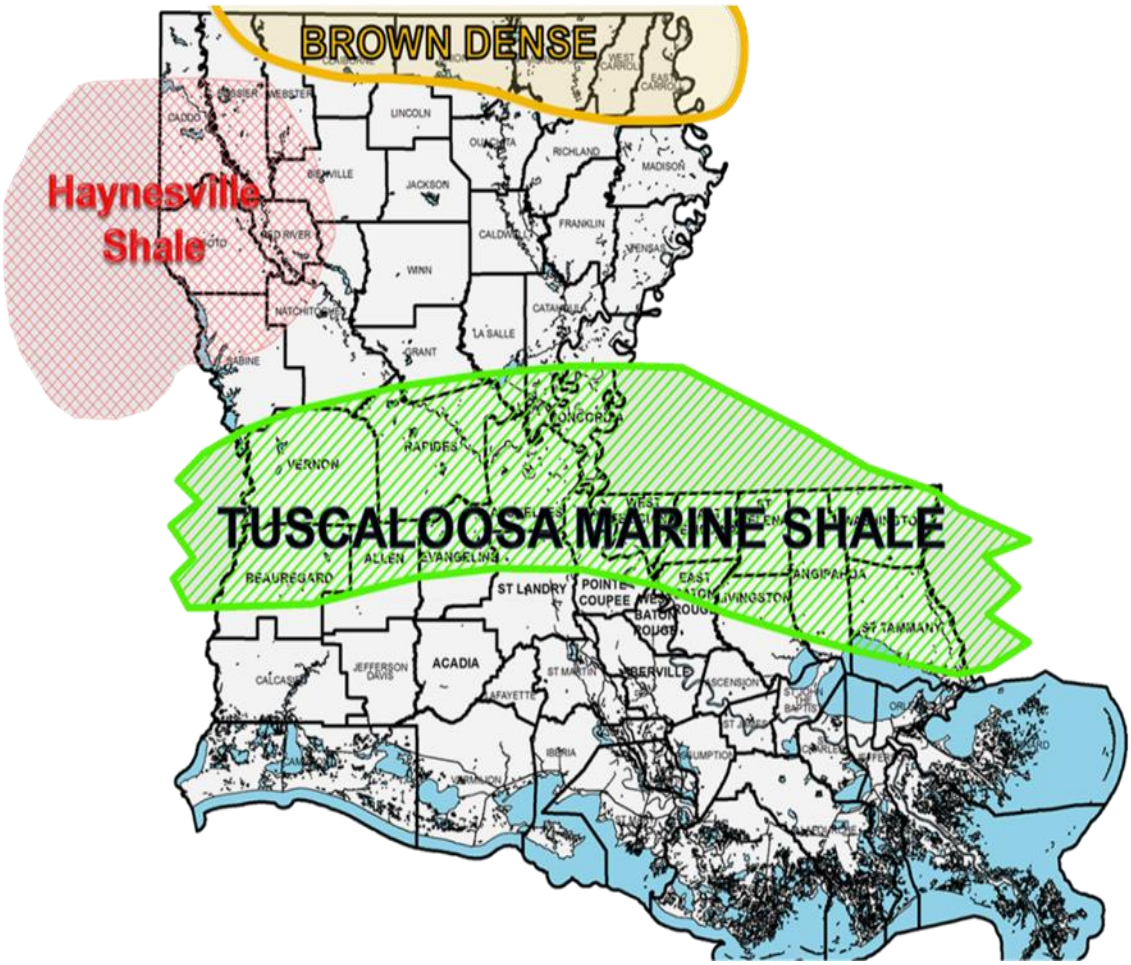
Louisiana Ecological Services Office

SUGGESTED STREAMLINED COORDINATION FOR OIL AND NATURAL GAS EXPLORATION, DRILLING AND PRODUCTION IN LOUISIANA SHALE PLAYS

Developed in partnership with
Louisiana Department of Wildlife and Fisheries

September 2017

SHALE OIL AND GAS FORMATIONS



Source: Louisiana Department of Natural Resources

TABLE OF CONTENTS

INTRODUCTION

This document was prepared by the U.S. Fish and Wildlife Service's (Service) Louisiana Ecological Services Office (LESO) and partners to protect and conserve important public resources such as wildlife and plants, and their habitats (including waterbodies) within areas of Louisiana with a high potential for new or continued oil and natural gas drilling and production.

We encourage the use of best management practices (BMPs) in exploration, drilling and reclamation activities. BMPs should be innovative and dynamic environmental practices to guide activities to be conducted in an environmentally responsible manner. They should allow energy companies to prepare for and maintain energy production while minimizing environmental impacts.

Louisiana shale plays may now or hereafter contain plants and animals determined to be threatened, endangered, or special status species (*i.e*., Federal proposed, candidate, and at-risk species and State Species of Greatest Conservation Need). State and Federal agencies may recommend modifications to, or mitigation for oil and gas proposals to further their conservation and management objectives to avoid activities that will contribute to species impacts or trends toward the need to federally list a species.

Federal agencies may recommend modifications to a proposed activity that is likely to adversely affect or result in jeopardy to the continued existence of a proposed or threatened or endangered species or result in the destruction or adverse modification of designated or proposed critical habitat, in accordance with the Endangered Species Act (Act) as amended (16 U.S.C.1531 *et seq*.).

If implementation of a project has the potential to directly or indirectly affect a federally listed species, consultation with the Service would be through the Federal action agency if there will be Federal involvement (such as permitting or other authorization). Otherwise, coordination with the Service is also recommended (non-Federal entities, private sector), as a Habitat Conservation Plan may be necessary to comply with prohibitions against taking listed species.

Section 9 of the Act and Federal regulation under section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering.

Please contact the LESO at (337-291-3101) and the Louisiana Department of Wildlife and Fisheries (LDWF) at 225-765-2800 if you are unsure of the occurrence of sensitive fish, wildlife, or plants or their habitats in potential construction areas. **The LESO website can be used for initial project review/screening for Federal trust resources** (https://www.fws.gov/southeast/lafayette). Also, if a proposed project area is within a state or federally owned management area, that appropriate agency office should be contacted for any authorization that may be needed. These include National Wildlife Refuges (985-882-2011) and the Kisatchie National Forest (318-473-7160).

The Louisiana Legislature has directed the Department of Natural Resources to coordinate the management, preservation, conservation and protection of the state's water resources and has given authority for the agency to enter into cooperative agreements with water users for the withdrawal of surface water from the state's water bodies. If proposed project activities include utilizing state owned surface water, please consult the following website to file a surface water use application: http://www.dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=92&pnid=0&nid=375

All photos in this document are by U.S. Fish and Wildlife Service.

