds may occur in accordance with the Migratory Bird Treaty Act. Overall, the improvement in forest health provided by the FSI would result in substantial long-term beneficial impacts to Migratory Birds.
 - f. The proposed project would avoid impacts to archaeological remains, historic properties, and tribal resources.
 - g. The proposed FSI activities would result in only temporary minor impacts to soils, aesthetics, recreation, noise levels, air quality, and water quality.
 - h. No significant impacts are anticipated to wetlands or bottomland hardwood forests.
 - i. There are no significant hazardous and toxic waste (HTRW) issues anticipated.
 - j. The Proposed Action would not adversely impact topography, geology, or prime and unique farmland.
 - k. The FSI alternative would not result in disproportionately high and adverse human health or environmental effects to minority or low-income populations, or disadvantaged communities, or cause other Environmental Justice concerns.
 - l. No significant climate change impacts are anticipated.
 - m. No significant cumulative impacts are anticipated.
4. Based on my analysis and evaluation of the alternative courses of action presented in the Environmental Assessment, I have determined that the implementation of the Action Alternative would not have significant effects on the quality of the environment. The proposed action has been coordinated with appropriate resource agencies, and there are no significant unresolved issues. Therefore, an Environmental Impact Statement will not be prepared prior to proceeding with this action.

(Date)

Kevin R. Golinghorst
Colonel, U.S. Army
District Commander

Appendix 1

USFWS Coordination

IPaC Report



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Missouri Ecological Services Field Office
101 Park Deville Drive
Suite A
Columbia, MO 65203-0057
Phone: (573) 234-2132 Fax: (573) 234-2181

In Reply Refer To:
Project Code: 2022-0043677
Project Name: Wappapello Lake Forestry Management

March 14, 2023

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

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Threatened and Endangered Species

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and may be affected by your proposed project. The species list fulfills the requirement for obtaining a Technical Assistance Letter from the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. **Note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days.** The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Consultation Technical Assistance

Refer to the Midwest Region [S7 Technical Assistance](#) website for step-by-step instructions for making species determinations and for specific guidance on the following types of projects:

projects in developed areas, HUD, pipelines, buried utilities, telecommunications, and requests for a Conditional Letter of Map Revision (CLOMR) from FEMA.

Federally Listed Bat Species

Indiana bats, gray bats, and northern long-eared bats occur throughout Missouri and the information below may help in determining if your project may affect these species.

Gray bats - Gray bats roost in caves or mines year-round and use water features and forested riparian corridors for foraging and travel. If your project will impact caves, mines, associated riparian areas, or will involve tree removal around these features – particularly within stream corridors, riparian areas, or associated upland woodlots –gray bats could be affected.

Indiana and northern long-eared bats - These species hibernate in caves or mines only during the winter. In Missouri the hibernation season is considered to be November 1 to March 31. During the active season in Missouri (April 1 to October 31) they roost in forest and woodland habitats. Suitable summer habitat for Indiana bats and northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥ 5 inches diameter at breast height (dbh) for Indiana bat, and ≥ 3 inches dbh for northern long-eared bat, that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Tree species often include, but are not limited to, shellbark or shagbark hickory, white oak, cottonwood, and maple. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat and evaluated for use by bats. If your project will impact caves or mines or will involve clearing forest or woodland habitat containing suitable roosting habitat, Indiana bats or northern long-eared bats could be affected.

Examples of unsuitable habitat include:

- Individual trees that are greater than 1,000 feet from forested or wooded areas;
- Trees found in highly-developed urban areas (e.g., street trees, downtown areas);
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees; and
- A stand of eastern red cedar shrubby vegetation with no potential roost trees.

Using the IPaC Official Species List to Make No Effect and May Affect Determinations for Listed Species

1. If IPaC returns a result of “There are no listed species found within the vicinity of the project,” then project proponents can conclude the proposed activities will have **no effect** on any federally listed species under Service jurisdiction. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example ["No Effect" document](#) also can be found on the S7 Technical Assistance website.
-

2. If IPaC returns one or more federally listed, proposed, or candidate species as potentially present in the action area of the proposed project – other than bats (see #3 below) – then project proponents can conclude the proposed activities **may affect** those species. For assistance in determining if suitable habitat for listed, candidate, or proposed species occurs within your project area or if species may be affected by project activities, you can obtain [Life History Information for Listed and Candidate Species](#) through the S7 Technical Assistance website.
3. If IPaC returns a result that one or more federally listed bat species (Indiana bat, northern long-eared bat, or gray bat) are potentially present in the action area of the proposed project, project proponents can conclude the proposed activities **may affect** these bat species **IF** one or more of the following activities are proposed:
 - a. Clearing or disturbing suitable roosting habitat, as defined above, at any time of year;
 - b. Any activity in or near the entrance to a cave or mine;
 - c. Mining, deep excavation, or underground work within 0.25 miles of a cave or mine;
 - d. Construction of one or more wind turbines; or
 - e. Demolition or reconstruction of human-made structures that are known to be used by bats based on observations of roosting bats, bats emerging at dusk, or guano deposits or stains.

If none of the above activities are proposed, project proponents can conclude the proposed activities will have **no effect** on listed bat species. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example ["No Effect" document](#) also can be found on the S7 Technical Assistance website.

If any of the above activities are proposed in areas where one or more bat species may be present, project proponents can conclude the proposed activities **may affect** one or more bat species. We recommend coordinating with the Service as early as possible during project planning. If your project will involve removal of over 5 acres of suitable forest or woodland habitat, we recommend you complete a Summer Habitat Assessment prior to contacting our office to expedite the consultation process. The Summer Habitat Assessment Form is available in Appendix A of the most recent version of the [Range-wide Indiana Bat Summer Survey Guidelines](#).

Other Trust Resources and Activities

Bald and Golden Eagles - Although the bald eagle has been removed from the endangered species list, this species and the golden eagle are protected by the Bald and Golden Eagle Act and the Migratory Bird Treaty Act. Should bald or golden eagles occur within or near the project area please contact our office for further coordination. For communication and wind energy projects, please refer to additional guidelines below.

Migratory Birds - The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Service. The Service has the responsibility under the MBTA

to proactively prevent the mortality of migratory birds whenever possible and we encourage implementation of recommendations that minimize potential impacts to migratory birds. Such measures include clearing forested habitat outside the nesting season (generally March 1 to August 31) or conducting nest surveys prior to clearing to avoid injury to eggs or nestlings.

Communication Towers - Construction of new communications towers (including radio, television, cellular, and microwave) creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. However, the Service has developed [voluntary guidelines for minimizing impacts](#).

Transmission Lines - Migratory birds, especially large species with long wingspans, heavy bodies, and poor maneuverability can also collide with power lines. In addition, mortality can occur when birds, particularly hawks, eagles, kites, falcons, and owls, attempt to perch on uninsulated or unguarded power poles. To minimize these risks, please refer to [guidelines](#) developed by the Avian Power Line Interaction Committee and the Service. Implementation of these measures is especially important along sections of lines adjacent to wetlands or other areas that support large numbers of raptors and migratory birds.

Wind Energy - To minimize impacts to migratory birds and bats, wind energy projects should follow the Service's [Wind Energy Guidelines](#). In addition, please refer to the Service's [Eagle Conservation Plan Guidance](#), which provides guidance for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities.

Next Steps

Should you determine that project activities **may affect** any federally listed species or trust resources described herein, please contact our office for further coordination. Letters with requests for consultation or correspondence about your project should include the Consultation Tracking Number in the header. Electronic submission is preferred.

If you have not already done so, please contact the Missouri Department of Conservation (Policy Coordination, P. O. Box 180, Jefferson City, MO 65102) for information concerning Missouri Natural Communities and Species of Conservation Concern.

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

John Weber

Attachment(s):

- Official Species List
-

OFFICIAL SPECIES LIST

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

This species list is provided by:

Missouri Ecological Services Field Office

101 Park Deville Drive

Suite A

Columbia, MO 65203-0057

(573) 234-2132

PROJECT SUMMARY

Project Code: 2022-0043677

Project Name: Wappapello Lake Forestry Management

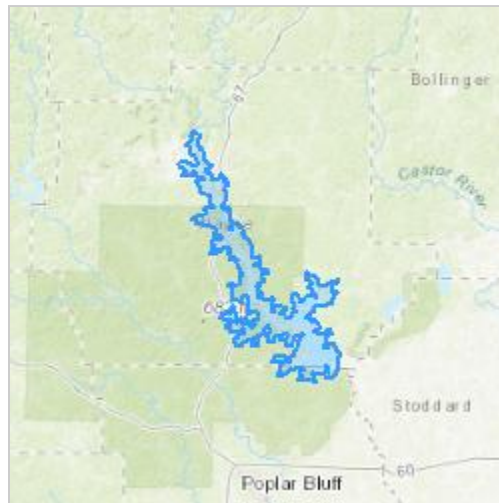
Project Type: Forest Management Plan

Project Description: This is the correct IPaC for the Wappapello Forestry Management, disregard the copy that was made in error on 17 May 2022.

The Tentatively Selected Plan (TSP) includes FSI actions intended to meet the objectives laid out in Section 1.5 in order to improve the quality of forest habitat at the Wappapello Lake project. The FSI actions included in this alternative would occur on 9 compartments which are split into 67 individual forest stands. The full area of the project is 19,704 acres. The total tree harvest acreage is 5,903 acres. As part of the tree removal process, the trees felled in 50 of the 67 stands will be sold commercially. A priority list was drafted that ranks each stand to maximize productivity over the span of the project. Some of the stands will also require invasive species removal.

Project Location:

The approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@37.070076,-90.43398286356134,14z>



Counties: Butler and Wayne counties, Missouri

ENDANGERED SPECIES ACT SPECIES

There is a total of 11 threatened, endangered, or candidate species on this species list.

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

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

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

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

MAMMALS

NAME	STATUS
Gray Bat <i>Myotis grisescens</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6329	Endangered
Indiana Bat <i>Myotis sodalis</i> There is final critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949 General project design guidelines: https://ipac.ecosphere.fws.gov/project/SNPV5AAZYJGFPJWVCXRPNNUY2A/documents/generated/6868.pdf	Endangered
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045 General project design guidelines: https://ipac.ecosphere.fws.gov/project/SNPV5AAZYJGFPJWVCXRPNNUY2A/documents/generated/6868.pdf	Threatened
Tricolored Bat <i>Perimyotis subflavus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

REPTILES

NAME	STATUS
Alligator Snapping Turtle <i>Macrochelys temminckii</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4658	Proposed Threatened

CLAMS

NAME	STATUS
Rabbitsfoot <i>Quadrula cylindrica cylindrica</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5165	Threatened
Snuffbox Mussel <i>Epioblasma triquetra</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4135	Endangered
Western Fanshell <i>Cyprogenia aberti</i> There is proposed critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/6895	Proposed Threatened

INSECTS

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

CRUSTACEANS

NAME	STATUS
Big Creek Crayfish <i>Faxonius peruncus</i> There is proposed critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/10759	Proposed Threatened
St. Francis River Crayfish <i>Faxonius quadruncus</i> There is proposed critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/10761	Proposed Threatened

CRITICAL HABITATS

There are 3 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Big Creek Crayfish <i>Faxonius peruncus</i> https://ecos.fws.gov/ecp/species/10759#crithab	Proposed
Rabbitsfoot <i>Quadrula cylindrica cylindrica</i>	Final

NAME	STATUS
https://ecos.fws.gov/ecp/species/5165#crithab	
St. Francis River Crayfish <i>Faxonius quadruncus</i> https://ecos.fws.gov/ecp/species/10761#crithab	Proposed

IPAC USER CONTACT INFORMATION

Agency: Army Corps of Engineers
Name: Evan Hill
Address: 1222 Spruce St
City: St. Louis
State: MO
Zip: 63103
Email: evan.b.hill@usace.army.mil
Phone: 3149255004

USFWS Biological Opinion

United States Department of the Interior



FISH AND WILDLIFE SERVICE
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-0057
Phone: (573) 234-2132 Fax: (573) 234-2181



April 11, 2023

Mr. Evan Hill
Environmental Compliance Section
U.S. Army Corps of Engineers - St. Louis District
1222 Spruce Street, St. Louis, MO 63103

Subject: Biological Opinion on the Wappapello Lake Forest Stand Improvement (2022-0043677)

Dear Mr. Hill:

This document transmits our final biological opinion under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.) on the proposed Wappapello Lake Forestry Stand Improvement in Wayne and Butler Counties, Missouri. This biological opinion is based on information provided in the November 2022 BA prepared by the St. Louis district of the U.S. Army Corps of Engineers (USACE), other available literature, survey data, and other sources of information. A complete administrative record of this consultation is on file at the Missouri Ecological Field Office.

The enclosed biological opinion addresses effects of the project, which you have determined may affect and is likely to adversely affect the federally listed Indiana bat (*Myotis sodalis*), and Northern long-eared bat (*Myotis septentrionalis*). We concur with these determinations, and the biological opinion provides a statement of anticipated incidental take as a result of the project. The Incidental Take Statement (ITS) issued exempts the USACE from the prohibitions of taking under Section 9 of the Act provided that such taking is in compliance with the terms and conditions of the ITS.

The USACE has also concluded that the proposed activities may affect, but are not likely to adversely affect gray bat (*Myotis grisescens*), Rabbitsfoot Mussel (*Quadrula cylindrica*), Western Fanshell Mussel (*Cyprogenia aberti*), Snuffbox Mussel (*Epioblasma triquetra*), and Big Creek crayfish (*Faxonius peruncus*) and that the proposed action is not likely to jeopardize the continued existence of the alligator snapping turtle (*Macrochelys temminckii*), monarch butterfly (*Danaus plexippus*), and tricolored bat (*Perimyotis subflavus*). Furthermore, the project was determined not likely to destroy or adversely modify the designated critical habitat for the Rabbitsfoot Mussel, Big Creek crayfish and St. Francis River crayfish. Based on information in the BA and our database review of locations and habitats of this species, we concur with these determinations.

If you have any questions or concerns regarding this consultation and biological opinion, please contact Kris Budd of this office at kris_budd@fws.gov (573-234-5038).

Sincerely,

John Weber
Field Supervisor

BIOLOGICAL OPINION

**Wappapello Lake Forest Stand Improvement
(2023-0043677)**

Prepared by:
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office

April 11, 2023

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INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the U.S. Army Corps of Engineers' (USACE) proposed Wappapello Lake forest stand improvement strategies. This BO evaluates the potential and actual effects on the Northern long-eared bat (*Myotis septentrionalis*), and Indiana bat (*Myotis sodalis*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

The proposed action includes the implementation of the forest stand improvements (FSI) activities outlined within the 2022 Wappapello Lake Forest Stand Improvement Environmental Assessment (EA). The FSI treatments would include tree removal, chemical and mechanical removal of invasive species, and tree plantings. Edge feathering to be used in some transitional areas along the edge of forested areas. Tree removal would also include the removal of hazard trees, which pose a threat to public safety. Formal consultation was initiated on January 3rd 2023 upon acceptance of the final Biological Assessment (BA) by the Service's Missouri Ecological Services Field Office. The purpose of the formal consultation process is to ensure federal agency activities are not likely to jeopardize the continued existence of any federally listed species or result in the destruction or adverse modification of any designated critical habitat.

This BO is based on information provided in the January 2023 BA prepared by the U.S. Army Corps of Engineers St. Louis District, survey data, available literature, other sources of information available to us and/or in our database. The Service has determined that implementation of the proposed activities described in the BA will not jeopardize the continued existence of the Northern long-eared bat or Indiana bat, but may result in incidental take of these species. No designated critical habitat will be affected by this action; therefore, no further discussion of critical habitat is included in this BO.