Primary contacts for the LESO regarding this document are:

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Brad Rieck, Deputy Field Supervisor (337-291-3116)

Endangered, Threatened, Candidate, and Proposed Species in Louisiana Shale Plays: *(E=Endangered, T=Threatened, C=Candidate, P=Proposed)*		
Shale Area	**Species**	**Status**
Tuscaloosa, Haynesville, Brown Dense	red-cockaded woodpecker, *Picoides borealis*	E
Tuscaloosa, Haynesville	Interior least tern, *Sterna antillarum*	E
Tuscaloosa, Brown Dense	Louisiana black bear, *Ursus americanus luteolus*	Recovered *(State-Protected Species)*
Tuscaloosa	northern long-eared bat, *Myotis septentrionalis*	T
Tuscaloosa, Haynesville	pallid sturgeon, *Scaphirhynchus albus*	E
Tuscaloosa	Atlantic sturgeon, *Acipenser oxyrhynchus desotoi*	T
Tuscaloosa	gopher tortoise, *Gopherus polyphemus*	T
Tuscaloosa	ringed map turtle, *Graptemys oculifera*	T
Tuscaloosa, Brown Dense	fat pocketbook pearly mussel, *Potamilus capax*	E
Tuscaloosa	Alabama heelsplitter, *Potamilus inflatus*	T
Tuscaloosa	Louisiana pearlshell mussel, *Margaritifera hembeli*	T
Brown Dense	pink mucket pearly mussel, *Lampsilis abrupta*	E
Brown Dense	rabbitsfoot mussel, *Quadrula cylindrical cylindrica*	T
Tuscaloosa	dusky gopher frog, *Rana sevosa*	E
Tuscaloosa	American chaffseed, *Schwalbea americana*	E
Tuscaloosa	Louisiana quillwort, *Isoetes louisianaensis*	E
Haynesville	earth fruit, *Geocarpon minimum*	T
Tuscaloosa, Haynesville	Louisiana pine snake, *Pituophis ruthveni*	P

I. Federally Threatened and Endangered Species

A. Birds

Red-cockaded Woodpecker

The endangered red-cockaded woodpecker (RCW, *Picoides borealis*) is known to inhabit areas within Tuscaloosa, Haynesville, and Brown Dense shale plays in the following Louisiana Parishes: Bienville, Caddo, DeSoto, Red River, Webster, Bossier, Claiborne, Union, East, Carroll, West Carroll, Richland, Ouachita, Morehouse, Evangeline, Allen, Beauregard, Natchitoches, Livingston, Catahoula, LaSalle, Rapides, Sabine, and St. Tammany. RCWs roost and forage year-round and nest seasonally (i.e., April through July) in open, park-like stands of mature pine trees containing little hardwood component, a sparse midstory, and a well-developed herbaceous understory. RCWs can tolerate small numbers of overstory and midstory hardwoods at low densities found naturally in many southern pine forests, but they are not tolerant of dense midstories resulting from fire suppression or from overstocking of pine. Trees selected for cavity excavation are generally at least 60 years old, although the average stand age can be younger. The collection of one or more cavity trees plus a surrounding 200 foot wide buffer of continuous forest is known as a RCW cluster. RCW foraging habitat is located within one-half mile of the cluster and is comprised of pine and pine-hardwood stands (i.e., 50 percent or more of the dominant trees are pines) that are at least 30 years of age and have a moderately low average basal area (i.e., 40 – 80 square feet per acre is preferred).

If a proposed project area does not contain suitable nesting and/or foraging habitat as defined above, further consultation with the Service will not be necessary. However, if potential RCW nesting or foraging habitat is located within the project area, all suitable nesting habitat within the project area and within a one-half mile radius from such habitat should be carefully surveyed by a qualified biologist for the presence of RCW cavity trees in accordance with the survey protocol found in Appendix 4 of the RCW Recovery Plan (2003), which can be found online at http://www.fws.gov/rcwrecovery/recovery_plan.html. We request that you provide this office with a copy of the survey report, which should include the following details:

1. survey methodology including dates, qualifications of survey personnel, size of survey area, and transect density;

2. pine stand characteristics including number of acres of suitable nesting and/or foraging habitat, tree species, basal area and number of pine stems 10 inches or greater per acre, percent cover of pine trees greater than 60 years of age, species of dominant vegetation within each canopy layer, understory conditions and species composition (several representative photographs should be included);

3. number of active and inactive RCW cavity trees observed and the condition of the cavities (e.g., resin flow, shape of cavity, start-holes);

4. presence or absence of RCWs; and

5. topographic quadrangle maps which illustrate areas of adequate RCW nesting and/or foraging habitat, cluster sites, and cavity tree locations relative to proposed construction activities.

If implementation of a proposed project has the potential to directly or indirectly affect RCW individuals or their habitat, consultation with this office is recommended.

Oil and gas development, with concurrence from the Service, can occur within the 0.8 km (0.5 mi) radius surrounding the cluster. However, the level of development cannot reduce the available foraging substrate below the required standard of managed stability. Should drilling sites and their associated infrastructures (roads, right-of-way, parking areas, etc.) be permitted, all reasonable measures should be taken to minimize the impact of these developments on the foraging habitat available to the RCW. Projects should strive to minimize clearing for drill sites, rights-of-way, road widths, living quarters, etc.

Interior Least Tern

Interior least terns (*Sterna antillarum*) are an endangered migratory shorebird that breeds, nests, and rears its young on sparsely or non-vegetated portions of sand or gravel bars located mid-stream or along the shoreline in the Mississippi, Missouri, Arkansas, Ohio, Red and Rio Grande river systems and the rivers of central Texas. On the lower Mississippi River, the listed interior least tern population is concentrated within approximately 500 river miles between its confluence with the Ohio River at Cairo, Illinois, and Vicksburg, Mississippi. In Louisiana, the interior least tern historically occurred along the Mississippi River north of Baton Rouge, but few birds have been observed in surveys conducted over the last few years. Interior least tern nesting colonies are known to occur along the Red River in Central Louisiana (Grant, Rapides and Natchitoches Parishes) and Northeast Louisiana (Bossier, Caddo, and Red River Parishes). Major threats to this species include habitat loss, human disturbance at nesting colonies, and altered water flow patterns.

Should a proposed project directly or indirectly affect interior least terns or suitable nesting habitat within the Red or Mississippi Rivers, consultation with the Service is recommended. In this event, the Service recommends implementing the guidance below into project plans.

1. The absence of nesting interior least terns should be confirmed before initiating any work in or adjacent to the Red River within the aforementioned Louisiana Parishes during the breeding season (May 15 to August 31, depending upon river stages).

2. No activity, such as drilling and/or seismic survey activity should be conducted within 650 feet of a nesting colony (Martin and Lester 1990). The directional drilling

method should be utilized to the furthest extent in order to position drilling wells away from least tern nesting colonies.

If that guidance would be incorporated into a proposed action, impacts to interior least terns in Louisiana may be avoided thereby improving consultation efficiency amongst the Service and project sponsors. However, if nesting least terns are observed in proximity to the project area during the breeding season, all work should cease and the Service should be contacted for further consultation.

B. Mammals

Louisiana Black Bear

The Louisiana black bear (*Ursus americanus luteolus*) was listed as a threatened subspecies in 1992 and inhabits the Tuscaloosa Marine Shale area and the Brown Dense Shale area (Avoyelles, Concordia, Catahoula, St. Landry, Point Coupee, West Feliciana, Madison, East and West Carroll Parishes). Although Louisiana black bears are primarily associated with forested wetlands, they utilize a variety of other habitat types, including scrub-shrub, marsh, spoil banks, and upland forests. Louisiana black bears normally den from December through April and preferred den sites include large, hollow trees (36 inches or more in diameter at breast height) with sufficiently sized openings that allow access to interior cavities.

Due to recovery, the Louisiana black bear was officially removed from the List of Endangered and Threatened Species on March 11, 2016 (effective April 11, 2016); critical habitat designation for this subspecies has also been withdrawn. Because the Louisiana black bear is no longer protected under the ESA, consultation with the Service is not required for this subspecies. The Louisiana black bear remains protected, however, under Louisiana state law, and the Louisiana Department of Wildlife and Fisheries (LDWF) will continue to actively manage this subspecies. The Service and LDWF have developed a plan to extensively monitor the status of the Louisiana black bear for 7 years following its delisting (until year 2022). That monitoring will be undertaken to detect any potential population decreases or threat increases that may warrant the implementation of measures to ensure that the Louisiana black bear remains secure from risk of extinction.

Although ESA consultation is no longer required for the Louisiana black bear, in the interest of conserving that subspecies, we encourage project proponents to implement the following conservation measures in areas that are known to be inhabited by Louisiana black bears (a current Louisiana black bear breeding area map is located at https://www.fws.gov/Lafayette/pdf/LA_Black_Bear_Breeding_Habitat_Map.pdf):

- reducing the footprint of proposed actions to the maximum extent feasible.

- avoiding impacts to potential den trees that are 36 inches or more in diameter at breast height.

- implementing programs to prevent the habituation of bears to human-associated food sources (e.g., use of "bear-proof" waste disposal containers or daily removal of food and garbage) during construction and operation of projects.

- avoiding vegetative clearing during the black bear denning season (i.e., December 1 through April 30).

- because the Louisiana black bear remains protected under Louisiana state law, Maria Davidson (LDWF - Large Carnivore Program Manager) should be contacted at (337) 262-2080 regarding any additional conservation measures that may be required.

Northern Long-Eared Bat

The northern long-eared bat (*Myotis septentrionalis*) (NLEB), federally listed as a threatened species, inhabits the Tuscaloosa Marine Shale area (Winn and Grant parishes). Northern-long eared bats are distinguished by their long ears and are about 3 to 3.7 inches in length and have a wingspan of 9 to 10 inches. Its fur color can range from medium to dark brown on the back and tawny to pale-brown on the underside. The northern long-eared bat can be found in much of the eastern and north central United States and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. In Louisiana, there have been confirmed reports of sightings in Winn and Grant parishes; although they can possibly be found in other parishes in the state. Some individuals were documented during mist net and bridge surveys on the Winn District of the Kisatchie National Forest and were also observed under bridges on the Winn District in Grant Parish.

Northern long-eared bats can be found in mixed pine/hardwood forest with intermittent streams. Northern long-eared bats roost alone or in small colonies underneath bark or in cavities or crevices of both live trees and snags (dead trees). During the winter, northern long-eared bats can be found hibernating in caves and abandoned mines, although none have been documented using caves in Louisiana. Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges to feed on moths, flies, leafhoppers, caddis flies and beetles, which they catch using echolocation. This bat can also feed by gleaning motionless insects from vegetation and water surfaces.

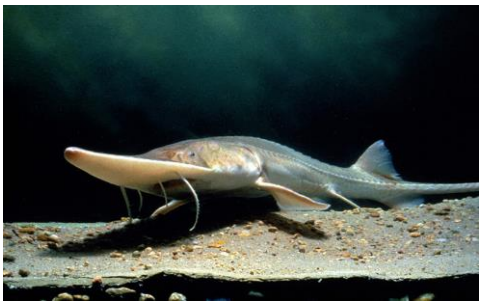
The most prominent threat to this species is white-nose syndrome, a disease known to cause high mortality in bats that hibernate in caves. Other sources of mortality for northern long-eared bats are wind energy development, habitat destruction or disturbance, and contaminants.

If implementation of a proposed action has the potential to directly or indirectly affect the northern long-eared bat, consultation with the Service is recommended.

Note: A final 4(d) rule for the NLEB was published in the Federal Register on January 14, 2016. This rule tailors protections to areas affected by white-nose syndrome during the bat's most sensitive life stages. The rule is designed to protect the bat while minimizing regulatory requirements for landowners, land managers, agencies and others within the species' range. More information can be found at https://www.fws.gov/Midwest/endangered/mammals/nleb/index.html.

C. Fish

Pallid Sturgeon



The pallid sturgeon (*Scaphirhynchus albus*) is an endangered, bottom-oriented, fish that inhabits large river systems from Montana to Louisiana. In Louisiana, pallid sturgeons are adapted to large, free-flowing, turbid rivers with a diverse assemblage of physical characteristics that are in a constant state of change, such as the Atchafalaya and Mississippi Rivers, and below Lock and Dam Number 3 on the Red River (with known concentrations in the vicinity of the Old River Control Structure Complex).

The life history details and subsequent habitat requirements of this fish are not known. However, the pallid sturgeon is believed to utilize Louisiana riverine habitat during reproductive stages of its life cycle. Habitat loss through river channelization and dams has adversely affected this species throughout its range.

Consultation with the Service will be necessary if a proposed action may directly or indirectly affect the pallid sturgeon. Should a proposed action lead to the consultation phase, the Service recommends implementing the guidance below into project plans.

1. Utilize the directional drilling method to the furthest extent in order to position drilling wells away from Atchafalaya and Mississippi Rivers Basins, and below Lock and Dam Number 3 on the Red River (including the vicinity of the Old River Control Structure Complex).