CONSULTATION HISTORY

30 Aug 2022 – Submission of a BA from Evan Hill to USFWS for pre-consultation coordination

20 Sep 2022 – Feedback provided on the initial BA from Kris Budd to Evan Hill

29 Sep 2022 – Additional Review of preliminary BA submitted by Evan Hill with further discussion regarding tree clearing restrictions

17 Oct 2022 - Consultation regarding Tricolored bats and Little brown bats clarified by Kris Budd with further conversations regarding tree clearing restrictions

09 Nov 2022 – NABat Survey results for Wappapello Lake provided by Evan Hill

12 Dec 2022 – Meeting between Eric Lemons, Teri Allen, Evan Hill, Kris Budd and Trisha Crabill to discuss BA in regard to winter tree clearing restrictions

03 Jan 2023 – Submission of a revised BA from Evan Hill to Kris Budd with request for formal consultation

03 Jan 2023 – Formal acceptance of the BA from Kris Budd

20 Jan 2023 – Draft BO sent from Kris Budd to Evan Hill for review and comments

31 Jan 2023—Monitoring for endangered bats discussed between John Weber and Evan Hill

27 Mar 2023—Final bat monitoring plan received by John Weber

11 Apr 2023—Final draft of biological opinion sent to USACE

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Section 7(a)(2) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.) requires that Federal agencies shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat. When the actions of a Federal agency may adversely affect a protected species, that agency (i.e., the action agency) is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (Service), depending upon the protected species that may be affected.

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, St. Louis District, requested formal consultation to evaluate the potential impacts to fish, wildlife, and habitat associated with the proposed forest stand improvements surrounding Wappapello Lake in Wayne County, Missouri. Wappapello Lake is located on the Upper St. Francis River in southeastern Missouri. The dam site lies 22 miles southeast of Greenville, MO, one mile southwest of Wappapello, MO, and 16 miles northeast of Poplar Bluff, MO. Although most of the lake is in Wayne County, a small southern portion extends into Butler County (Figure 1). Wayne and Butler Counties are in southeastern Missouri. St. Louis MO is approximately 144 miles to the north, Memphis TN approximately 159 miles to the south, Carbondale IL 127 miles northeast, Cape Girardeau MO 59 miles northeast and Jonesboro AR 97 miles southwest.

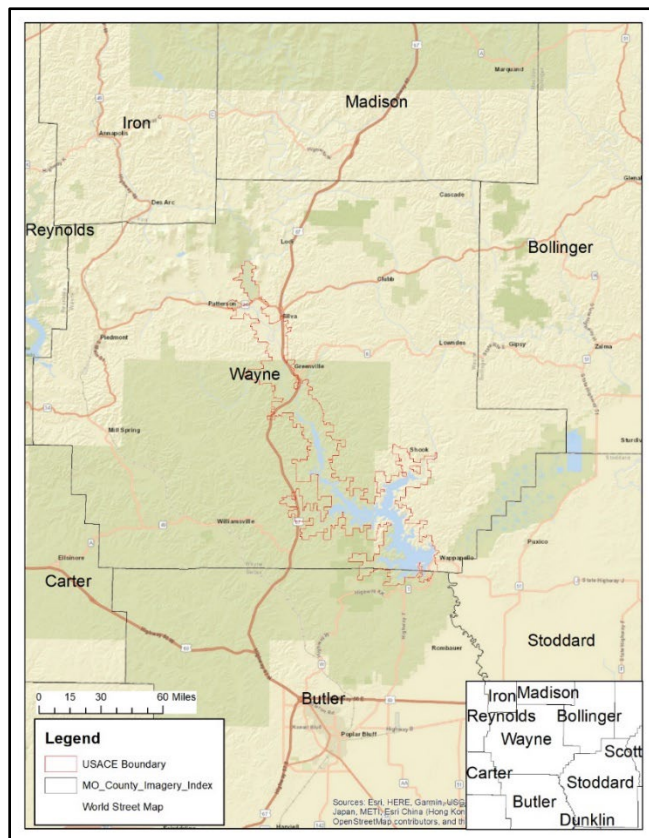


Figure 1. Map of Wappapello Lake in Wayne and Butler counties, Missouri.

The Wappapello Lake FSI actions focus on proposed forest management activities that would improve the forest community and wildlife habitat within the Proposed Action Area. The FSI treatments would include tree removal, chemical and mechanical removal of invasive species, and tree plantings. Edge feathering would be used in some transitional areas along the edge of forested areas. Tree removal would also include the removal of hazard trees, which pose a threat to public safety.

Forest improvement strategies seek to restore and enhance oak-hickory forest communities to ensure long-term sustainability of these critical community types. Improving the number of age cohorts and species diversity within the oak-hickory community types can provide for future sustainability of the forest resource. The high tree stem density with closed forest structure creates highly shaded conditions which prevent shade intolerant tree species, i.e., oak species, from becoming established. Oak and hickory species are deemed desirable due to their mast producing capabilities and physiological characteristics, which directly benefits a wide range of wildlife species.

The Wappapello Lake FSI actions focus on proposed forest management activities that would improve the forest community and wildlife habitat within the Action Area. Physical treatment of all stands will take approximately 20-years to complete. This timeline may be reduced or slightly exceeded during periods of above-average precipitation when soils are too saturated for operation and movement of equipment.

The FSI actions would occur on 9 compartments which are split into 67 individual forest stands (Table 1; Figure 2). The full area of the project is 20,861 acres. The total tree harvest acreage is 6,431 acres. As part of the tree removal process, the trees felled in 50 of the 67 stands will be sold commercially, when possible.

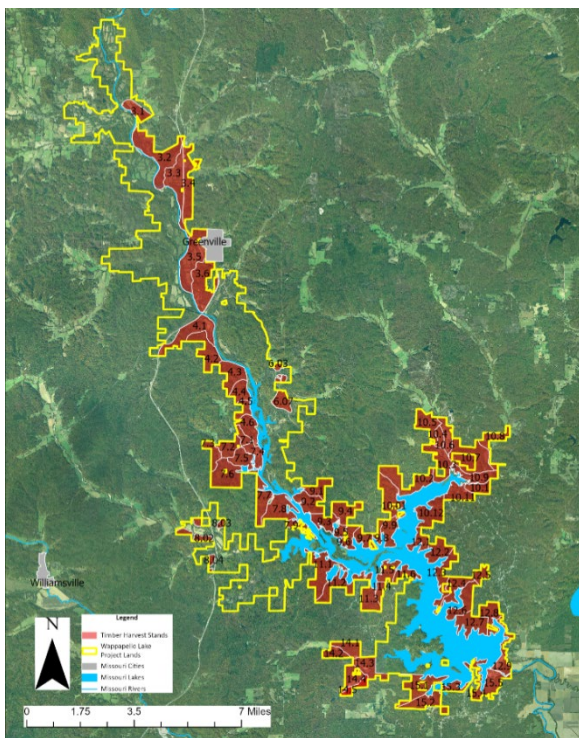


Figure 2. Location of the forested areas around Wappapello Lake where the FSI activities would take place over 20 years.

Table 1. Description of the area and treatment for each forest stand. (1EF-Edge Feathering, 2STS-

Single Tree Selection, 3TSI-Cut and Spray Timber Stand Improvement, 4HTR-Hazard Tree Removal).

Compartment	Stand	Area (Acres)	Tree Removal (Acres)	Harvest/Sale (Y/N)	Proposed Treatment*	Year of Harvest
3	3.1	212	0	N	EF ¹	N/A
3	3.2	717	209	Y	STS ² ,TSI ³ ,EF	2
3	3.3	494	67	Y	STS,TSI,EF	5
3	3.4	499	197	Y	STS,TSI,EF	9
3	3.5	638	12	Y	STS,TSI,EF	12
3	3.6	580	179	Y	STS,TSI	16
4	4.1	504	183	Y	STS,TSI	1
4	4.2	400	256	Y	STS,TSI	4
4	4.3	354	160	Y	STS,TSI	7
4	4.4	217	148	Y	STS,TSI	10
4	4.5	127	85	Y	STS,TSI	15
4	4.6	262	146	Y	STS,TSI,EF	18
6	6.3	166	85	Y	STS, TSI	1
6	6.7	208	184	Y	STS, TSI	2
7	7.1	104	91	Y	STS,TSI	3
7	7.2	219	187	Y	STS,TSI	6
7	7.3	178	88	Y	STS,TSI,EF	8
7	7.4	191	0	N	EF	N/A
7	7.5	229	107	Y	STS,TSI	11
7	7.6	498	237	Y	STS,TSI,EF	13
7	7.7	353	157	Y	STS,TSI	15
7	7.8	398	180	Y	STS,TSI	17
7	7.9	142	0	N	TSI	N/A
8	8.2	344	168	Y	STS, TSI EF	3
8	8.3	245	40	Y	STS, TSI EF	4
8	8.4	194	51	Y	STS, TSI EF	5
9	9.1	223	81	Y	STS,TSI,EF	2
9	9.2	306	78	Y	STS,TSI,EF	5
9	9.3	224	97	Y	STS,TSI	7
9	9.4	293	137	Y	STS,TSI,EF	10
9	9.5	87	47	Y	STS,TSI	12
9	9.6	163	76	Y	STS,TSI	14
9	9.7	201	95	Y	STS,TSI	16
9	9.8	86	43	Y	STS,TSI	18
9	9.9	238	185	Y	STS,TSI	19
10	10.01	453	214	Y	STS,TSI	1
10	10.2	479	127	Y	STS,TSI,EF	4
10	10.3	366	0	N	TSE,EF	8
10	10.4	99	65	Y	STS,TSI	9

10	10.5	301	65	Y	STS,TSI,EF	12
10	10.6	207	0	N	EF	N/A
10	10.7	696	304	Y	STS,TSI,EF	14
10	10.8	245	0	N	EF	N/A
10	10.9	257	23	Y	TSI, EF	16
10	10.1	163	100	Y	STS,TSI,EF	19
10	10.11	268	117	Y	STS,TSI,EF	20
10	10.12	417	0	N	TSI	N/A
11	11.1	477	235	Y	STS,TSI	3
11	11.2	374	41	N	STS,TSI	6
11	11.3	292	10	N	STS,TSI	8
11	11.4	103	0	N	STS,TSI	11
11	11.5	227	163	Y	STS,TSI	13
11	11.6	165	0	N	STS,TSI	17
12	12.1	176	0	N	HTR ⁴	N/A
12	12.2	280	0	N	TSI	N/A
12	12.3	323	62	Y	STS,TSI	3
12	12.4	278	74	Y	STS,TSI	7
12	12.5	134	0	N	TSI	N/A
12	12.6	324	54	Y	STS,TSI	11
12	12.7	370	0	N	HTR	N/A
12	12.8	289	5	N	STS,TSI	15
12	12.9	280	0	N	HTR	N/A
14	14.1	216	182	Y	STS,TSI	1
14	14.2	159	34	Y	STS,TSI	4
14	14.3	294	71	Y	STS,TSI,EF	6
14	14.4	359	129	Y	STS,TSI,EF	10
14	14.5	121	35	Y	STS,TSI,EF	14
15	15.1	431	147	Y	STS,TSI,EF	2
15	15.2	329	80	Y	STS,TSI,EF	5
15	15.3	150	14	Y	STS,TSI,EF	9
15	15.4	185	24	Y	STS,TSI,EF	13
15	15.5	280	0	N	HTR	N/A
Total		20,861	6,431			

¹EF-Edge Feathering, ²STS-Single Tree Selection, ³TSI-Cut and Spray Timber Stand Improvement, ⁴HTR-Hazard Tree Removal

The following forest management treatments were proposed to achieve the project objectives: uneven-aged, even-aged, and intermediate forest management. The treatment used at each forest stand would be based on the existing conditions at that stand.

Intermediate Treatments – Forest Stand Improvement is broadly defined as an intermediate treatment. It is further defined as any treatment or tending designed to enhance growth, quality, vigor, and composition of the stand.

Overstory Treatments: Overstory trees are removed to reduce competition to desirable hardwoods and to promote oak regeneration. Oak cannot regenerate and survive under low light levels and are often shaded out of the forest without some type of overstory disturbance. Trees to be removed are undesirable overstory hardwood species consisting primarily of elm, honey locust, sassafras, boxelder, and hackberry.

Midstory Treatments: Thinning is a tree removal treatment performed to reduce stand density of trees. It is utilized primarily to increase growth, enhance forest health, or reduce potential mortality. Thinning of existing forest resources would be a focus of many of the prescriptions in order to establish early successional and oak-hickory forest communities and support uneven-age management of maple-ash-elm forest communities.

Crop Tree Release: A desirable tree species (e.g. oaks, black cherry, hickories) in good health and form would be selected as a crop tree. Then, each tree that is touching or directly competing with the selected tree is felled or girdled. The crop tree can be released on one side (a light cut) or on up to all four sides (very heavy cut). Trees to be removed in the crop tree release are undesirable overstory hardwood consisting primarily of elm, honey locust, sassafras, boxelder, and hackberry. Desirable tree species would include shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), mockernut hickory (*Carya tomentosa*), black cherry (*Prunus serotina*), cherrybark oak (*Quercus pagoda*), pin oak (*Quercus palustris*), shingle oak (*Quercus imbricaria*), white oak (*Quercus alba*), and northern red oak (*Quercus rubra*). Undesirable tree and other plant species would include red maple (*Acer rubrum*), silver maple (*Acer saccharinum*), sweetgum (*Liquidambar* spp.), elm (*Ulmus* spp.), hackberry (*Celtis* spp.), any poorly formed midstory trees, regardless of species. Invasive plants that have become a problem in many of the stands include autumn olive (*Eleagnus umbellata*), multiflora rose (*Rosa multiflora*), bush honeysuckle (*Lonicera maackii*), Japanese honeysuckle (*Lonicera japonica*), and winter creeper (*Euonymus fortunei*).

Tree Removal: Tree removal will be accomplished with mechanical methods over the 20-year period of FSI actions. In some cases, construction of temporary access roads and staging areas will be required but existing access roads and open areas would be used when possible. Trees targeted for removal would include low quality, diseased, over-mature and/or undesirable tree species. The mechanism of removal would be by means of commercial timber harvesting within each stand. Individual selection of single tree would be marked by USACE biologists/foresters and removal would be accomplished through means of a timber sale contract. Contractors would cut and harvest trees identified for removal through use of commonly used logging equipment like hand-held chainsaws, skidders, and mechanical cutters. Because the trees are being removed for FSI, there will be some trees identified for removal that would not be suitable for sale but the removal would benefit the goals and objectives of FSI.

Single Tree Selection: A single tree selection treatment would reduce the density/basal area within each stand. The amount of basal area reduction would be determined by existing stand conditions such as; tree stocking percentage, individual tree species health, and amount of desirable hardwood regeneration present. Black oak (*Quercus velutina*) and scarlet oak (*Quercus coccinea*) trees compose the majority of harvestable saw timber within the proposed treatment stands. A complex interaction of environmental stressors and pests

contribute to the decline of oak in addition to biological maturity of individual trees. Specifically, oak decline has contributed to the widespread mortality of the red oak (*Quercus rubra*) species within the Ozark region over the past few decades. The red oak species would be targeted to reduce basal area, encourage desirable regeneration, and promote growth for intermediate size trees. White oak (*Quercus alba*) tree species are well distributed throughout their size classes. Tree removal within the white oak species group would be implemented to improve individual tree health while maintaining residual size class distribution within each diameter group, i.e. 10, 12, 14 inch, etc. Shortleaf pine (*Pinus echinata*) tree species groups within the treatment area would be thinned to promote growth of individual trees and improve overall forest health.

Stand re-assessments or inventories would be utilized to monitor stand conditions post silvicultural treatments. The level of success would be determined through vegetation monitoring.

Invasive Species Management – Invasive species management is in accordance with the National Invasive Species Act of 1996 (PL 104-332) and the USACE Invasive Species Policy (2009), which seeks to contain and reduce the spread and populations of established invasive species to minimize their harmful impacts. Acceptable control techniques include chemical, mechanical, biological, fire, cultural, and flooding. All of these alternatives would be evaluated prior to the implementation of a control technique. The control technique chosen would be based upon potential ecological impact, susceptibility of targeted species, cultural acceptability, and cost benefit analysis. A Pesticide Use Proposal (PUP) evaluating each control technique and justifying the use of chemical pesticides would be produced prior to the large-scale use of a pesticide. Treatment of invasive species would occur within the proposed treatment stands as part of FSI or as needed to ensure tree seedling survival and recruitment. Monitoring pre- and post-treatment would be conducted to determine the success of the treatment and adaptive management adjustments would be made based upon this analysis.

Prescribed Fire – Prescribed fire is a fire intentionally set in a specific pre-planned area to accomplish established management goals. Fire management is a tool used to improve forest habitat by reducing the potential for wildfire, reducing the cover of undesirable and invasive vegetation, and for promoting oak/hickory regeneration and the growth of other desirable tree species. Where feasible, prescribed fire will be used to maintain woodland tracts that do not meet the above-mentioned management objectives and goals. Often fire management will be used after timber harvests and after undesirable tree species have been mechanically felled. Where possible, existing roadways, timber haul roads and other natural barriers will be used for fire lines. In instances where fire lines need to be constructed, they will be in areas that have been surveyed to avoid impacts to cultural resources and built using BMP's so as to not cause erosion. The timing of prescribed burns would be either in the dormant or the growing season, depending on the site-specific conditions of each stand in order to provide the maximum long-term benefits.

Other Activities Caused by the Action

A BO evaluates all consequences to species or critical habitat caused by the proposed Federal action, including the consequences of other activities caused by the proposed action, that are reasonably certain to occur (see definition of “effects of the action” at 50 CFR §402.02). Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities caused by the proposed action (but not part of the proposed action) are reasonably certain to occur. These factors include, but are not limited to:

1. past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;
2. existing plans for the activity; and
3. any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In its request for consultation, the USACE did not describe, and the Service is not aware of, any additional activities caused by the Action that are not included in the previous description of the proposed Action. Therefore, this BO does not address further the topic of “other activities” caused by the Action.

Conservation Measures

Conservation measures are those actions taken to benefit or promote the recovery of the species. These actions taken by the federal agency serve to minimize or compensate for project effects on the species under review and are included as an integral portion of the proposed action.

Stream and Wetland Protection: Forested buffers a minimum of 50-feet would be retained on each side of all perennial and intermittent streams to prevent any soil, bank, and bed disturbance. There will be no temporary or permanent stream crossings that will be constructed over perennial or intermittent streams. In some cases, access roads will cross steep valley drainages, which can serve as ephemeral streams during major precipitation events but that do not have a defined bank otherwise. No wetlands would be crossed by access roads, have staging/landing areas placed within their boundaries, or have temporary or permanent fills added to them.

Soil Disturbance: Haul roads would consist of ridge tops, agricultural fields, and both new and existing roads. Landings and staging areas would be established where necessary on ridge tops and flat areas suitable for access and appropriate to minimize soil disturbance. Access roads and staging areas would not be used during periods of saturated soil conditions to prevent excessive rutting and compaction. Routes for new access roads would be designed to run along high elevation when possible and for minimal tree removal. Typical soil erosion prevention BMPs would be used throughout. Actions that could produce excessive soil disturbance, such as using access roads and staging areas during wet conditions, would be avoided.

Timing of Tree Clearing: Tree removal would not take place between June 1-July 31 to avoid impacts to listed bat species during non-volant juvenile season; i.e., when bat maternity colonies are at their most vulnerable. Summer habitat could undergo FSI activities during other months; however, any construction activities would take place during daylight hours.

Maternity Roosts: All known maternity roosts would be retained with an intact a 1.62-acre patch of trees surrounding known maternity roosts.

Snag and Den Trees: All snags would be preserved except where public or worker safety concerns exist (e.g., prescribed fire line, catastrophic weather events) or disease/insect outbreaks in a stand constitute a threat to the health of the surrounding forest. As a general rule, seven snags or living den trees per acre provide an adequate number of cavities (Missouri Department of Conservation, 2022). While seven dens are optimal, in some cases the number would be less than seven if there are not enough available den trees of each dbh.

- Leave at least one snag and one den tree larger than 20-inches at diameter at breast height (dbh) for every acre of woodland.
- Keep at least four snags ranging between 10 and 20-inches dbh per acre.
- Leave at least two snags and two den trees ranging between 6 and 10-inches at dbh.
- Trees with cavities higher than 20-feet above the ground.
- Prioritize roost trees with multiple types of roosting structures (e.g., cavities, crevices, exfoliating bark).
- Prefer shagbark and shellbark hickory (*Carya ovata* and *C. laciniosa*).
- On average, retain two to four super-canopy trees (trees that are taller than the surrounding trees), or those with potential to become such trees, per acre in to promote structural diversity and provide large leafy surfaces for foraging activities.

If insufficient snags exist, create snags based on average per-acre targets. This should concentrate on creating large diameter (16-inch or greater) snags with exfoliating bark for bat maternity habitat. Prefer shagbark and shellbark hickory, when available.

Caves and Structures: Although there are no known caves found within the action areas or within the boundaries of the Wappapello Lake area, the FSI activities would not remove or modify any natural caves and no cave entrances would be blocked or entered as part of the FSI work. No structures that could be used as roosting habitat would be removed or modified.

Action Area

The Action Area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations [CFR] 402.02). The Action Area is defined by measurable or detectable changes in land, air, and water or to other measurable factors that would result from the proposed action. The Action Area is not limited to the “footprint” of the project but rather encompasses the aerial extent of the biotic, chemical, and physical impacts to the environment resulting from the action.

Disturbance or removal of roosts within the project area could disrupt Indiana bat and Northern long-eared bat maternity colony dynamics throughout the rest of the home range, therefore the action area for the Wappapello Lake FSI includes the treatment areas and up to a 2-mi buffer of additional potential bat habitat based on approximate home range size. The immediate action area for the Wappapello Lake FSI includes 20,861 acres organized into 11 compartments or 72 stands with 6,431 acres of trees estimated be removed total as a result of these activities. Including a two-mile buffer around the immediate project area potentially impacted by the project activities, there is approximately 542,714 acres of deciduous forest, 5,342 acres of evergreen forest, and 18,961 acres of mixed forest. Taken cumulatively, this amounts to 567,017 acres of forested area within the immediate project area and 2-mile buffer zone. If forest stand improvement activities were to be distributed evenly over the 20-year project timeline, there would be approximately 321.55 acres impacted per year.

II. STATUS OF THE SPECIES

This section presents the biological or ecological information relevant to formulating this BO. Appropriate information on the species’ life history, its habitat and distribution, and other data on factors necessary to its survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to

the current range-wide status of the species. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), and the draft recovery plan, and first revision (USFWS 2007) and available literature.

Species Description

This BO addresses effects of the project on the Northern long-eared bat (*Myotis septentrionalis*), and Indiana bat (*Myotis sodalis*).

Northern Long-eared Bat, *Myotis septentrionalis*

The Northern long-eared bat was originally proposed for federal listing as endangered on 2 October 2013. On 2 April 2015, the species was given a proposed listing of threatened with a 4(d) rule (USFWS 2015). On 23 March 2022, the Service published a proposal to reclassify the Northern long-eared bat as endangered under the Endangered Species Act. The reclassification, removed the previous 4(d) rule for the Northern long-eared bat, as these rules may be applied only to threatened species. The reclassification to endangered and the removal of the 4(d) rule is effective on 30 January 2023; 60 days following publication of the final ruling on 30 November 2022 in the Federal Register. No critical habitat has been proposed for the species.

The Northern long-eared bat is about 3 to 3.7 inches long with a wingspan of 9 to 10 inches. As its name suggests, it is distinguished by its long ears, particularly compared to other bats in its genus, *Myotis*. It emerges at dusk to fly primarily through the understory of forest areas, feeding mostly on moths, flies, leafhoppers, caddisflies and beetles. It catches these insects while in flight using echolocation or by using gleaning behavior, catching motionless insects from vegetation.

Life History and Biology - Typical of most bat species in the eastern United States, Northern long-eared bats migrate between winter hibernacula and summer roosting habitat. When female Northern long-eared bats hibernate in winter torpor from mid-September through late October, and then emerge in April to migrate to summer maternity colonies. Pups are born between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant (able to fly) in mid- to late-July. Migration back to the hibernaculum may begin in August, peak in September, and continue into October.

Winter Hibernation – Northern long-eared bats are thought to predominantly overwinter in hibernacula that include caves and abandoned mines. These hibernacula have relatively constant, cooler temperatures (0 to 9 degrees Celsius [°C] or 32 to 48 degrees Fahrenheit [°F]) (Raesly and Gates 1987, p. 18; Caceres and Pybus 1997, p. 2; Brack 2007, p. 744), with high humidity and no strong currents (Fitch and Shump 1979, p. 2; van Zyll de Jong 1985, p. 94; Raesly and Gates 1987, p. 118; Caceres and Pybus 1997, p. 2). Northern long-eared bats are typically found roosting singly or in small numbers in cave or mine walls or ceilings, often in small crevices or cracks, sometimes with only the nose and ears visible and thus are easily overlooked during surveys (Griffin 1940a, pp. 181–182; Barbour and Davis 1969, p. 77; Caire et al. 1979, p. 405; van Zyll de Jong 1985, p. 9; Caceres and Pybus 1997, p. 2; Whitaker and Mumford 2009, pp. 209–210).

Northern long-eared bats have also been observed overwintering in other types of habitats that have similar conditions (e.g., temperature, humidity levels, air flow) to cave or mine hibernacula. The species may use these alternate hibernacula in areas where caves or mines are not present (Griffin 1945, p. 22). Northern long-eared bats have been found using the following alternative hibernacula: abandoned railroad tunnels (USFWS 2015, p. 17977), the entrance of a storm sewer in central

Minnesota (Goehring 1954, p. 435), a hydroelectric dam facility in Michigan (Kurta et al. 1997, p. 478), an aqueduct in Massachusetts (Massachusetts Department of Fish and Game 2012, unpublished data), a dry well in Massachusetts (Griffin 1945, p. 22). More recently, Northern long-eared bats were found in a crawl space within a dwelling in Massachusetts (Dowling and O'Dell 2018, p. 376) and a rock crevice in Nebraska (White et al. 2020, p. 114). Further, Girder et al. (2016, p. 11) found Northern long-eared bat to be present and active year-round on the coastal plain of North Carolina, where there is no known non-cavernicolous (cave-like) hibernacula; therefore, it is possible this population was not (traditionally) hibernating. Also, in coastal North Carolina, Northern long-eared bat were observed to be active the majority of the winter, and although torpor was observed, time spent in torpor was very short with the longest torpor bout (i.e., hibernation period) for each bat averaging 6.8 days (Jordan 2020, p. 672).

Summer Roosting and Foraging – Suitable summer habitat for Northern long-eared bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure.

Most foraging occurs above the understory, 1 to 3 m (3 to 10 ft) above the ground, but under the canopy (Nagorsen and Brigham 1993, p. 88) on forested hillsides and ridges, rather than along riparian areas (LaVal et al. 1977, p. 594; Brack and Whitaker 2001, p. 207). This coincides with data indicating that mature forests are an important habitat type for foraging Northern long-eared bats (Caceres and Pybus 1997, p. 2; White et al. 2017, p. 8). Foraging also takes place over small forest clearings and water, and along roads (van Zyll de Jong 1985, p. 94). Northern long-eared bat seem to prefer intact mixed-type forests with small gaps (i.e., forest trails, small roads, or forest-covered creeks) in forest with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clear cut (USFWS 2015, p. 17992; USFWS 2022 p. 18-19).

Northern long-eared bats typically roost singly or in maternity colonies underneath bark or more often in cavities or crevices of both live trees and snags (Sasse and Pekins 1996, p. 95; Foster and Kurta 1999, p. 662; Owen et al. 2002, p. 2; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 222; Timpone et al. 2010, p. 119). Males' and non-reproductive females' summer roost sites may also include cooler locations, such as caves and mines (Barbour and Davis 1969, p. 77; Amelon and Burhans 2006, p. 72). Studies have documented the Northern long-eared bat's selection of both live trees and snags (Sasse and Pekins 1996, p. 95; Foster and Kurta 1999, p. 668; Lacki and Schwierjohann 2001, p. 484; Menzel et al. 2002, p. 107; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 224; Timpone et al. 2010, p. 118). Northern long-eared bats are flexible in tree species selection and while they may select for certain tree species regionally, likely are not dependent on certain species of trees for roosts throughout their range; rather, many tree species that form suitable cavities or retain bark will be used by the bats opportunistically (Foster and Kurta 1999, p. 668; Silvis et al. 2016, p. 12; Hyzy 2020, p. 62).

To a lesser extent, Northern long-eared bats have also been observed roosting in colonies in human-made structures, such as in buildings, in barns, on utility poles, behind window shutters, in bridges, and in bat houses (Mumford and Cope 1964, p. 72; Barbour and Davis 1969, p. 77; Cope and

Humphrey 1972, p. 9; Burke 1999, pp. 77–78; Sparks et al. 2004, p. 94; Amelon and Burhans 2006, p. 72; Whitaker and Mumford 2009, p. 209; Timpone et al. 2010, p. 119; Bohrman and Fecske 2013, pp. 37, 74; ; Feldhamer et al. 2003, p. 109; Sasse et al. 2014, p. 172; USFWS 2015, p. 17984; Dowling and O'Dell 2018, p. 376). It has been hypothesized that use of human-made structures may occur in areas with fewer suitable roost trees (Henderson and Broders 2008, p. 960; Dowling and O'Dell 2018, p. 376). In north-central West Virginia, Northern long-eared bats were found to more readily use artificial roosts as distance from large forests (greater than 200 hectares [494 acres]) increased, suggesting that artificial roosts are less likely to be selected when there is greater availability of suitable roost trees (De La Cruz et al. 2018, p. 496).

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009, p. 212) to 60 individuals (Caceres and Barclay 2000, p. 3); however, larger colonies of up to 100 adult females have been observed (Whitaker and Mumford 2009, p. 212). Most studies have found that the number of individuals roosting together in a given roost typically decreases from pregnancy to post-lactation (Foster and Kurta 1999, p. 667; Lacki and Schwierjohann 2001, p. 485; Garroway and Broders 2007, p. 962; Perry and Thill 2007, p. 224; Johnson et al. 2012, p. 227). Northern long-eared bats exhibit fission-fusion behavior (Garroway and Broders 2007, p. 961), where members frequently coalesce to form a group (fusion), but composition of the group is in flux, with individuals frequently departing to be solitary or to form smaller groups (fission) before returning to the main spatially discrete unit or network (Barclay and Kurta 2007, p. 44). As part of this behavior, Northern long-eared bats switch tree roosts often (Sasse and Pekins 1996, p. 95), typically every 2 to 3 days (Foster and Kurta 1999, p. 665; Owen et al. 2002, p. 2; Carter and Feldhamer 2005, p. 261; Timpone et al. 2010, p. 119). Patriquin et al. (2016, p. 55) found that Northern long-eared bat roost switching and use varies regionally in response to differences in ambient conditions (e.g., precipitation, temperature).

Adult females give birth to a single pup (Barbour and Davis 1969, p. 104). Birthing within the colony tends to be synchronous, with the majority of births occurring around the same time (Krochmal and Sparks 2007, p. 654). Parturition (birth) may occur as early as late May or early June (Easterla 1968, p. 770; Caire et al. 1979, p. 406; Whitaker and Mumford 2009, p. 213) and may occur as late as mid-July (Whitaker and Mumford 2009, p. 213). Juvenile volancy (flight) often occurs by 21 days after birth (Kunz 1971, p. 480; Krochmal and Sparks 2007, p. 651) and has been documented as early as 18 days after birth (Krochmal and Sparks 2007, p. 651; USFWS 2022 p. 17-18

Population Status and Distribution – The Northern long-eared bat ranges across much of the eastern and north central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993; Caceres and Pybus 1997; Environment Yukon 2011). In the United States, the species range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east through the Gulf States to the Atlantic Coast (Whitaker and Hamilton 1998; Caceres and Barclay 2000; Amelon and Burhans 2006). The species range includes the 37 states (plus the District of Columbia). The species' range includes all or portions of the following 37 states and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming (USFWS 2022 p. 15). Historically, the species has been most frequently

observed in the northeastern United States and in Canadian Provinces, Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000). However, throughout the majority of the species range it is patchily distributed, and historically was less common in the southern and western portions of the range than in the Northern portion of the range (Amelon and Burhans 2006).