2. Utilize the closed loop drilling system to minimize/avoid habitat destruction via water withdrawals and spills.

3. Intake velocities at the screen should not exceed ½ ft/sec (U.S. Fish and Wildlife Service 1993).

4. Utilize mesh size at intake screens with a maximum mesh opening of ¼ inch to reduce the size of aquatic organisms that can be entrained (Environmental Protection Agency 1976, US Fish and Wildlife Service 1993).

5. Utilize a Johnson (or Johnson-type) screen/intake, with ⅛-inch mesh or less, if feasible.

6. Based upon previously conducted flow studies, an appropriate monthly minimum instantaneous flow rate for the survival of aquatic species is 40 percent of the annual average flow for October through March and 60 percent of the annual average flow for April through September (Stalnaker 1976).

7. Intake flow must be no more than either the lower 5 percent of the source water body mean annual flow or 25 percent of the source water 7Q10. Existing monthly 7Q10 should be maintained.

If those recommendations would be incorporated into a proposed action, impacts to pallid sturgeon in Louisiana may be minimized or avoided.

Atlantic Sturgeon

The Atlantic sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine and marine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Atlantic sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain Basin, the Pearl River System, and adjacent estuarine and marine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Atlantic sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures and navigation projects that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the Service and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Atlantic sturgeon in Louisiana, Mississippi, Alabama, and Florida. In Louisiana, the designation includes portions of the Pearl and Bogue Chitto Rivers which are within the Tuscaloosa Marine Shale area in St. Tammany and Washington Parishes. That critical habitat area also includes Lake Pontchartrain east of the Lake Pontchartrain Causeway, as well as Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne in their entirety. The primary constituent elements essential for the conservation of Atlantic sturgeon, which should be considered when determining potential project impacts, are those habitat components that support feeding, resting, sheltering, reproduction, migration, and physical features necessary for maintaining the natural processes that support those habitat components. The primary constituent elements for Atlantic sturgeon critical habitat include:

1. abundant prey items within riverine habitats for larval and juvenile life stages, and within estuarine and marine habitats for juvenile, sub-adult, and adult life stages;

2. riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone, or hard clay;

3. riverine aggregation areas, also referred to as resting, holding and staging areas, used by adult, sub-adult, and/or juveniles, generally, but not always, located in holes below normal riverbed depths, believed necessary for minimizing energy expenditures during freshwater residency and possibly for osmoregulatory functions;

4. a flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of freshwater discharge over time) necessary for normal behavior, growth, and survival of all life stages in the riverine environment, including migration, breeding site selection, courtship, egg fertilization, resting, and staging; and necessary for maintaining spawning sites in suitable condition for egg attachment, egg sheltering, resting, and larvae staging;

5. water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;

6. sediment quality, including texture and chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and,

7. safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by a permanent structure, or a dammed river that still allows for passage).

Consultation with the Service is recommended if a proposed action may directly or indirectly affect the Atlantic sturgeon. In addition, should the proposed action involve federal implementation, funding, or a federal permit and directly or indirectly affects designated critical habitat, consultation with the Service is necessary. The Service recommends implementing the guidance below into project plans when drilling wells within the Pearl and Bogue Chitto River Basins.

1. Utilize the closed loop drilling system (refer to section V. Best Management Practices) to minimize/avoid habitat destruction via water withdrawals and spills.

2. Utilize the directional drilling method (refer to section V. Best Management Practices) to the furthest extent in order to position drilling wells away from Pearl and Bogue Chitto River Basins.

If those recommendations would be incorporated into a proposed action, impacts to Atlantic sturgeon in Louisiana may be avoided.

D. REPTILES

Gopher Tortoise

The federally threatened gopher tortoise (*Gopherus polyphemus*) occurs within the Tuscaloosa Marine Shale area in Washington, Tangipahoa, and St Tammany Parishes. The gopher tortoise is the only native tortoise found in the southeastern United States. This species is associated with areas that have well-drained, sandy soils appropriate for burrow establishment, ample sunlight for nesting, and understory vegetation suitable for foraging (i.e., grasses and forbs). The burrow opening is semicircular or "half-moon" in shape and a low mound of bare soil, called the "apron", will be immediately in front of the mouth of an active burrow. Suitable soil types for gopher tortoises include Latonia and Bassfield (highly suitable), Cahaba, Ruston, and Smithdale (less suitable), and Abita, Malbis, Angie, and Prentiss (marginal).

Gopher tortoises prefer "open" longleaf pine-scrub oak communities that are thinned and burned every few years to maintain an open canopy and midstory. Habitat degradation (lack of thinning or burning on pine plantations), predation, and conversion to agriculture or urbanization have contributed to the decline of this species. That habitat decline has concentrated many remaining gopher tortoise populations along pipeline and power line rights-of-way (ROW) within their range. Tortoise burrows also can be found along road ROW's, and other marginal habitats; including fence rows, orchard edges, golf course roughs and edges, old fields, and pasturelands. Tortoises are often pushed into these areas due to adjacent habitat becoming unsuitable.

If suitable gopher tortoise habitat does exist within a proposed action area, those areas should be surveyed by a qualified biologist for the presence of gopher tortoises and/or their burrows. Survey areas should be divided into consecutive "sight-distance" strip transects, each of which should be traversed by walking. Transect widths may range from 10 to 50 feet, and will be determined by ground visibility within the site. We recommend that the project sponsor provide this office with a copy of the survey report, as described in Appendix A. Should the proposed action directly or indirectly affect the gopher tortoise, consultation with the Service is recommended.

Ringed Map Turtle

The federally threatened ringed map (=sawback) turtle (*Graptemys oculifera*) is endemic to the Pearl River system and inhabits the Tuscaloosa Marine Shale area in St. Tammany and Washington Parishes. In Louisiana, it occurs in the Bogue Chitto River and in the Pearl River north of Louisiana Highway 190. This turtle prefers riverine habitats with moderate currents, channels wide enough to permit sunlight penetration for several hours

each day, numerous logs for basking, and large, sandy banks that are used for nesting.

The ringed map turtle is a small turtle (4 to 7 inches in plastron length) with a yellow to orange ring bordered inside and outside with dark olive-brown on each shield of the carapace and a yellow plastron. The head has a large yellow spot behind the eye, two yellow stripes from the orbit backwards, and a characteristic yellow stripe covering the whole lower jaw.

The decline of the ringed map turtle has been attributed to habitat modification (i.e., loss of exposed sandbars, basking areas) and water quality deterioration, reservoir construction, channelization, desnagging for navigation, siltation, and the subsequent loss of invertebrate food sources. Should the proposed action directly or indirectly affect the ringed map turtle or its habitat, consultation with the Service is recommended.

E. MOLLUSKS

Fat Pocketbook Pearly Mussel

Federally listed as an endangered species, the fat pocketbook pearly mussel (*Potamilus capax*) inhabits the Tuscaloosa Marine Shale area within the Mississippi River in Concordia Parish and the Brown Dense area in East Carroll Parish, Louisiana. The fat pocketbook pearly mussel has a smooth, rayless, shiny yellow to brown shell measuring up to 5 inches long. Although little is known about the ecology of this species, the fat pocketbook is a large river species and suitable habitat is most likely a mixture of stable sand, silt, and clay substrates with flowing water (e.g., old dike fields, secondary channels). The life history of this species is believed to be similar to that of other members of the Unionidae family, and the host fish is likely to be one or more species of large river fish. The greatest threats to this species include habitat alteration caused by activities related to navigation (e.g., channel maintenance dredging) and flood control, and reduction in water quality due to siltation.

Should a proposed project directly or indirectly affect the fat pocketbook pearly mussel or its habitat, consultation with the Service is recommended.

Alabama Heelsplitter

Federally listed as a threatened species, the Alabama heelsplitter mussel (*Potamilus inflatus*) was historically found in Louisiana in the Amite, Tangipahoa, and Pearl Rivers. Many life history aspects of the species are poorly understood but are likely similar to that of other members of the Unionidae family. Although the primary host fish for the species is not certain, investigation by Roe *et al*. (1997) indicates that the freshwater drum (*Aplodinotus*

grunniens) is a suitable glochidial host for the species.

Based on the most recent survey data, the currently known range for the Alabama heelsplitter occurs within the Tuscaloosa Marine Shale area in the lower third of the Amite River along the East Baton Rouge/Livingston Parish line from Spiller's Creek, which is in the vicinity of Denham Springs downstream to the vicinity of Port Vincent. In addition, the species may be found in the Pearl River, as evidenced by two dead specimens reported from the West Pearl River drainage in 1996.

Because it has not been used widely for past or present gravel mining operations, the lower third of the Amite River (between Louisiana Highway 37 and Louisiana Highway 42) is more typical of a coastal plain river; being characterized by a silt substratum, less channelization, and slower water flow, all of which are characteristic of heelsplitter habitat. This freshwater mussel is typically found in soft, stable substrates such as sand, mud, silt, and sandy gravel, in slow to moderate currents. Alabama heelsplitter mussels are usually found in depositional pools below sand point bars and in shallow pools between sandbars and river banks.

Major threats to this species in Louisiana are the loss of habitat resulting from sand and gravel dredging and channel modifications for flood control, as shown by the apparent local extirpation of the species in the extensively modified upper portions of the Amite River.

If a proposed action would directly or indirectly affect Alabama heelsplitter individuals or their habitat, consultation with the Service is recommended.

Louisiana Pearlshell Mussel

The threatened Louisiana pearlshell mussel (LPM; *Margaritifera hembeli*), is a freshwater species found only in Louisiana, within the Tuscaloosa Marine Shale area in Rapides and Grant Parishes. The shell of the LPM is oblong with moderately full beaks, no obvious sculpture, and its surface has uneven growth lines. The epidermis is brown to blackish and the nacre is white to purple with numerous pits. Adults are about 3.9 inches long, 2.0 inches high, and 1.2 inches wide. The LPM requires clear, moderately swift-flowing, perennial streams having stable mineral substrate (such as gravel bottom or sandy bottom with rocky outcroppings). This mussel is known to occur in the tributaries of Bayou Boeuf and Bayou Rapides in Rapides Parish, specifically Bayou Clear, Brown Creek, Burney Branch, Castor Creek, Clear Creek, Haikey's Creek, Little Bayou Clear, Little Brushy Creek, Little Loving Creek, Long Branch, Loving Creek, Mack Branch, Patterson Branch, Valentine Creek, and Williamson Branch. The species is known to occur in the tributaries of Bayou Rigolette in Grant Parish, specifically Beaver Creek, Black Creek, Chandler Creek, Clear Branch, Coleman Branch, Cress Creek, Cypress Creek, Glady Hollow, Gray Creek, Hudson Creek, James Branch, Jordan Creek, Moccasin Branch, and Swafford Creek.

At present, the life history of this mussel is poorly understood. Research conducted by the Service's Natchitoches National Fish Hatchery is ongoing. Reproductive timing (i.e., spawning and glochidial release) likely occurs once annually in the February through April timeframe, and the primary host fish is pickerel.

Major threats to the LPM include loss of habitat, degradation of water quality, and impacts to stream morphology as a result of impoundments (both man-made and beaver dams), non-implementation of streamside best management practices during timber harvest operations, and lack of sufficient erosion control measures and maintenance during construction activities (e.g., drilling well pad construction, road construction, road improvement or widening, bridge replacement or installation, culvert replacement or installation, gravel mining, etc.). In addition, in-stream water withdrawal and equipment use could result in direct impacts to LPM individuals from stranding, trampling, or crushing. Additional information on threats and current status of this species can be found online at: http://www.fws.gov/southeast/5yearReviews/5yearreviews/louisianapearlshellmussel.pdf.

If a proposed project has the potential to directly or indirectly affect LPM individuals or their habitat, consultation with the Service is recommended.

Pink Mucket Pearly Mussel

Federally listed as an endangered species, the pink mucket pearly mussel (*Lampsilis abrupta*) occurs within the Brown Dense Shale area in Bayou Bartholomew in Morehouse Parish, Louisiana. The pink mucket pearly mussel is characterized by an elliptical shell approximately 4 inches long, 3 inches high, and 2 inches wide. The surface of the shell is smooth, except for wide, relatively dark, concentric growth rests, and shell color is yellow to yellowish or greenish brown, with wide, greenish rays present in younger individuals. The pink mucket pearly mussel is found in a variety of habitats ranging from silt to boulders, rubble, gravel, and sand substrates, and standing to fast-flowing water at depths ranging from 1.5 to 26 feet. The host fish essential to development of the glochidia of this species is believed to be a species of bass in the genus *Micropterus*. Major threats to the pink mucket pearly mussel are habitat loss and/or alteration due to impoundments and excessive siltation resulting in reduced water quality.

If a proposed project has the potential to directly or indirectly affect the pink mucket pearly mussel or its habitat, consultation with the Service is recommended.