Prior to 2006 (i.e., before white-nose syndrome was first documented), the Northern long-eared bat was abundant and widespread throughout much of its range (despite having low winter detectability) with 737 occupied hibernacula, a maximum count of 38,181 individuals and its range being spread across >1.2 billion acres in 29 states and 3 Canadian provinces. Northern long-eared bat numbers vary temporally and spatially, but abundance and occurrence on the landscape were stable (Cheng et al. 2022, p. 204; Wiens et al. 2022, p. 233). Winter colony sizes ranged from small (less than 100) to large (greater than 100), although the vast majority of known individuals occupied a small subset of hibernacula; for example, in 2000, 16.6% (n = 66) of the known winter colonies contained 90% of total winter abundance. Among the five representation units (RPU) identified in the Northern long-eared bat SSA (USFWS 2022), the Eastern Hardwoods RPU historically encompassed approximately 90% of the total known hibernacula and 78% of the species' known winter abundance. The Southeast RPU contained 7% of the sites and 1% of total abundance, while the Subarctic RPU comprised 1% of the sites and 14% of the abundance. The Midwest and East Coast RPUs comprised 1% of the sites and 3% and 4% of the abundance, respectively (USFWS 2022 p. 28).

Available evidence, including both winter and summer data, indicates Northern long-eared bat abundance has and will continue to decline substantially over the next 10 years under current demographic conditions. Evidence of the past decline is demonstrated in available data in both winter and summer. For example, rangewide winter abundance has declined by 49% and the number of extant winter colonies (populations) by 81%. There has also been a noticeable shift towards smaller colony sizes, with a 96–100% decline in the number of large hibernacula (≥ 100 individuals). Although the declines are widespread, the magnitudes of the winter declines vary spatially. In the Eastern Hardwoods, the core of species' range, abundance declined by 56% and the number of sites by 88%. Abundance and the number of sites declined in the remaining 4 RPUs (87% and 82% - East Coast RPU, 90% and 44% - Midwest RPU, 24% and 70% - Southeast RPU, and 0% and 40% - Subarctic RPU, respectively). Across all RPUs, the potential of population growth is low; the probability of RPU growth rates ($\lambda \geq 1$) ranges from 0 to 11% (USFWS 2022 p. 53).

Declining trends in abundance and occurrence are also evident across much of Northern long-eared bat's summer range. Based on derived rangewide summaries from Stratton and Irvine (2022, p. 102), rangewide occupancy has declined by 80% from 2010–2019. Although these declines attenuate westward, the probability of occupancy declined in all RPUs. Similarly, Whitby et al. (2022, p. 160), using data collected from mobile acoustic transects, found a 79% decline in rangewide relative abundance from 2009–2019. Measurable declines were also found in the Midwest RU (91%) followed by the Eastern Hardwoods (85%), East Coast (71%), and Southeast (57%) RPUs. Data were not analyzed in the Subarctic RPU due to a lack of observations. Finally, Deeley and Ford (2022, p. 18, 21–23) observed a significant decrease in mean capture rate post-WNS arrival. Estimates derived from their results indicted a 43–77% decline in summer mist net captures compared pre and post arrival of WNS (USFWS 2022, p. 54).

Threats – Although there are countless stressors affecting Northern long-eared bats, the primary factor influencing the viability of the species is white-nose syndrome (WNS), a disease of bats caused by a fungal pathogen. Other primary factors influencing the Northern long-eared bat’s viability include wind energy mortality, effects from climate change, and habitat loss (USFWS 2022, pp. iii-iv).

- White-nose Syndrome -WNS has been the foremost stressor on the Northern long-eared bat for more than a decade. The fungus that causes the disease, *Pseudogymnoascus destructans* (Pd), invades the skin of bats, and infection leads to increases in the frequency and duration of arousals during hibernation and eventual depletion of fat reserves needed to survive winter, and often results in mortality. WNS has caused estimated Northern long-eared bat population declines of 97–100% across 79% of the species’ range (USFWS 2022, p. iv).
- Wind Energy - Wind energy-related mortality of Northern long-eared bat is also proving to be a consequential stressor at local and regional levels, especially in combination with impacts from WNS. Most bat mortality at wind energy projects is caused by direct collisions with moving turbine blades. Wind energy mortality may occur over 49% of the Northern long-eared bat range (USFWS 2022 p. iv).
- Climate Change - Climate change variables, such as changes in temperature and precipitation, may influence Northern long-eared bat resource needs, such as suitable roosting habitat for all seasons, foraging habitat, and prey availability. Although there may be some benefit to Northern long-eared bat from a changing climate, overall negative impacts are anticipated, especially at local levels (USFWS 2022 p. iv).
- Habitat Loss - Habitat loss may include loss of suitable roosting or foraging habitat, resulting in longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colony networks, and direct injury or mortality. Loss of or modification of winter roosts (i.e., making hibernaculum no longer suitable) can result in impacts to individuals or at the population level (USFWS 2022, p. iv).

Status within Missouri – Northern long-eared bats in Missouri span three different units; the Eastern Hardwoods unit in the southern Ozarks, the Midwest unit along the northern half of the state, and the southeast unit along the bootheel make up smaller proportions of Missouri’s populations. In general, the Eastern hardwoods Unit was established based on longer hibernation duration and differences in landcover. The Midwest unit was established based primarily on markedly different landcover than other units, with limited or fragmented forested habitat prevailing throughout much of this unit. Unlike the other units, the Midwest Unit is largely non-forested landcover (e.g., grassland/pasture, cultivated crops, and pasture/hay).

Measurable winter declines have been observed by unit: Midwest unit (91%) followed by the Eastern Hardwoods (85%), East Coast (71%), and Southeast (57%) units. In the Eastern Hardwoods, median abundance declines 99%, with bats persisting in 10 hibernacula by 2030. Of the projected extant hibernacula, 1 is projected to be large (≥ 100 individuals). In the Eastern Hardwoods, the core of Northern long-eared bat’s range, abundance in summer sites declined by 56% and the number of sites by 88% (USFWS 2022, p. 53).

Indiana Bat, *Myotis sodalis*

The Indiana bat was originally listed as an endangered species by the Service in 1967. Thirteen winter hibernacula (11 caves and two mines) in six states were designated as critical habitat for the Indiana bat in 1976 (USFWS 1976). Six of these hibernacula are in Missouri. The Indiana bat is an insectivorous, temperate, medium-sized bat that migrates annually from winter hibernacula to summer habitat in forested areas. The bat has a head and body length that ranges from 41 to 49 mm, with a forearm length of 35 to 41 mm. The fur is described as dull pinkish-brown on the back but somewhat lighter on the chest and belly, and the ears and wing membranes do not contrast with the fur (Barbour and Davis 1969). Although the bat resembles the little brown bat and the Northern long-eared bat, it is distinguished by its distinctly keeled calcar.

Life History and Biology - The key stages in the annual cycle of Indiana bats are: hibernation, spring staging, pregnancy, lactation, volancy/weaning, migration, and swarming. While there is variation based on weather and latitude, generally Indiana bats begin winter torpor in mid-September through late-October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant (able to fly) in mid- to late-July. Migration back to the hibernaculum may begin in August, peak in September, and continue into October.

Winter Hibernation – Following a summer maternity period, Indiana bats migrate to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September the number of males and females are present in comparable numbers. Autumn “swarming” occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn and use trees and snags as day roosts (Cope and Humphrey 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females.

All cohorts of Indiana bats are hibernating by November and remain in hibernacula through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. Indiana bats hibernate in caves and mines with cold, stable microclimates. They form large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson et al. 1980, Clawson, pers. observ. October 1996 in USFWS 2000). Clusters form in the same area in a cave each year, with more than one cluster possible in a particular cave (NatureServe 2007). Banding of Indiana bats demonstrates, especially with females, philopatry to hibernacula (i.e., they return annually to the same hibernaculum).

Summer Roosting and Foraging - After hibernation ends in late March or early April, most Indiana bats migrate to summer roosts. Females emerge from hibernation ahead of males. Reproductively active females store sperm from autumn copulations through winter, and ovulation takes place after the bats emerge from hibernation. The period after hibernation and just before spring migration is referred to as “staging,” a time when bats forage and a limited amount of mating occurs (USFWS 2007). In spring when fat reserves and food supplies are low and females are pregnant, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence. Once en route to their summer destination, females move quickly across the landscape. Radio-telemetry studies in New York documented females flying between 10 and 30 miles in one night after release from their hibernaculum, arriving at their

maternity sites within one night. Indiana bats can migrate hundreds of miles from their hibernacula. Observed migration distances range from just 34.1 mi to 356.5 mi (USFWS 2007).

Females seek suitable habitat for maternity colonies, which is a requisite behavior for reproductive success. They exhibit strong site fidelity to summer roosting and foraging areas, generally returning to the same summer range annually to bear their young (Garner and Gardner 1992). For example, surveys conducted in summer 2014 in a maternity colony home range first documented in 1985, indicated continued presence of a maternity colony in the area. Females arrive in their summer habitats as early as April 15 in Illinois (Garner and Gardner 1992), and usually start grouping into larger maternity colonies by mid-May. Garner and Gardner (1992) reported that Indiana bats first arrived at their maternity roost in early May in Indiana, with many individuals arriving in mid-May. During this early spring period, a number of roosts may be used temporarily until a roost with larger numbers of bats is established.

In general, Indiana bats roost in large, often dead or partially dead trees with exfoliating bark and/or cavities and crevices (Callahan et al. 1997; Farmer et al. 2002; Kurta et al. 2002). Trees in excess of 16-inch diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inches dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Rittenhouse et al. (2007) considered roost trees as suitable at approximately 7 inches dbh, but the suitability index (SI, SI = 0.00 to 1.00) of roost trees increased with greater dbh with trees reaching a SI of 0.50 at approximately 12 inches dbh and a SI of 1.00 at approximately 20 inches dbh or greater. Indiana bat maternity roosts can be described as primary or alternate based upon the proportion of bats in a colony consistently occupying the roost site. Maternity colonies typically use 10 to 20 trees each year, but only one to three of these are primary roosts used by the majority of bats for some or all of the summer (Garner and Gardner 1992; Miller et al. 2002). Alternate roosts are used by individuals, or a small number of bats, and may be used intermittently throughout the summer or used only once or for a few days. Females frequently switch roosts to find optimal roosting conditions, switching roosts every few days on average, although the reproductive condition of the female, roost type, and time of year affect switching. When switching between day roosts, Indiana bats may travel as little as 23 feet or as far as 3.6 miles (Kurta et al. 1996; Kurta et al. 2001; Kurta et al. 2002). In general, moves are relatively short and typically less than 0.6 mile (USFWS 2017).

Maternity colonies typically contain 100 or fewer adult females (Harvey 2002), but as many as 384 have been observed from a single maternity roost tree in Indiana (Whitaker and Brack 2002). The average sized maternity colony in Indiana was 80 females (Whitaker and Brack 2002). Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977). The young are able to fly between mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al. 1991, Kurta et al. 1996). An exit count conducted on July 17, 2014 on U.S. Army Corps of Engineers property (Wappapello Lake) in Missouri yielded a count of 195 individuals exiting a 26-inch dbh cottonwood snag (York- Harris, pers. comm). Volant pups likely were included in the count, but at least 96 adults were present in the primary tree.

The home range of a maternity colony is the area within a 2.5-mile radius (i.e., 12,560 acres) around documented roosts or within a 5-mile radius (i.e., 50,265 acres) around capture location of a reproductive female or juvenile Indiana bat or a positive identification of Indiana bat from properly deployed acoustic devices and acceptable analysis of data. Based on data provided in the Indiana

bat draft revised recovery plan (USFWS 2007), a maternity colony needs at least 10% suitable habitat (i.e., forested habitat that provides adequate roost sites and foraging areas) to exist at a given point on the landscape. Garner and Gardner (1992) found that females in Illinois utilized larger foraging ranges than males, whereas Menzel et al. (2005) found no difference in home range sizes of males and females in west-central Illinois.

Male Indiana bats may be found throughout the entire range of the species. Some males spend the summer near hibernacula, as has been observed in Missouri (LaVal and LaVal 1980) and West Virginia (Stihler, pers. observ. October 1996, in USFWS 2000). Males appear to roost singly or in small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 inches dbh, but the average roost diameter for male Indiana bats is 13 inches (USFWS 2007).

Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest, along roads, or along the corridors of small streams. Menzel et al. (2005) found that females foraged significantly closer to forests, roads, and riparian habitats than agricultural land and grasslands. Womack et al. (2012) documented selection by reproductive females of forests with higher canopy cover but more open mid-stories caused by management via prescribed fire. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80% (Garner and Gardner 1992). Bats forage between dusk and dawn at a height of approximately 6-90 feet above ground level and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects (Humphrey et al. 1977).

Population Status and Distribution - The population of the Indiana bat has decreased significantly from an estimated 808,000 in the 1950s (USFWS 2007). Based on censuses taken at all hibernacula, the current total known Indiana bat population in 2019 is estimated to number approximately 537,297, which represents a 4% decline since 2017 and a 19% decline since 2007 when White-nose Syndrome (WNS) was first discovered in the United States.

Missouri, Indiana, and Kentucky have historically had the highest estimated numbers of hibernating Indiana bats; all had estimates of greater than 10,000 bats in 1965. Over the period 1965 to 2005, estimated numbers of hibernating bats in Missouri and Kentucky clearly declined (USFWS 2007). Among the group of states in which aggregate hibernaculum surveys have never reached 100,000 bats, hibernaculum surveys in Arkansas, Tennessee, and Virginia consistently declined from 1965 to 2000. Hibernacula surveys in Illinois, New York, Ohio, and West Virginia were greater in 2000 than in 1965, but trends are not entirely consistent through the period. Thus, the southern tier of states in the species' range shows declines in counts at hibernacula, whereas some states in the upper Midwest show increasing counts (USFWS 2007).

The current species range for the Indiana bat includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The species has disappeared from, or greatly declined, in most of its former range in the northeastern United States. The current revised recovery plan (USFWS 2007) delineates recovery units based on population discreteness, differences in population trends, and broad level differences in land-use and macro-habitats. There are currently four recovery units for the Indiana bat: Ozark-Central, Midwest, Appalachian Mountains, and Northeast.

Historically, the Indiana bat winter range was restricted to areas of cavernous limestone in the karst regions of the east-central United States. Hibernacula are divided into groups and defined in the Service's Draft Recovery Plan (USFWS 2007): Priority 1 (P1) hibernacula typically have a current and/or historically observed winter population of greater than or equal to 10,000 Indiana bats; P2 have a current or observed historic population of 1,000 or greater, but fewer than 10,000; P3 have current or observed historic populations of 50 to 1,000 bats; and P4 have current or observed historic populations of fewer than 50 bats. Based on 2009 winter surveys, there were a total of 24 P1 hibernacula in seven states: Illinois (one); Indiana (seven); Kentucky (five); Missouri (six); New York (three); Tennessee (one); and West Virginia (one). One additional P1 hibernaculum was discovered in Missouri in 2012. A total of 55 P2, 151 P3, and 229 P4 hibernacula are also known from the aforementioned states, as well as 15 additional states.