Rabbitsfoot Mussel

The threatened rabbitsfoot mussel (*Quadrula cylindrical cylindrica*) occurs within the Brown Dense Shale area in Bayou Bartholomew in Morehouse Parish, Louisiana. The rabbitsfoot mussel is characterized by an elongate, rectangular, and moderately inflated shell that reaches approximately 6 inches in

length. The surface of its shell is generally smooth and yellowish, greenish, or olive in color becoming darker and yellowish-brown with age. The rabbitsfoot mussel is primarily an inhabitant of small to medium-sized streams and some large rivers, occurring in shallow areas along the bank and adjacent runs and shoals where the water velocity is reduced. This mussel may also occupy deep water runs up to 12 feet in depth; its preferred substrate is sand or gravel, and it seldom burrows but lies on its side. The host fish species essential to development of the glochidia of the mussel is believed to be several species of shiners (genus *Cyprinella, Luxilus,* and *Notropis*) for populations west of the Mississippi River. Major threats to the rabbitsfoot mussel are habitat loss and/or alteration due to impoundments, sedimentation (e.g., resulting from poor timber harvest best management practices, construction activities, cattle grazing, etc.), agricultural pollutants, and lead and zinc mining.

If a proposed project has the potential to directly or indirectly affect the rabbitsfoot mussel or its habitat, consultation with the Service is recommended.

F. Amphibians

Dusky Gopher Frog

Historically, the dusky gopher frog (=Mississippi gopher frog) (*Rana sevosa*) was found in Louisiana, Mississippi, and Alabama, west of the Mobile River drainage. It has not been seen in Louisiana since 1965 and is presently known to survive at only one site in Mississippi. The dusky gopher frog is a darkly-colored, moderately-sized frog with warts covering its back and dusky spots on its belly. The Dusky (Mississippi) gopher frog was listed as endangered under the Endangered Species Act on December 4, 2001, as a distinct population segment (DPS) of the gopher frog.

The Dusky gopher frog's habitat includes both upland, sandy areas with varying pine coverage; and isolated, temporary, wetland breeding sites within the forested landscape. Adult frogs spend most of their lives underground in forests with an open canopy and abundant ground cover. They use active and abandoned gopher tortoise burrows, abandoned mammal burrows and holes in and under stumps as their underground retreats. Breeding sites are isolated ponds that dry out completely at certain times of the year. Substantial winter rains are needed to ensure that ponds are filled sufficiently to allow development of juvenile frogs.

On June 12, 2012, the Service announced the final rule in the Federal Register (Volume 77, No. 113) designating dusky gopher frog critical habitat on 1,544 acres in St. Tammany Parish, Louisiana (Unit 1) and 1,996 acres in four Mississippi counties (Units 2-12). The primary constituent elements (PCE) essential for the conservation of the Dusky gopher frog are:

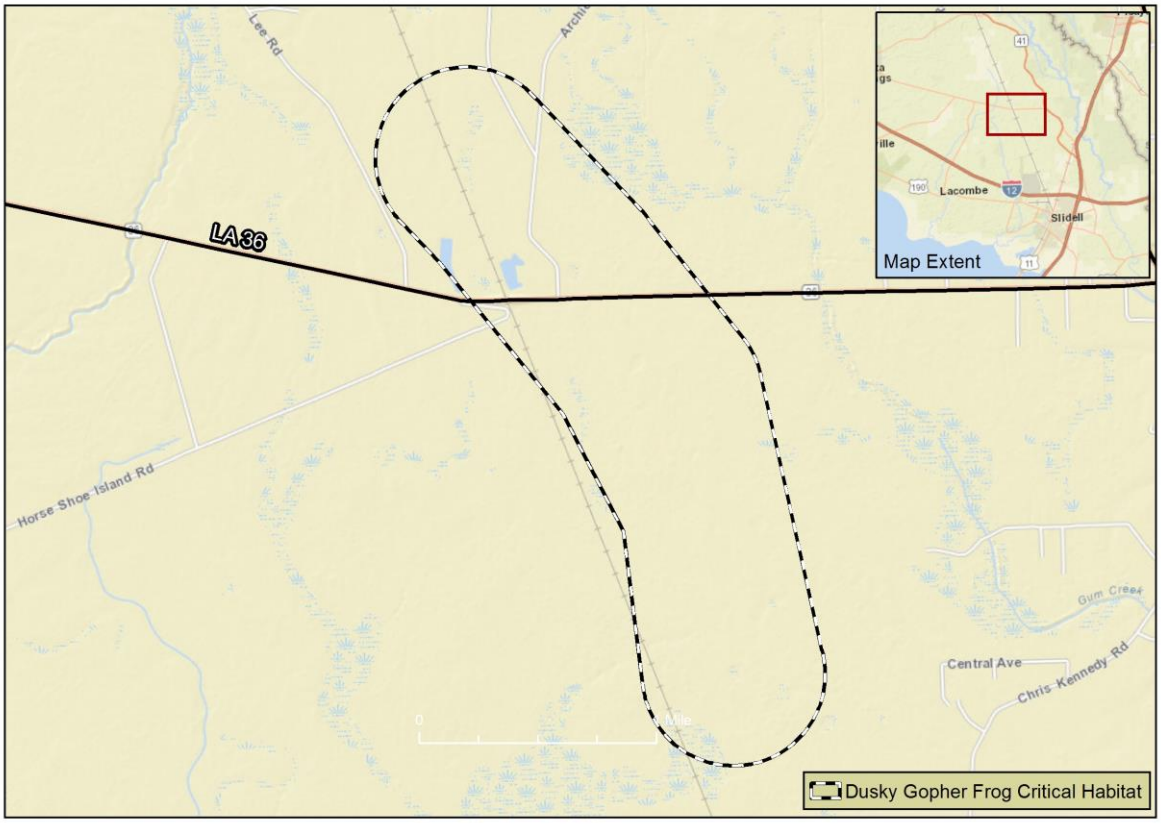
PCE 1 – Ephemeral wetland habitat. Breeding ponds, geographically isolated from other waterbodies and embedded in forests historically dominated by longleaf pine communities, that are small (generally <0.4 to 4.0 ha (<1 to 10 ac)), ephemeral, and

acidic. Specific conditions necessary in breeding ponds to allow for successful reproduction of dusky gopher frogs are:

(a) An open canopy with emergent herbaceous vegetation for egg attachment;
(b) An absence of large, predatory fish that prey on frog larvae;
(c) Water quality such that frogs, their eggs, or larvae are not exposed to pesticides or chemicals and sediment associated with road runoff; and
(d) Surface water that lasts for a minimum of 195 days during the breeding season to allow a sufficient period for larvae to hatch, mature, and metamorphose.

PCE 2 – Upland forested nonbreeding habitat. Forests historically dominated by longleaf pine, adjacent to and accessible to and from breeding ponds, that are maintained by fires frequent enough to support an open canopy and abundant herbaceous ground cover and gopher tortoise burrows, small mammal burrows, stump holes, or other underground habitat that the dusky gopher frog depends upon for food, shelter, and protection from the elements and predation.

PCE 3 – Upland connectivity habitat. Accessible upland habitat between breeding and nonbreeding habitats to allow for dusky gopher frog movements between and among such sites. This habitat is characterized by an open canopy, abundant native herbaceous species, and a subsurface structure that provides shelter for dusky gopher frogs during seasonal movements, such as that created by deep litter cover, clumps of grass, or burrows.



Although the Louisiana Unit (Unit 1) is currently unoccupied, the last observation of this frog occurred in 1965 in one of the ponds within this unit. The uplands associated with this unit currently do not contain the essential physical or biological features of critical habitat (PCE 2 and PCE 3), however, the Service believes them to be restorable with reasonable effort. Thus, the Service determined Unit 1 to be essential for the conservation and recovery of the Dusky gopher frog because it provides important breeding sites for recovery. The Unit 1 acreage in Louisiana is within the Tuscaloosa Marine Shale area. Therefore, should a proposed action involve Federal implementation, funding, or a Federal permit and directly or indirectly affect designated critical habitat, consultation with the Service is recommended.

G. Plants

American Chaffseed

Federally listed as an endangered plant species, the American chaffseed (*Schwalbea americana*) grows on "pimple mounds" in longleaf pine flatwoods. Those pine flatwoods occur within the Tuscaloosa Marine Shale area in Allen and Beauregard Parishes. The American chaffseed is a tall perennial herb in the snapdragon family, and can be identified by its two-inch-long, purplish-yellow, tubular flowers. The plant, a partial parasite on the roots of other plants, grows to a height of 12 to 24 inches at the time of flowering in the spring. Its leaves are alternate, lance-shaped to elliptic, and its flowers are borne singularly on short stalks. The fruit is a long, narrow capsule enclosed in a sac-like structure. Flowering occurs from April to June in the south and from June to mid-July in the north. Fruits mature from early summer in the south to October in the north.

A major threat to this species is the decline in prescribed burning throughout the Atlantic and Gulf coasts. Should a proposed project directly or indirectly affect the American chaffseed, consultation with the Service is recommended.

Louisiana Quillwort

Federally listed as an endangered plant species, the Louisiana quillwort (*Isoetes louisianensis*) is a small, semi-aquatic, facultative evergreen plant with spirally arranged leaves (sporophylls) arising from a globose, two-lobed corm. The hollow leaves are transversely septate, and measure approximately 0.12 inches wide and up to 16 inches long.

This species can be found within the Tuscaloosa Marine Shale area, growing on sand and gravel bars on the accreting sides of streams and moist overflow channels within riparian forest and bay head swamp communities in Washington and St. Tammany Parishes, Louisiana.

The Louisiana quillwort is believed to be dependent on a special hydrologic regime resulting from the presence of small springs scattered at the base of banks or bluffs. Major threats to this species are habitat loss through hydrologic modifications of stream habitat, and land use practices that significantly alter stream water quality and hydrology. Should a proposed action directly or indirectly affect the Louisiana quillwort or its stream habitat, consultation with the Service is recommended.

Earth Fruit

The proposed project area would be located within a parish known to support populations of the federally threatened earth fruit (*Geocarpon minimum*). The earth fruit is a tiny annual plant that completes its life cycle within 4 to 6 weeks and is rarely visible except during the flowering stage in March and April. The flowers, which are inconspicuous in the leaf axils, have a greenish-red calyx and no petals. The fruit (a capsule) splits open into three parts at maturity, releasing numerous 0.02-inch-long seeds. Young plants are dull gray, turn reddish-purple at maturity, and then diminish at the end of the life cycle. Under optimal conditions, the seeds remain in the nearby earth until the following spring when they complete another life cycle.

The current known distribution of earth fruit is limited to the sandstone glades of Missouri and the saline prairies of Arkansas and Louisiana. In Louisiana, saline prairies are generally located as openings within or adjacent to forested habitat. These prairies are commonly characterized by a low, extensive coverage of sedges, grasses, and forbs, with few to no trees or shrubs.

This topographic characteristic is a function of the soil chemistry, which precludes trees from growing in the area and allows for specialized vegetation to establish. Because the earth fruit is not tolerant of competition from other herbaceous species, the plant often occurs on "slick spots," which are small areas within a saline prairie that are either bare or have noticeably less vegetation than the surrounding area. In Louisiana, earth fruit is currently known to occur throughout the Haynesville Shale area in saline prairies of Caddo, DeSoto, and Winn Parishes.

The earth fruit is associated with the Bonn soil series in DeSoto and Caddo Parishes and with the Brimstone soil series in Winn Parish. However, in certain landscape positions, the soil survey may have mapped these soils under the Guyton soil series. More information about the earth fruit can be found in the recovery plan at http://ecos.fws.gov/docs/recovery_plan/930726.pdf or in the species' 5-year review at http://ecos.fws.gov/docs/five_year_review/doc2487.pdf.

Major threats to this species include conversion of saline prairies to pastureland or other land uses, cattle grazing, habitat destruction through construction activities, and rutting via the use of heavy equipment and off-road vehicles.

If a proposed project area would include saline prairie habitat, the Service recommends one of the following to minimize project related impacts to earth fruit:

1. Earth fruit surveys should be conducted by qualified personnel during the flowering season (March and April). Even at the flowering stage, this species can be difficult to detect in the field; thus, thorough survey efforts are needed within appropriate habitat to determine species presence/absence. If found, earth fruit locations should be marked or flagged and avoided during construction.

2. In lieu of conducting surveys, we recommend avoiding project-related impacts to saline prairies. This is our preference due to the rarity of this habitat.

If saline prairie habitat and suitable soils are found within the proposed project area or the earth fruit plant could be impacted by the proposed action, consultation with the Service is recommended.

II. Species Proposed for Listing

Proposed species are those for which the Service has proposed to list as either threatened or endangered because of the species' status and the threats to its continued existence.

Louisiana Pinesnake

The Louisiana pinesnake (*Pituophis ruthveni*) has been proposed to be federally listed as a threatened species. Historically, the Louisiana pinesnake occurred in portions of west-central Louisiana and east-central Texas.

According to our records, the Louisiana pinesnake is currently known to occur in portions of Sabine, Natchitoches, and Vernon Parishes of the Tuscaloosa Marine Shale area and in Bienville Parish in the Haynesville Shale area.

Louisiana pinesnakes prefer pine forests with sandy, well-drained soils, substantial herbaceous ground cover, and little midstory (e.g., longleaf pine savannah). The Louisiana pinesnake is highly associated with Baird's pocket gopher (*Geomys breviceps*), a major food source, which is dependent on the same habitat type.