The historical summer range of the Indiana bat is similar to its modern range. However, the bat has been locally extirpated due to loss of summer habitat. The majority of known maternity sites have been located in forested tracts and riparian areas in agriculturally dominated landscapes such as Missouri, Iowa, Indiana, Illinois, southern Michigan, western Ohio, and western Kentucky. They have been documented to use roost trees in highly fragmented areas as well as more contiguous forested patches.

Threats - The reasons for listing the Indiana bat were summarized in the original Recovery Plan (USFWS 1983) including: declines in populations at major hibernacula despite efforts to implement cave protection measures, the threat of mine collapse and the potential loss of largest known hibernating population at Pilot Knob Mine, Missouri, and other hibernacula throughout the species range were not adequately protected. Although several known human-related factors have caused declines in the past, they may not solely be responsible for recent declines. Documented causes of Indiana bat population decline include: 1) human disturbance of hibernating bats; 2) improper cave gates and structures rendering them unavailable or unsuitable as hibernacula; and 3) natural hazards like cave flooding and freezing. Suspected causes of Indiana bat declines include: 1) changes in the microclimate of caves and mines; 2) dramatic changes in land use and forest composition; and 3) chemical contamination from pesticides and agricultural chemicals. Current threats from changes in land use and forest composition include forest clearing on private and public land within the summer range, woodlot management and wetland drainage by landowners, and other private and municipal land management activities that affect the structure and abundance of forest resources.

- **Habitat Loss** - Habitat loss may include loss of suitable roosting or foraging habitat, resulting in longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colony networks, and direct injury or mortality. Loss of or modification of winter roosts (i.e., making hibernaculum no longer suitable) can result in impacts to individuals or at the population level (USFWS 2022).
- **White-nose Syndrome** - White-nose syndrome (WNS) was first documented in New York in February of 2006 and has since been confirmed in 20 states and 4 Canadian Provinces (www.whitenosesyndrome.org/resources/map). It has been correlated with erratic behavior such as early or mid-hibernation arousal that leads to emaciation and mortality in several species of bats, including the Indiana (<http://whitenosesyndrome.org/>; www.fws.gov). WNS is thought to be transmitted by direct bat contact with an infected bat and by transmission of the causative agent from cave to cave. The distribution of WNS appears to be expanding in all directions from its epicenter in New York. Between 2007 and 2008, it was documented

to have spread from a 9 km radius to a 200 km radius, and at the end of the 2008-2009 winter, it was documented in all major hibernacula in New York. More recently it has been found throughout Missouri, Northern Alabama, Illinois, and suspected in eastern Iowa. The Service and partners are conducting research to develop management strategies to reduce the spread and impacts of WNS. However, it remains a significant and immediate threat to the Indiana bat. At the time the revised recovery plan was drafted in 2007, the causative agent for WNS had not yet been discovered (now known to be caused by the fungus *Pseudogymnoascus destructans*), and the additive impacts to the already declining Indiana bat were not yet considered. Given the documented deaths of Indiana bat due to WNS in the Northeast since 2006, the species is further threatened with extinction. Numerous research projects have been completed and are ongoing at a rapid rate since the first discovery of WNS, a national response plan has been completed (available at www.whitenosesyndrome.org), multiple states and agencies have approved or are in the process of developing response action plans, and various management actions have been undertaken with the hope of slowing the spread of the disease (e.g., cave closures, the development of decontamination protocols, etc.). Despite these efforts, there is no known cure for the disease and all bats in North America that hibernate in caves could be detrimentally impacted and, in some cases, threatened with extinction.

Overall mortality rates have ranged from 90 to 100 percent in Indiana bat hibernacula in the northeastern United States. It is currently estimated that 5.7 to 6.7 million bats of all species have died from WNS in infected regions (www.whitenosesyndrome.org/about-white-nose-syndrome). Apparent losses of 685 Indiana bats in Hailes Cave and 12,890 (previous population was 13,014) Indiana bats in the Williams Preserve Mine in New York were documented during the first winter WNS was observed at each site. Additionally, Indiana bat surveys conducted at hibernacula in New York during early 2008 estimated the population declined 15,662 bats, which represents 3.3% of the 2007 revised rangewide population estimate. The number of confirmed cases of WNS has increased significantly in the Ozark-Central Recovery Unit since 2011 (www.whitenosesyndrome.org/resources/map) and if trends continue, it is likely that additional reductions in the Indiana bat population will occur in this region.

- Wind Energy - Wind energy-related mortality of Indiana bat is also proving to be a consequential stressor at local and regional levels, especially in combination with impacts from WNS (USFWS 2016). Most bat mortality at wind energy projects is caused by direct collisions with moving turbine blades.
- Climate Change - Climate change is an emerging threat to the Indiana bat, primarily because temperature is an essential feature of both hibernacula and maternity roosts. Potential impacts of climate change on temperatures within Indiana bat hibernacula were reviewed by V. Meretsky (pers. comm., 2006 in USFWS 2007). Climate change may be implicated in the disparity of population trends in southern versus Northern hibernating populations of Indiana bats (Clawson 2002), but Meretsky noted that confounding factors are clearly involved. Potential impacts of climate change on hibernacula can be compounded by mismatched phenology in food chains (e.g., changes in insect availability relative to peak energy demands of bats) (V. Meretsky, pers. comm., 2006 in USFWS 2007). Changes in maternity roost temperatures may also result from climate change, and such changes may have negative or positive effects on development of Indiana bats,

depending on the location of the maternity colony. The effect of climate change on Indiana bat populations is a topic deserving additional consideration.

Status within Missouri – The Indiana bat populations of Missouri are part of the Ozark-Central Recovery Unit (RU) and have declined significantly since 1990 but have been relatively stable from 2009 to 2019 (USFWS 2017, 2019a, 2019b). Historically, the Ozark-Central Recovery Unit had the largest numbers of Indiana bats in hibernacula; however, populations have declined such that the Midwest RU unit hosts the largest populations of Indiana bats. Prior to 2012, the majority of hibernating bats in the Ozark-Central RU were assumed to overwinter in Pilot Knob Mine in Missouri. Dramatic declines in the hibernating population at this site occurred since the early 1980s from an original estimation of approximately 100,000 in the 1970s to an estimation of 1,678 in the 2000s. The discovery of the Sodalis Nature Preserve population in Hannibal, Missouri has increased the baseline size of the population in the Ozark-Central RU, but not the overall trend across the range of the species. Based on observations by private cavers, the site has been occupied by Indiana bats since the 1970s. These bats are not considered to be bats that moved from Pilot Knob Mine following a partial collapse of the mine. In 2017, Sodalis Nature Preserve housed approximately 197,000 hibernating Indiana bats. A survey in 2019 of the hibernacula showed the first signs of a WNS- caused decline in this population with the count being approximately 180,000 hibernating Indiana bats, however, it appears to have rebounded by 2021 with a count of approximately 205,000 bats.

III. ENVIRONMENTAL BASELINE

The environmental baseline is the current status of listed species and their habitats, and critical habitat, as a result of past and ongoing human and natural factors in the area of the proposed action. Also included in the environmental baseline are the anticipated impacts of other proposed Federal projects in the action area that have already undergone formal section 7 consultation.

Status of the Species Within the Action Area

Since 2004, multiple mist net and acoustic surveys have been conducted across Corps lands at Wappapello Lake and adjacent Forest Service lands within the Mark Twain National Forest system. Bat survey information regarding threatened and endangered species has been collected within Compartments 2, 6, and 8 at Wappapello Lake Project lands. These three compartments were selected because USACE Foresters and Biologists considered them to be representative of all project lands. Although each forest compartment has not been surveyed, each forest stand within them would be treated as though Indiana bats and Northern long-eared bats (and other forest bats) are likely present.

Potential and known forest bat habitat has been defined by the USFWS within the Range-wide Indiana Bat Protection and Enhancement Plan Guidelines (U.S. Fish & Wildlife Service, 2022). Based on this definition, potential forest bat habitat exists in the forest stands at Wappapello Lake. The existing forest community types, structure, and tree species composition within and adjacent to Wappapello Lake project lands are consistent with the USFWS's definition of forest bat habitat. Bat species monitored include Indiana bat and Northern long-eared bat. Due to the proximity to known locations and because potentially suitable roosting, foraging, drinking, and stopover/migration habitat is present within each stand, each timber stand will be treated as though Indiana bats and Northern long-eared bats are likely present.

There are several Indiana bat maternity trees on the northern portion of the Wappapello Lake property near the city Greenville, Missouri with one known maternity tree overlapping an area proposed for tree clearing. Existing bat maternity trees have been identified through survey efforts within compartments 2 and 8. Acoustic surveys frequently identified calls of Indiana bats and mist netting efforts have resulted in Indiana bat captures. Captured bats were fitted with transmitters which led to the discovery of alternate roost trees and maternity colony locations. A maternity colony exists within compartment 2, where numerous maternity trees have been identified. In 2013, a maternity tree was identified approximately 700 feet north of stand 6 within compartment 2. Compartment 6 and 8 have not yielded successful captures of Indiana Bats, however, a maternity tree was identified in 2012 near Asher Creek 3 miles southeast of compartment 8. During the 2017 survey season, three gray bats were captured within and adjacent to Compartment 2 within Brown's Hollow and the Bounds Creek watershed respectively. Past surveys have resulted in several NLEB captures and identification of maternity trees within riparian areas outside of the timber harvest units. Maternity trees have been located within Compartment 2 and NLEBs have been captured within the Mark Twain National Forest adjacent to USACE lands. Approximately 3 miles southeast of Compartment 8, NLEBs have been captured and maternity trees and multiple alternate roost trees have been identified within this area. Most recent captures of NLEBs occurred during the 2015 survey season.

The bat usage data has shown that any continued efforts to capture or locate bats within the timber harvest areas (upland slopes and ridges) is difficult. Tracked and confirmed roost tree locations have also been confined to the riparian areas where timber harvest operations do not take place. No hibernacula caves have been documented within or adjacent to the Project Area.

Outside the immediate action area, acoustic and mist-net captures by Missouri Department of Conservation (MDC) have further found Northern long-eared bats and Indiana bats from multiple survey sites at Mingo National Wildlife Refuge, ranging from 2.15-mi to 12-mi from Wappapello Dam. Numerous records of Indiana bats are also present at Big Lake creek near Greenville, ranging from 14.3-mi to 17.96-mi from Wappapello dam.

Factors Affecting the Species within the Action Area

Factors affecting the Indiana bat environment within and adjacent to the action area are expected to be the same. Landownership in the action area is approximately 25% private and 75% public, with the public portion being owned and managed by the USACE, USFS Mark Twain National Forest, and MDC. Current land-use in the action area varies. Timber production and forest management activities are implemented on Mark Twain National Forest and MDC-managed lands. There are limited agricultural areas with row crops and grazing. Ecosystem restoration and recreational opportunities occur on portions of all public lands in the action area.

IV. EFFECTS OF THE ACTION

In a BO for a listed species, the effects of the proposed action are all reasonably certain consequences to the species caused by the action, including the consequences of other activities caused by the action. Activities caused by the action would not occur but for the action. Consequences to species may occur later in time and may occur outside the action area.

The proposed TSI management strategies through single tree selection would be implemented on approximately 20,861 acres of forest adjacent to Wappapello Lake. Indiana bats have been captured

within Compartment 2 and near Compartment 6, and several known maternity trees have been identified located within 5 miles of the stands. Although no Indiana bats have been captured within the other stands, forest inventories indicate that suitable roosting habitat is present. Based on the presence of suitable roosting habitat and proximity to known maternity colonies, it is likely that some trees may be utilized by resident maternity colonies.

Direct Injury and/or Mortality - Tree felling (6,431 acres) will be conducted outside of the non-volant juvenile season (June-July) for the Indiana bat and Northern long-eared bat, to avoid direct take of maternity colonies during their most vulnerable timeframe as a result of this action. Permanent impacts could include direct mortality of bats if an occupied roost tree is felled. However, the USACE has proposed in the conservation measures to retain all trees that could provide roosting habitat to minimize the likelihood of mortality or injury of individuals. Trees that will be favored for retention include all wolf trees, dead trees, split trees, trees that have cavities, and trees with exfoliating bark.

Loss of Roosting and Foraging Habitat - The likely behavioral response of bats returning in the spring if a previously utilized tree was removed will be to disperse to adjacent suitable habitat. However, dispersal to adjacent suitable habitat may affect the bat in the short term by causing increased energetic demands, exposure to inter and intra-specific competition, and exposure to predation while searching unfamiliar habitat for new roosting and foraging areas if high quality roosting habitat is not available in close proximity to their previous maternity area. Loss of familiar roost trees and associated foraging habitat, while adverse in the short term, however, are not expected to have long term consequences for a colony because of the remaining forested habitat within the known foraging range of the Indiana bat (Sparks et.al. 2005) and the propensity of the species to utilize alternative roost sites (Carter and Feldhammer 2005). Additionally, forest management actions implemented in unmanaged forest habitat will serve to benefit bats in the long-term by improving foraging and roosting opportunities.

Disturbance by Construction Activities – Noise disturbance created by construction activities occurring in areas adjacent to suitable roost trees may disturb roosting Indiana bats and Northern long-eared bats. However, maximizing operations within these areas during the hibernation season and avoiding the non-volant juvenile season (June-July) should minimize the amount of disturbance to which roosting bats are exposed.

Number of Individuals Affected – Based on results of surveys conducted within the treatment stands and surrounding areas (i.e., Mark Twain National Forest), we believe that one Indiana bat or Northern long-eared bat colony, at most, could occur within each of the Lake Wappapello compartments. Because the average maternity colony size for the Indiana bat is estimated to be 50 to 80 adult females (USFWS 2007), it is possible that a maximum of 80 individuals per compartment could be harmed or harassed if a roosting tree is inadvertently felled or if construction activities adjacent to a roosting tree disturb individuals. However, we do not anticipate that all individuals in a colony would be impacted since all activities will take place outside the most vulnerable life stage period (June-July); thus, the number of reproductive females and non-volant juveniles potentially impacted would likely be less than 80. But because it is possible that males and non-reproductive females (not part of the colony) could also be affected, we consider 80 to be an appropriate estimate of the maximum number of individuals potentially adversely affected by project activities per compartment.

The proposed activities are intended to improve forest health in the future and improve foraging and roosting opportunities for Indiana bats, Northern long-eared bats, and other forest wildlife. Some of the impacts would be temporary, such as loss of a roost tree. However, senescence of trees within the stands would provide a long-term supply of potential roost trees. Dead trees and other trees with qualities that provide roosting opportunities will be left standing to provide roosting opportunities in the short-term. The proposed FSI practices that include single tree selection will likely ensure the availability of quality roosting habitat within the project area.

Interrelated Activities - Interrelated activities are those that are part of a larger action and depend on the larger action for their justification. For this consultation, interrelated activities would include the transport of timber using haul roads and possible establishment of landings. Haul roads will consist of ridgetops, agricultural fields, and preexisting roads (agricultural, county, USACE, etc.). Landings may be established on ridge tops and flat areas suitable for access and for minimizing soil disturbance. Landings would be established in locations in which removal of potential roost trees is not necessary, and most landings would be sited in naturally open areas or where prior timber harvest has occurred.

Indirect Effects - Indirect effects to listed species are those effects that are caused by or will result from the proposed action and are later in time but are still reasonably certain to occur. Indirect effects may include other Federal activities that have not undergone Section 7 consultation but will result from the action under consideration as well as non-Federal actions that might reasonably be expected to occur in the future as a result of the subject action. In this consultation, the Service considered the potential for such future activities on the action area and determined that other additional Federal activities in the action area are reasonably certain to occur. These actions include treatment of additional stands with TSI and prescribed burning. It is also possible that actions by individual landowners, such as timber harvest, could occur in the action area.

We expect that potentially occupied trees may be cut to preserve human health and safety while Indiana bats and Northern long-eared bats are present in the area. In addition, tree clearing and general silviculture practices as part of forest management or landscaping scheduled during the hibernation period could also result in the further removal of roost trees, rendering them unavailable to pregnant bats that exhibit roosting area and/or roost tree fidelity following migration in the spring. However, decreases in the long-term reproductive success and viability of a maternity colony in the area are unlikely because of the remaining habitat on the surrounding landscape. Additionally, the anticipated benefits of the conservation measures proposed by the USACE will help reduce impacts to individual Indiana bats and Northern long-eared bats and provide roosting habitat.

V. CUMULATIVE EFFECTS

A BO must predict the consequences to species caused by future non-Federal activities within the action area, i.e., cumulative effects. Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR §402.02). Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities are reasonably certain to occur. These factors include, but are not limited to: existing plans for the activity; and any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

Action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. State, local, and private actions not associated with the proposed action (e.g., development, agriculture, etc.) are likely to continue throughout the action area. These State, local, and private actions are likely to result in varying degrees of adverse effects to bats. Therefore, cumulative effects may occur. Within Missouri, numerous cumulative effects that can have long-term, continuous impacts on the listed bat species' populations and suitable habitat in the future are related, but not limited, to: local municipalities' transportation activities; activities related to timber harvest, agriculture and livestock production; housing and commercial development; public access to caves; and the State of Missouri's management and enforcement of laws that affect riparian areas where bats forage. Similarly, there are future actions of the State, research centers, and municipalities that can aid in the recovery of species or preserve the baseline status of the species. These actions include, but are not limited, to: the MDC Comprehensive Wildlife Conservation Strategy; establishment of conservation and mitigation banks; and educating private landowners on the benefits of preserving forested habitat, caves, and the benefits of insectivorous bat species.

VI. CONCLUSION

After reviewing the current status of the Indiana bat and the Northern long-eared bat, the environmental baseline for the action area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed project is not likely to jeopardize the continued existence of the Indiana bat or Northern long-eared bats. Although as many as 80 individual Indiana bats and Northern long-eared bats will likely be harmed per compartment by the action, we do not anticipate population-level impacts. This determination is based on the following considerations: 1) the proposed action will impact at most 0.03% of the Ozark-Central Recovery Unit, 2) the proposed action area is small relative to the species' range, 3) the proposed action will only affect a small portion of the action area and will not substantially alter the overall availability of Indiana bat and Northern long-eared bat habitat within the action area; 4) while the proposed action may result in direct effects through loss of occupied roost trees, the potential for this has been minimized as a result by restricting tree clearing during the non-volant juvenile period (June-July); and 5) the proposed action will improve forest health in the future and improve foraging and roosting opportunities for Indiana bats and Northern long-eared bats. There is no critical habitat for either species in the project area; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species without special exemption. Take is defined as to harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such [an] act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(a)(2), taking that is incidental to and not intended as part of the agency action is not

considered prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

The measures described below are non-discretionary, and must be undertaken so that they become binding conditions of any grant, permit, or action for the exemption of Section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the USACE fails to adhere to the terms and conditions of the Incidental Take Statement, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement, pursuant to 50 CFR § 402.14(i)(3).

Amount or Extent of Take Anticipated

As described under EFFECTS OF THE ACTION, incidental take of the Indiana bat and Northern long-eared bat could occur if individuals are present or utilize one of the areas proposed for timber management.

50 CFR 402.14(i)(1)(i) states that surrogates may be used to express the amount or extent of anticipated take provided that the BO or ITS includes: 1) a description of the causal link between the surrogate and take of the listed species; 2) a description on why it is not practical to express the amount of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and 3) sets a clear standard for determining when the amount or extent of the taking has been exceeded. The Service anticipates that actual incidental take of the Indiana bat and Northern long-eared bat as a result of the projects evaluated in this BO will be difficult to quantify and detect due to these species small body size, widely dispersed individuals under loose bark or in cavities of trees, and unknown areal extent and density of the roosting and foraging populations within the stands proposed for treatment. Monitoring to determine take of individual bats within an expansive area of forested habitat is a complex and arduous task. Unless every individual tree that contains suitable roosting habitat is inspected by a knowledgeable biologist before management activities begin, it would be impossible to know if a roosting bat is present in an area proposed for timber management. Inspecting individual trees is not considered by the Service to be a practical survey method and is not recommended as a means to determine incidental take. Therefore, we will use the areal extent of potential roosting habitat affected as a surrogate to monitor the level of take.

The Service anticipates that no more than 20,861 acres of potential Indiana bat and Northern long-eared bat habitat will be disturbed as a result of project activities; with 30.8% (6,425 acres) of that resulting in tree removal (Table 2). We expect take to occur over the course of 20-years based on the anticipated work schedule.

Table 2. Estimated total habitat affected by Forest Stand Improvement strategies with the corresponding percentage of tree removal over the 20-year treatment plan. Lake Wappapello, Wayne County, Missouri.

Location	Indiana Bat / Northern long-eared Bat Incidental Take - Acres of Habitat (Tree Clearing)
Compartment 3	3,140 (21.1%)

Compartment 4	1,864 (52.5%)
Compartment 6	374 (71.9%)
Compartment 7	2,312 (45.3%)
Compartment 8	783 (33.1%)
Compartment 9	1,821 (46.1%)
Compartment 10	3,951 (25.7%)
Compartment 11	1,638 (27.4%)
Compartment 12	2,454 (7.9%)
Compartment 14	1,149 (39.3%)
Compartment 15	1,375 (19.3%)
Total	20,861 (30.8%)

If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation. In this case, the USACE must also immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures provided.

Effect of the Take

Overall, the harm to individuals from the loss of potential roosting habitat contributing to the anticipated take of Indiana bat and Northern long-eared bat is not likely to jeopardize the continued existence of these species.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the incidental take:

1. All conservation measures, as described in the BA and restated in the Project Description section of this BO, shall be fully implemented and adhered to.
2. Any injured or dead Indiana bats or Northern long-eared bats incidentally observed should be reported to the Service.
3. Avoid direct mortality of females and non-volant juveniles in maternity roosts;
4. Locate, maintain, and monitor known occupied maternity trees;
5. Avoid direct mortality of individuals that use non-maternity roosts for shelter;
6. Ensure the presence of an adequate short-term supply of roost trees and maintain a continuous, long-term supply of high-quality roost trees

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the USACE must comply with the following terms and conditions. These terms and conditions are non-discretionary.

1. Avoid direct mortality of females and non-volant juveniles in maternity roosts
 - a. If removal of a potential maternity roost tree is necessary during the non-volant juvenile season to protect human health and safety, the Service shall be notified, and reasonable effort shall be made to determine if the tree is occupied by one or more Indiana bats or Northern long-eared bats. If the tree is determined to be occupied, further coordination with the Service is required.
2. Locate, maintain, and monitor known occupied maternity trees and resident Indiana bat and Northern long-eared bat populations
 - a. Presence and use of the project area by Indiana bats and Northern long-eared bats will be determined through surveys (acoustic, capture, and radio telemetry) and location of primary and alternate maternity roost trees in the project area will be determined, if applicable.
 - b. Prevent the cutting or felling and maintain occupied/active maternity roost trees until they naturally fall to the ground.
 - c. Continue bat monitoring. The spatial extent of monitoring and level of survey effort will be outlined in a comprehensive monitoring plan developed by the USACE in coordination with the Service. Monitoring results shall be submitted to the Missouri Ecological Services Field Office of the Service by December 31 of the year in which the monitoring event occurred. Reports must contain:
 - i. Any management or habitat manipulations that have occurred to date.
 - ii. The results of the mist netting survey, including number, sex, age (mature or juvenile) and reproductive status of all bats captured, including Indiana bats, if any are captured.
 - iii. Whether or not dead threatened and /or endangered species were found in the project area. Should one or more Indiana bats or Northern long-eared bats be encountered during the course of the project, the Missouri Ecological Services Field Office must be notified upon the discovery, and the number, age, sex, and reproductive status of the bat(s) is to be reported.
 - d. In order to determine the location of occupied roost trees, radio transmitters should be placed on the first female Indiana bat captured within each compartment during mist-netting surveys. Procedures should follow permit conditions outlined in approved Section 10 (a)(1)(A) Federal permits and these activities should be reported within 24 hours to the Service's Missouri Ecological Services Field Office.
 - e. If any Indiana bats or Northern long-eared bats are found dead or injured following the necessary removal of an occupied tree, the following protocols are requested:
 - i. Contact Vona Kuczynska of our office at vona_kuczynska@fws.gov or Kris Budd at kris_budd@fws.gov for deposition of specimens. They will contact appropriate individuals regarding final deposition and use of any specimen pending condition of the recovered carcass.

- ii. Specimens should be frozen in a plastic bag and include date and location with latitude and longitude coordinates.
 - iii. Provide a report on the circumstances surrounding the discovery and incidental taking.
3. To the maximum extent possible and logistically feasible, provide an adequate short-term supply of high-quality roost trees and maintain a continuous, long-term supply of high-quality roost trees.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service as identified the following actions that would further the conservation of federally listed bats:

1. If possible, conduct tree clearing between October 31 and April 1 to avoid direct impacts to Indiana bats roosting within the project area.
2. Conduct surveys for bats in Missouri to better define areas of occupancy relative to Wappapello Lake and USACE lands

REINITIATION NOTICE

This concludes formal consultation on the proposed Wappapello Lake forest stand improvements. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the action agency that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

LITERATURE CITED

Literature cited throughout the BO is available upon request from the Missouri Ecological Field Office.

Appendix 2

MDC Coordination



Missouri Department of Conservation

Missouri Department of Conservation's Mission is to protect and manage the forest, fish, and wildlife resources of the state and to facilitate and provide opportunities for all citizens to use, enjoy and learn about these resources.

Natural Heritage Review Level Three Report: Species Listed Under the Federal Endangered Species Act

There are records of species listed under the Federal Endangered Species Act, and possibly also records for species listed Endangered by the state, or Missouri Species and/or Natural Communities of Conservation Concern within or near the the defined Project Area. Please contact the U.S. Fish and Wildlife Service and the Missouri Department of Conservation for further coordination.

Foreword: Thank you for accessing the Missouri Natural Heritage Review Website developed by the Missouri Department of Conservation with assistance from the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Missouri Department of Transportation and NatureServe. The purpose of this website is to provide information to federal, state and local agencies, organizations, municipalities, corporations and consultants regarding sensitive fish, wildlife, plants, natural communities and habitats to assist in planning, designing and permitting stages of projects.

PROJECT INFORMATION

Project Name and ID Number: Wappapello Lake Forest Management Project #10903

Project Description: Note: The "Project Type" is just a placeholder because there was not a suitable choice from the provided list. The project is large, and will span 10-20 years. We expect to have a coordination call with the appropriate MDC staff and the Wappapello Lake Biologists/Foresters to discuss the proposed work. In brief: The Tentatively Selected Plan (TSP) includes FSI actions intended to improve the quality of forest habitat at the Wappapello Lake project. The FSI actions included in this alternative would occur on 9 compartments which are split into 67 individual forest stands. The full area of the project is 19,704 acres. The total tree harvest acreage is 5,903 acres. As part of the tree removal process, the trees felled in 50 of the 67 stands will be sold commercially. A priority list was drafted that ranks each stand to maximize productivity over the span of the project. Some of the stands will also require invasive species removal.

Project Type: Recreation, Other

Contact Person: Evan Hill

Contact Information: evan.b.hill@usace.army.mil or 5739255004

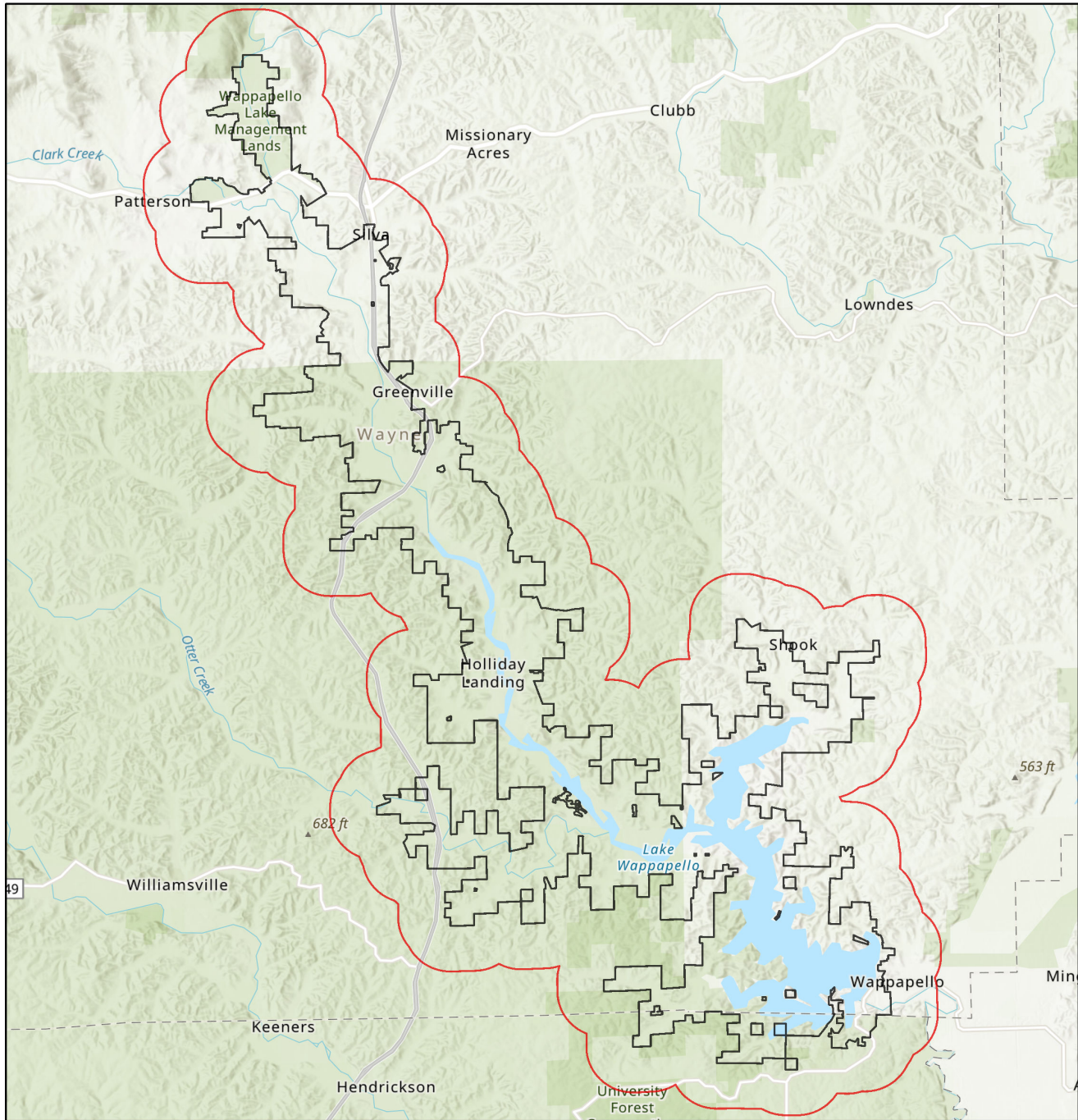
Disclaimer: The NATURAL HERITAGE REVIEW REPORT produced by this website identifies if a species tracked by the Natural Heritage Program is known to occur within or near the area submitted for your project, and shares suggested recommendations on ways to avoid or minimize project impacts to sensitive species or special habitats. If an occurrence record is present, or the proposed project might affect federally listed species, the user must contact the Department of Conservation or U.S. Fish and Wildlife Service for more information. The Natural Heritage Program tracks occurrences of sensitive species and natural communities where the species or natural community has been found. Lack of an occurrence record does not mean that a sensitive plant, animal or natural community is not present on or near the project area. Depending on the project, current habitat conditions, and geographic location in the state, surveys may be necessary. Additionally, because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present. Therefore, Reports include information about records near but not necessarily on the project site.

The Natural Heritage Report is not a site clearance letter for the project. It provides an indication of whether or not public lands and sensitive resources are known to be (or are likely to be) located close to the proposed project. Incorporating information from the Natural Heritage Program into project plans is an important step that can help reduce unnecessary impacts to Missouri's sensitive fish, forest and wildlife resources. However, the Natural Heritage Program is only one reference that should be used to evaluate potential adverse project impacts. Other types of information, such as wetland and soils maps and on-site inspections or surveys, should be considered. Reviewing current landscape and habitat information, and species' biological characteristics would additionally ensure that Missouri Species of Conservation Concern are appropriately identified and addressed in planning efforts.

U.S. Fish and Wildlife Service – Endangered Species Act (ESA) Coordination: Lack of a Natural Heritage Program occurrence record for federally listed species in your project area does not mean the species is not present, as the area may never have been surveyed. Presence of a Natural Heritage Program occurrence record does not mean the project will result in negative impacts. The information within this report is not intended to replace Endangered Species Act consultation with the U.S. Fish and Wildlife Service (USFWS) for listed species. Direct contact with the USFWS may be necessary to complete consultation and it is required for actions with a federal connection, such as federal funding or a federal permit; direct contact is also required if ESA concurrence is necessary. Visit the USFWS Information for Planning and Conservation (IPaC) website at <https://ecos.fws.gov/ipac/> for further information. This site was developed to help streamline the USFWS environmental review process and is a first step in ESA coordination. The Columbia Missouri Ecological Field Services Office may be reached at 573-234-2132, or by mail at 101 Park Deville Drive, Suite A, Columbia, MO 65203.

Transportation Projects: If the project involves the use of Federal Highway Administration transportation funds, these recommendations may not fulfill all contract requirements. Please contact the Missouri Department of Transportation at 573-526-4778 or visit <https://www.modot.org/> for additional information on recommendations.

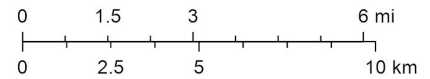
Wappapello Lake Forest Management Project



May 17, 2022

1:194,651

- Buffered Project Boundary
- Project Boundary



Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, CGIAR, USGS

Species or Communities of Conservation Concern within the Area:

There are records of species listed under the Federal Endangered Species Act, and possibly also records for species listed Endangered by the state, or Missouri Species and/or Natural Communities of Conservation Concern within or near the defined Project Area. Please contact the U.S. Fish and Wildlife Service and the Missouri Department of Conservation for further coordination.

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

U.S. Fish and Wildlife Service
Ecological Service
101 Park Deville Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Other Special Search Results:

The project occurs on or near public land, Graves Mountain CA, Lake Wappapello State Park, Lake Wappapello State Park - DNR, MARK TWAIN NF, MINGO NATIONAL WILDLIFE REFUGE, NOT USACOE LAND, Sam A. Baker State Park, USACE (Wappapello Lake, Choania Landing RA fishin*, USACE (Wappapello Lake, Greenville RA fishing pla*, USACE (Wappapello Lake, Spillway RA stairways), University Forest CA, WAPPAPELLO LAKE USACOE, Wappapello, Wappapello Lake ML, Yokum School CA, please contact MDC, DNR, COE, USFS, USFWS, MOARNG.

Your project is near a designated Natural Area . Please contact Missouri Department of Conservation (NaturalHeritageReview@mdc.mo.gov) for further coordination.

Project Type Recommendations:

Recreation: Other Construction should be managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any "Clean Water Permit" conditions. Project design should include stormwater management elements that assure storm discharge rates to streams for heavy rain events will not increase from present levels. Revegetate disturbed areas to minimize erosion using native plant species compatible with the local landscape and wildlife needs. Annual ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as crownvetch and sericea lespedeza.

Project Location and/or Species Recommendations:

Endangered Species Act Coordination - Indiana bats (*Myotis sodalis*, federal- and state-listed endangered) and **Northern long-eared bats** (*Myotis septentrionalis*, federal-listed threatened) may occur near the project area. Both of these species of bats hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in wooded areas, often riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana bats or Northern long-eared bats, especially from September to April. **If any trees need to be removed for your project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 ext. 100 for Ecological Services) for further coordination under the Endangered Species Act.**

The project site submitted and evaluated is on or near Sensitive Aquatic Species Waters St. Francis River, an important stream for freshwater mussel and amphibian populations. These streams were so designated because they have highly diverse mussel communities and mussel and amphibian species identified as Species of Conservation Concern. These streams are important to maintaining, restoring, or avoiding future listing of Species of Conservation Concern. Impacts to these aquatic species and habitats can be reduced by avoiding or minimizing activities that disturb the stream substrate, including rock placement, dredging, trenching, and wetted gravel bar disturbance; and avoid introducing heavy sediment loads, chemical or organic pollutants. These streams also are included as a Missouri Nationwide Permit Regional Condition (Number 7) that must be considered if working under a Clean Water Act Section 404 Permit issued by the U.S. Army Corps of Engineers (<http://www.nwk.usace.army.mil/Missions/RegulatoryBranch/NationWidePermit...>). A list of all streams designated under this Condition is available at <http://www.nwk.usace.army.mil/Portals/29/docs/regulatory/nationwidepermi...>

The project location submitted and evaluated is within the geographic range of nesting Bald Eagles in Missouri. Bald Eagles (*Haliaeetus leucocephalus*) may nest near streams or water bodies in the project area. Nests are large and fairly easy to identify. Adults begin nesting activity in late December and January and young birds leave the nest in late spring to early summer. While no longer listed as endangered, eagles continue to be protected by the federal government under the Bald and Golden Eagle Protection Act. Work managers should be alert for nesting areas within 1500 meters of project activities, and follow federal guidelines at: <http://www.fws.gov/midwest/MidwestBird/EaglePermits/index.html> if eagle nests are seen.

The submitted project location is within the range of the Gray Myotis (i.e., Gray Bat) in Missouri. Depending on habitat conditions of your project's location, Gray Myotis (*Myotis grisescens*, federal and state-listed endangered) could occur within the project area, as they forage over streams, rivers, lakes, and reservoirs. Avoid entry or disturbance of any cave inhabited by Gray Myotis and when possible retain forest vegetation along the stream and from the cave opening to the stream.

The project site submitted and evaluated is on or near Fish Spawning Stream Reaches St. Francis River, one of 138 state-designated fish spawning stream segments. These stream reaches were so designated because they have highly diverse fish communities, fish Species of Conservation Concern present, and because they are important to maintaining, restoring, or avoiding future listing of Species of Conservation Concern. These stream reaches also are included as a Missouri Nationwide Permit Regional Condition (Number 2) that must be considered if working under a Clean Water Act Section 404 Permit issued by the U.S. Army Corps of Engineers (<http://www.nwk.usace.army.mil/Missions/RegulatoryBranch/NationWidePermit...>). A list of all stream reaches is available at <http://www.nwk.usace.army.mil/Portals/29/docs/regulatory/nationwidepermi...>. Activities that alter or destabilize stream bottoms or banks should be avoided during the important fish spawning period for that stream, in order to not disrupt fish spawning (i.e., laying and fertilizing fish eggs.) The sensitive spawning period for this stream is March 15th to June 15th. At all times, avoid habitat destruction or introducing heavy sediment loads, chemical or organic pollutants.

Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment. Please inspect and clean equipment thoroughly before moving between project sites. See <https://mdc.mo.gov/community-conservation/managing-invasive-species-your-community> for more information.

- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
- Drain water from boats and machinery that have operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
- When possible, wash and rinse equipment thoroughly with hard spray or HOT water (>140° F, typically available at do-it-yourself car wash sites), and dry in the hot sun before using again.

Streams and Wetlands – Clean Water Act Permits: Streams and wetlands in the project area should be protected from activities that degrade habitat conditions. For example, soil erosion, water pollution, placement of fill, dredging, in-stream activities, and riparian corridor removal, can modify or diminish aquatic habitats. Streams and wetlands may be protected under the Clean Water Act and require a permit for any activities that result in fill or other modifications to the site. Conditions provided within the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 permit (<http://www.nwk.usace.army.mil/Missions/RegulatoryBranch.aspx>) and the Missouri Department of Natural Resources (DNR) issued Clean Water Act Section 401 Water Quality Certification (<http://dnr.mo.gov/env/wpp/401/index.html>), if required, should help minimize impacts to the aquatic organisms and aquatic habitat within the area. Depending on your project type, additional permits may be required by the Missouri Department of Natural Resources, such as permits for stormwater, wastewater treatment facilities, and confined animal feeding operations. Visit <http://dnr.mo.gov/env/wpp/permits/index.html> for more information on DNR permits. Visit both the USACE and DNR for more information on Clean Water Act permitting.

For further coordination with the Missouri Department of Conservation and the U.S. Fish and Wildlife Services, please see the contact information below:

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

U.S. Fish and Wildlife Service
Ecological Service
101 Park Deville Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Miscellaneous Information

FEDERAL Concerns are species/habitats protected under the Federal Endangered Species Act and that have been known near enough to the project site to warrant consideration. For these, project managers must contact the U.S. Fish and Wildlife Service Ecological Services (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132; Fax 573-234-2181) for consultation.

STATE Concerns are species/habitats known to exist near enough to the project site to warrant concern and that are protected under the Wildlife Code of Missouri (RSMo 3 CSR 1 0). "State Endangered Status" is determined by the Missouri Conservation Commission under constitutional authority, with requirements expressed in the Missouri Wildlife Code, rule 3CSR 1 0-4.111. Species tracked by the Natural Heritage Program have a "State Rank" which is a numeric rank of relative rarity. Species tracked by this program and all native Missouri wildlife are protected under rule 3CSR 10-4.110 General Provisions of the Wildlife Code.

See [Missouri Species and Communities of Conservation Concern Checklist \(mo.gov\)](#) for a complete list of species and communities of conservation concern. Detailed information about the animals and some plants mentioned may be accessed at [Missouri Fish and Wildlife Information System \(MOFWIS\)](#). Please contact the Missouri Department of Conservation to request printed copies of any materials linked in this document.



Missouri Department of Conservation
Natural Heritage Review Report

September 2, 2022

Science Branch
 P. O. Box 180
 Jefferson City, MO 65102
 Prepared by: Hannah Roos
 NaturalHeritageReview@mdc.mo.gov
 (573) 522 - 4115 ext. 3182

Evan Hill
 U.S. Army Corps of Engineers
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NHR ERT ID:	10903	NHR ERT Level:	3
Project type:	Forestry Stand Improvement		
Location/Scope:	Wappapello Lake		
County:	Wayne/Butler		
Query reference:	Wappapello Lake Forest Management Project		
Query received:	8/16/2022		

This NATURAL HERITAGE REVIEW is not a site clearance letter. Rather, it identifies public lands and records of sensitive resources located close to and/or potentially affected by the proposed project. If project plans or location change, this report may no longer be valid. On-site verification is the responsibility of the project. Natural Heritage records were identified at some time and location. This report considers records near but not necessarily at the project site. Animals move and, over time, so do plant communities. To say "there is a record" does not mean the species/habitat is still there. To say that "there is no record" does not mean a protected species will not be encountered. These records serve as one reference and additional information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Look for additional information about the biological and habitat needs of records listed to avoid or minimize impacts. More information is at [Natural Areas | Missouri Department of Conservation \(mo.gov\)](#) and [Missouri Fish and Wildlife Information System \(MOFWIS\)](#).

Level 3: Records of federal-listed (also state-listed) species or critical habitats near the project site:

Natural Heritage records indicate Indiana, Northern Long-eared, and Gray bats occur within the project area. **Prior to removing trees for this project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 Ext. 100 for Ecological Services) for further coordination under the Endangered Species Act.**

The St. Francis River and its tributaries are home to many aquatic species of concern, including fish, mussels, and crayfish of state and/or federal status. A portion of the Saint Francis River within the project area is Rabbitsfoot (*Theliderma cylindrica*, Federally Threatened) Federal Designated Critical Habitat and is a spawning restricted waterway. Alligator Snapping Turtles and Bald Eagles are also known to occur within the project area.

- **Indiana Bats and Northern Long-eared Bats** occur in Wayne County and could occur in the project area. Indiana Bats (*Myotis sodalis*, federal and state-listed endangered) and Northern Long-eared Bats (*Myotis septentrionalis*, federal-listed threatened) hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana Bats and/or Northern Long-eared Bats, especially from September to April.
- **Gray Bats:** Gray Bats (*Myotis grisescens*, federal and state-listed endangered) occur in Wayne County and could occur in the project area, as they forage over streams, rivers, and reservoirs. Avoid entry or disturbance of any cave inhabited by gray bats and when possible retain forest vegetation along the stream and from the gray bat cave opening to the stream. Please see [BMPs for Construction and Development Projects Gray Bat \(mo.gov\)](#).

- **St. Francis River Crayfish:** The St. Francis River Crayfish (*Faxonius quadruncus*, federally proposed threatened) occurs only in Missouri, in the upper St. Francis River and its tributaries (mostly exclusive of Big Creek and most other streams supporting populations of the Big Creek crayfish), in St. Francis, Iron, Madison, and Wayne counties. Projects that manage construction and include operation plans to avoid runoff of silt, fine sediments, or pollutants are unlikely to affect this aquatic species.
- **Big Creek Crayfish:** The Big Creek Crayfish (*Faxonius peruncus*, federally proposed threatened) occurs only in Missouri and has a very localized distribution in the St. Francis River basin of Iron, Madison, and Wayne Counties. A headwater species, the Big Creek Crayfish occurs exclusively in small, high-gradient rocky creeks. It is most abundant in Big Creek and its tributaries on the west side of the basin. Projects that manage construction and include operation plans to avoid runoff of silt, fine sediments, or pollutants are unlikely to affect this aquatic species.
- **Mussels:** Mussels are relatively immobile animals that are vulnerable to pollutants, sediment discharges, channel alterations and other activities destructive to mussel habitat. Activities that alter or destabilize stream bottoms or banks or introduce silt, chemical or organic pollutants should be avoided. Avoid crossing flowing water but, if unavoidable, minimize crossing distance and use temporary crossings that do not restrict water flow. Please see [BMP for Construction and Development Projects: Freshwater Mussels \(mo.gov\)](#) for best management recommendations.
- **Alligator Snapping Turtle:** The project site is in the known range of Alligator Snapping Turtle (*Macrochelys temminckii*), a turtle on the state's Species of Conservation Concern List and recently proposed for listing under the Endangered Species Act. Maintenance and restoration of sloughs and oxbow lakes, as well as riparian corridors along the rivers are critical for the survival of many species, including the Alligator Snapping Turtle. See <https://mdc.mo.gov/sites/default/files/2020-06/AlligatorSnappingTurtleBMP.pdf> for Best Management Practices regarding this species.
- **Bald Eagles:** Bald Eagles (*Haliaeetus leucocephalus*) nest near streams or water bodies in the project area. Nests are large and fairly easy to identify. While no longer listed as endangered, eagles continue to be protected by the federal government under the Bald and Golden Eagle Protection Act. Work managers should be alert for nesting areas within 1500 meters of project activities, and follow federal guidelines at: [Do I need an eagle take permit? | U.S. Fish & Wildlife Service \(fws.gov\)](#) if eagle nests are seen.

Following USFWS Incidental Take Guidelines: To avoid the incidental take of bald eagles we recommend:

- a buffer of at least 660 feet between project activities and the nests (including active and inactive nests).
- If project activities are within 660 feet of the nest, please restrict activities to outside the nesting season. The nesting season in Missouri is January 1 – July 15.
- If these recommendations cannot be implemented, incidental take of bald eagles may occur and a permit from USFWS may be necessary.
- Do not clear nests or nest trees.

FEDERAL LIST species/habitats are protected under the Federal Endangered Species Act. Contact U.S. Fish & Wildlife Service (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; 573-234-2132) for Endangered Species Act coordination and concurrence information).

Level 2: Records of state-listed (not federal-listed) endangered species AND / OR state-ranked (not state-listed endangered) species and natural communities of conservation concern. The Department tracks these species and natural communities due to population declines and/or apparent vulnerability.

Natural Heritage records identify several state-listed endangered species within the project area including Swainson's Warbler, Western Chicken Turtle, Mountain Madtom, and Longnose Darter. Project activities should not occur below the high water level of the stream between March 15 and July 31 to protect both of these fish species.

- **Swainson's Warblers** have very narrow habitat requirements and, thus, are dependent upon protection and restoration of canebrakes, swamps, and thickets in moist bottomland woods. Project activities should not occur within 100 feet of wetland habitat within the range of this species from late April to mid-August to avoid disturbing nesting pairs and from mid-August to October 1, since these birds stay near breeding habitat until migration. Erosion and sediment controls should be implemented, maintained, and monitored for the duration of the project. Maintain special habitat features such as tall dense stands of giant cane, overstory canopy, and leaf litter on ground to provide habitat for Swainson's Warblers. Draining or destroying known wetland habitat along streams should be avoided. Forests adjunct to streambeds with giant cane should be thinned occasionally between October 1 and April 1 to allow for new growth. See <https://mdc.mo.gov/sites/default/files/2020-06/SwainsonsWarblerBMP.pdf> for Best Management Practices regarding this species.
- **Western Chicken Turtle:** Western Chicken turtle (*Deirochelys reticularia miaria*, State-listed Endangered) have a historic range that includes southeastern Missouri, the coastal plain of Arkansas, Louisiana west of the Mississippi River, eastern Texas and southeastern Oklahoma. In Missouri, these turtles are a bottomland, hardwood forest species that inhabit cypress-bordered shallow ponds, river sloughs, temporarily water-filled ditches and drainage ditches in spring and early summer. However, they spend considerable time on the forested lands, especially near wetlands. See <https://mdc.mo.gov/sites/default/files/2020-06/WesternChickenTurtleBMP.pdf> for Best Management Practices Regarding this species.
- **Mountain Madtom:** Mountain Madtoms (*Noturus eleutherus*, State-listed Endangered) inhabit only a few large, clear rivers in the transition zone between the Ozark and Lowland faunal regions in the southeastern part of Missouri. These fish prefer gravelly riffles with thick growths of aquatic vegetation. See <https://mdc.mo.gov/sites/default/files/2020-06/MountainMadtomBMP.pdf> for Best Management Practices regarding this species.
- **Longnose Darter:** In Missouri, Longnose Darter (*Percina nasuta*, State-listed Endangered) inhabit the St. Francis River above Wappapello Reservoir. This species primarily occupies areas of low current velocity near riffles and runs (deep, fast water), and are often associated with large rocks or vegetation. See <https://mdc.mo.gov/sites/default/files/2020-06/LongnoseDarterBMP.pdf> for Best Management Practices regarding this species.

Natural Heritage records identify several state-ranked species/natural communities within the project area. Following Best Management Practices provided in this document will reduce potential impacts to these resources.

There are no regulatory requirements associated with this status, however we encourage voluntary stewardship to minimize the risk of further decline that could lead to listing.

STATE ENDANGERED species are protected under the Wildlife Code of Missouri (3CSR10-4.111).
See the [2022 Missouri Species and Communities of Conservation Concern Checklist](#) for a complete list.

General recommendations related to this project or site, or based on information about the historic range of species (unrelated to any specific Natural Heritage records):

- **Contact Area Manager:** This project is within Wappapello Lake Management Lands. Please contact area manager, Steve Orchard (573-663-7130) if project activities will impact this area.
- **Karst:** Wayne and Butler Counties have known karst geologic features (e.g. caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are species of conservation concern) are influenced by changes to water quality, so check your project site for any karst features and make every effort to protect groundwater in the project area. Please see [BMPs for Construction and Development Projects Affecting Missouri Karst Habitat \(mo.gov\)](#).
- Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, larvae, and aquatic plant material may be moved to new sites on boats or construction equipment, so inspect and clean equipment thoroughly before moving between project sites.
 - ◆ Remove any mud, soil, trash, plants (or plant material) or animals from equipment before leaving any water body or work area.
 - ◆ Drain water from boats and machinery that has operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
 - ◆ When possible, wash and rinse equipment thoroughly with hard spray or HOT water ($\geq 140^{\circ}$ F, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.

These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Natural Heritage records largely reflect sites visited by specialists in the last 30 years. Many privately owned tracts have not been surveyed and could host remnants of species once but no longer common.

MISSOURI



Appendix 3

Regulatory

Clean Water Act, Section 404(f) Exemptions

as of January 2014

Section 404(f) of the Clean Water Act (CWA) provides activities which are exempt from regulation under Section 404 of the Clean Water Act (i.e. a CWA Section 404 Permit would not be required).

Exempt Activities

1. Farming, silviculture and ranching activities.
2. (Emergency) maintenance activities.
3. Construction and maintenance of farm ponds, stock ponds, or irrigation ditches or the maintenance of drainage ditches.
4. Construction of temporary sedimentation basins.
5. Any activity with respect to which a State has an approved program under section 208(b)(4) of the CWA which meets the requirements of sections 208(b)(4) (B) and (C). *Not currently available in New Mexico.*
6. Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining equipment.

Refer to the U.S. Corps of Engineer (USACE) specific requirements of each exempt activity (provided below). Those requirements must be met in order for the exemption to apply. In addition, there are exceptions to the exemptions:

EXCEPTIONS TO THE EXEMPTIONS

I. Navigable Water. Section 404(f) exemptions DO NOT APPLY to any activity within a “navigable water of the U.S.” in which a permit is required under Section 10 of the Rivers and Harbors Act of 1899. For example, in-stream or streambank work such as bank shaping around a headgate or working on a weir/diversion dam will require a Section 404 permit.

II. Recapture Provision. Section 404(f) exemptions DO NOT APPLY where any discharge of dredged and/or fill material into “waters of the U.S.”, including wetlands, **IF 1]** the activity would convert an area of waters of the U.S. into a new use (e.g. wetland to upland, wetland to open water, etc.), **and 2]** where it would impair the flow and/or circulation or reduce the reach of the waters. If these two conditions apply, a Section 404 permit is required.

III. Toxic Pollutants. Section 404(f) exemptions DO NOT APPLY if any discharge resulting from the exempt activities contains any toxic pollutant listed under Section 307 of the Clean Water Act. If this condition applies, a Section 404 permit is required. [Refer to Appendix 1 for a list of Toxic Pollutants.](#)

1. NORMAL FARMING, SILVICULTURE, AND RANCHING ACTIVITIES

Includes: plowing, seeding, cultivating, minor drainage and harvesting for the production of food, fiber and forest products, or upland soil and water conservation practices.

- MUST be a part of an established (on-going) farming, silviculture, or ranching operation. An operation is no longer established when the area on which it was conducted has been converted to another use or has lain idle so long that modifications to the hydrologic regime are necessary to resume operations. For example, if a property has been used for cattle grazing, the exemption does not apply if future activities would involve planting crops for food; similarly, if the current use of a property is for growing a crop, the exemption does not apply if future activities would involve conversion to an orchard or vineyards.
- It is important to recognize that these terms have specific, regulatory meanings. For example, "plowing" under Section 404(f) means all mechanical means of manipulating soil, including grading to prepare it for the planting of crops. However, grading activities that would change any area of waters of the US, including wetlands, into dry land are not exempt. "Minor drainage" is limited to discharges associated with the continuation of established wetland crop production (e.g., building rice levees) or the connection of upland crop drainage facilities to waters of the U.S. or emergency removal of blockages that close/constrict existing crop drainage ways. Minor drainage does not include discharges associated with the construction of ditches which drain or significantly modify any wetlands or aquatic areas considered as waters of the U.S.

For more information, refer to the EPA Memorandum on the CWA Section 404 and Agricultural Activities: <http://water.epa.gov/lawsregs/guidance/wetlands/cwaag.cfm>

2. MAINTENANCE ACTIVITIES.

Includes emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, and bridge abutments or approaches, and transportation structures.

- DOES NOT include any modification that changes the character, scope, or size of the original fill design. If a maintenance activity would involve ANY modifications to the original fill design, including the location of the fill, the type of material to be used, the amount of material used, etc., then the activity DOES not qualify for the maintenance exemption and a permit would be required. However, the activity may qualify for authorization under a Nationwide Permit 3, Maintenance.
- Emergency reconstruction must occur within a reasonable period of time after damage occurs to qualify.

3. FARM OR STOCK POND OR IRRIGATION DITCH CONSTRUCTION OR MAINTENANCE

Construction or maintenance of farm or stock ponds (including fish ponds), irrigation ditches or the maintenance of drainage ditches.

- DOES NOT include the construction of drainage ditches. Maintenance is only exempt under Section 404(f) if does not include any modification that changes the character, scope, or size of the original design.
- Remember that the Exemptions to the Exceptions apply.

Example 1: a pond dug within a shallow, emergent wetland. The Recapture Provision applies because it changes the use (wetland to open water) and alters the flow/circulation of the wetland; therefore a Section 404 Permit is required.

Example 2: a surface ditch through a wetland is replaced with a pipeline that includes ‘berming’ or mounding of soil above the natural grade. The Recapture Provision applies because it changes the use (wetland to upland) and alters the flow and circulation of the water (i.e. berm bisecting a wetland alter the surface flow); therefore a Section 404 Permit is required. Please note: if it is believed that the wetland was solely formed by irrigation water, this must be proven to the USCOE. Consult an NRCS wetland expert or the state biologist for assistance.

Example 3: a tar coated diversion structure is used to divert stream water into an irrigation system. The Toxic Pollutant exception applies because tar (Naphthalene) is a Section 307 pollutant.

Example 4: excess dirt from construction or maintenance (such ditch/pond sediment removal) is placed in a low, wet spot (wetland). The Recapture Provision applies; therefore a Section 404 Permit is required.

4. CONSTRUCTION OF TEMPORARY SEDIMENTATION BASINS

Construction of temporary sedimentation basins, on a construction site, which does not include the placement of fill material into waters of the U.S., including wetlands. Construction site is any site involving the erection of buildings, roads, and other discrete structures and the installation of support facilities necessary for construction and utilization of the structures. Also includes any other land areas which involve land-disturbing excavation activities, including quarrying and other mining areas, where an increase in the runoff of sediment is controlled through the use of temporary sedimentation basins.

6. CONSTRUCTION OR MAINTENANCE OF FARM ROADS, FOREST ROADS, OR TEMPORARY ROADS FOR MOVING MINING EQUIPMENT

Roads must be constructed and maintained in accordance with Best Management Practices (BMPs) to assure that flow and circulation patterns and chemical and biological characteristics of waters of the U.S. are not impaired and that the reach of the waters of the U.S. is not reduced, and that any adverse effect on the aquatic environment are minimized. The BMPs which must be applied to satisfy this provision include the following baseline provisions:

- Roads shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silviculture or mining operations, and local topographic and climatic conditions.
- Road fill shall be bridged, culverted or designed to prevent the restriction of expected flood flows.
- The fill shall be properly stabilized and maintained during and following construction to prevent erosion.
- Discharges shall be made in a manner that minimizes construction equipment in waters of the U.S. outside of the fill area.
- Vegetative disturbance shall be kept to a minimum.
- Construction and maintenance of crossing shall not disrupt the migration or other movement of aquatic life.
- Borrow material shall be taken from upland sources where feasible.

- The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species, or adversely modify or destroy the critical habitat of such species.
- Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided.
- The discharge shall not be located in the proximity of a public water supply intake.
- The discharge shall not occur in a component of the National Wild and Scenic River System.
- The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and
- All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Conclusion: If the proposed discharge satisfies all of the above restrictions, it is automatically exempted and no further permit action from the USCOE is required. If any of the restrictions of this exemption will not be complied with, a Section 404 permit is required (a CWA nationwide permit may be available for the proposed work). State or local approval of the work may also be required.

Contact: For a written determination regarding a specific project, contact the USCOE:

Albuquerque Regulatory Office
4101 Jefferson Plaza NE
Albuquerque, NM 87109
(505) 342-3262

Durango Regulatory Office
1970 East 3rd Ave., Suite 109
Durango, Colorado 81301
(970) 259-1764

Las Cruces Regulatory Office
505 South Main Street, Suite 142
Las Cruces, New Mexico 88001
(575) 556-9939

Reference:

USACE Website: <http://www.spk.usace.army.mil/Missions/Regulatory/Permitting/Section404Exemptions.aspx>
New Mexico Environment Department website: <http://www.nmenv.state.nm.us/swqb/404/>

Appendix 1: Toxic Pollutants

[44 FR 44502, July 30, 1979, as amended at 46 FR 2266, Jan. 8, 1981; 46 FR 10724, Feb. 4, 1981]

The following comprise the list of toxic pollutants designated pursuant to section 307(a)(1) of the Act:

- | | |
|--|---|
| 1. Acenaphthene | 35. Ethylbenzene |
| 2. Acrolein | 36. Fluoranthene |
| 3. Acrylonitrile | 37. Haloethers (other than those listed elsewhere; includes chlorophenylphenyl ethers, bromophenylphenyl ether, bis(dichloroisopropyl) ether, bis-(chloroethoxy) methane and polychlorinated diphenyl ethers) |
| 4. Aldrin/Dieldrin | 38. Halomethanes (other than those listed elsewhere; includes methylene chloride, methylchloride, methylbromide, bromoform, dichlorobromomethane) |
| 5. Antimony and compounds | 39. Heptachlor and metabolites |
| 6. Arsenic and compounds | 40. Hexachlorobutadiene |
| 7. Asbestos | 41. Hexachlorocyclohexane |
| 8. Benzene | 42. Hexachlorocyclopentadiene |
| 9. Benzidine | 43. Isophorone |
| 10. Beryllium and compounds | 44. Lead and compounds |
| 11. Cadmium and compounds | 45. Mercury and compounds |
| 12. Carbon tetrachloride | 46. Naphthalene (Tar) |
| 13. Chlordane (technical mixture and metabolites) | 47. Nickel and compounds |
| 14. Chlorinated benzenes (other than di-chlorobenzenes) | 48. Nitrobenzene |
| 15. Chlorinated ethanes (including 1,2-di-chloroethane, 1,1,1-trichloroethane, and hexachloroethane) | 49. Nitrophenols (including 2,4-dinitrophenol, dinitroresol) |
| 16. Chloroalkyl ethers (chloroethyl and mixed ethers) | 50. Nitrosamines |
| 17. Chlorinated naphthalene | 51. Pentachlorophenol |
| 18. Chlorinated phenols (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols) | 52. Phenol |
| 19. Chloroform | 53. Phthalate esters |
| 20. 2-chlorophenol | 54. Polychlorinated biphenyls (PCBs) |
| 21. Chromium and compounds | 55. Polynuclear aromatic hydrocarbons (including benzantracenes, benzopyrenes, benzofluoranthene, chrysenes, dibenz-anthracenes, and indenopyrenes) |
| 22. Copper and compounds | 56. Selenium and compounds |
| 23. Cyanides | 57. Silver and compounds |
| 24. DDT and metabolites | 58. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) |
| 25. Dichlorobenzenes (1,2-, 1,3-, and 1,4-di-chlorobenzenes) | 59. Tetrachloroethylene |
| 26. Dichlorobenzidine | 60. Thallium and compounds |
| 27. Dichloroethylenes (1,1-, and 1,2-dichloroethylene) | 61. Toluene |
| 28. 2,4-dichlorophenol | 62. Toxaphene |
| 29. Dichloropropane and dichloropropene | 63. Trichloroethylene |
| 30. 2,4-dimethylphenol | 64. Vinyl chloride |
| 31. Dinitrotoluene | 65. Zinc and compounds |
| 32. Diphenylhydrazine | |
| 33. Endosulfan and metabolites | |
| 34. Endrin and metabolites | |