Louisiana pinesnakes are most frequently found near or within pocket gopher burrow systems and move from one burrow system to another. Threats to this species include the sharp decline in quality and quantity of open pine forest habitat due to logging, suppression of fire and short-rotation silviculture, as well as vehicle-related mortality on roads and off-road trails. A more recently identified threat for many snake species is entanglement in filamentous mesh (particularly synthetic, non-biodegradable types) used in erosion control blankets installed on pipeline and road construction rights-of-ways has been documented (Kapfer and Paloski 2011). The potential impact from those erosion control blankets to the Louisiana pine snake population is unknown.

In the interest of conservation, we encourage you to avoid project activities that would have an adverse effect on this species or its habitat. Should it be federally listed as threatened or endangered, and project impacts could be expected to this species, consultation with the Service is recommended.

III. Migratory Birds and Pollinators

Potential migratory bird issues within these shale plays include nesting bald eagles and colonial nesting wading/water 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 U.S. Department of the Interior. While the Act has no provision for allowing unauthorized take, the Service realizes that some birds may be harmed or killed as a result of exploration and production activities even when reasonable measures to protect birds are implemented.

The Service's Office of Law Enforcement (LE) carries out its mission to protect migratory birds through investigations and fostering relationships with individuals, companies, and entities that have taken effective steps to minimize their impacts on migratory birds, and by encouraging others to enact such programs. As such, LE focuses its resources on investigating individuals and entities that take migratory birds without regard for their actions or without effort to implement Service recommendations/conservation measures.

Bald Eagle

All Louisiana shale plays contain nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species as of August 8, 2007. However, the bald eagle remains protected under the Bald and Golden Eagle Protection Act (BGEPA) and the MBTA. Comprehensive bald eagle survey data have not been collected by the LDWF since 2008, and new active, inactive, or alternate nests may have been constructed within the proposed project area since that time.

Bald eagles typically nest in large trees located near coastlines, rivers, or lakes that support adequate foraging from October through mid-May. In southeastern Louisiana parishes, eagles typically nest in mature trees (e.g., baldcypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water. Bald eagles may also nest in mature pine trees near large lakes in central and northern Louisiana. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead). Furthermore, bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during these periods may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival. To avoid those threats to bald eagles, a survey

should be conducted to determine if an eagle nest is located within 200 meters (660 feet) of a project site proposed to be situated in habitats described above. If an eagle nest is not found within that distance, no further evaluation for impacts to bald eagles is necessary. If an eagle nest is found within that distance, please refer to the guidance below.

The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at: https://catalog.data.gov/dataset/national-bald-eagle-management-guidelines Those Guidelines recommend:

1. Maintaining a specified distance between the activity and the nest (buffer area).

2. Maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers).

3. Avoiding certain activities during the breeding season. During any project construction, on-site personnel should be informed of the possible presence of nesting bald eagles in the vicinity of the project boundary, and should identify, avoid, and immediately report any such nests to this office.

If a bald eagle nest occurs or is discovered within 660 feet of a proposed project area, an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary.

On September 11, 2009, the Service published two federal regulations establishing the authority to issue permits for non-purposeful bald eagle take (typically disturbance) and eagle nest take when recommendations of the NBEM Guidelines cannot be achieved. Permits may be issued for nest take only under the following circumstances where: (1) necessary to alleviate a safety emergency to people or eagles, (2) necessary to ensure public health and safety, (3) the nest prevents the use of a human-engineered structure, or (4) the activity or mitigation for the activity will provide a net benefit to eagles. Except in emergencies, only inactive nests may be permitted to be taken. The Division of Migratory Birds for the Southeast Region of the Service (phone: 404-679-7051, e-mail: SEmigratorybirds@fws.gov) has the lead role in conducting consultations and issuance of permits. For further assistance interpreting the guidelines, avoidance measures, or performing an on-line project evaluation, please contact that Division.

Colonial Wading/Water Birds and Bird Species of Conservation Concern

Louisiana shale areas contain habitats which are commonly inhabited by these birds. Colonies may be present that are not currently listed in the database maintained by the LDWF. That database is updated primarily by (1) monitoring previously known colony sites and (2) augmenting point-to-point surveys with flyovers of adjacent suitable habitat. Although several

comprehensive surveys have been recently conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season because some water bird colonies may change locations year-to-year.

For colonies containing nesting wading birds, restricting activity occurring within 1,000 feet of a rookery is preferred if work cannot be undertaken during the non-nesting period of species present.

Species	Non-nesting Period
Anhinga	July 1 to March 1
Cormorant	July 1 to March 1
Great Blue Heron	August 1 to February 15
Great Egret	August 1 to February 15
Snowy Egret	August 1 to March 1

Non-Colonial Birds	Non-nesting Period
Little Blue Heron	August 1 to March 1
Tricolored Heron	August 1 to March 1
Reddish Egret	August 1 to March 1
Cattle Egret	September 1 to April 1
Green-backed Heron	September 1 to March 15
Black-crowned Night-Heron	September 1 to March 1
Yellow-crowned Night-Heron	September 1 to March 15
Ibis	September 1 to April 1
Roseate Spoonbill	August 1 to April 1

A project area could be nesting habitat for other bird species (Species of Conservation Concern), and the Service recommends that if necessary and feasible, land clearing be done sometime from August 1 to March 1 (outside of the general nesting period). A map and list of birds for areas of consideration in Louisiana can be found at www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf (Table 23 - BCR 25 and Table 24 – BCR 26). Additional guidelines for minimizing bird impacts can be found at www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/oil-and-gas.php .

Pollinators

On June 20, 2014, President Obama signed a Presidential Memorandum, "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators," outlining an expedited agenda to address the declines in honey bees and native pollinators, including the monarch butterfly. Recent research has shown dramatic declines in monarchs and their habitats leading conservation groups to petition the Service to list the species under the Endangered Species Act. Ensuring adequate and sustainable habitats, meeting all the life history needs of these species is of paramount importance. The Service and its partners are taking immediate actions to replace

and restore monarch and pollinator habitat on both public and private lands across the U.S. landscape. Therefore we recommend revegetation of disturbed areas with native plant species, including species of nectar-producing plants and milkweed endemic to the area. Please consult with the LDWF, Louisiana Natural Heritage Program (225) 765-2821, for further guidance regarding re-vegetation of disturbed areas with native plants.

IV. Wetlands

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil condition. Wetlands include swamps, marshes, bottomland hardwoods, some flatwoods, bogs and similar areas. Jurisdictional wetlands and waters of the U.S. are regulated under Section 404 of the Clean Water Act by the U.S. Army Corps of Engineers.

A Section 404 permit issued by the Corps may be required for activities involving deposition of dredge or fill material in a jurisdictional wetland. There are four Corps Districts in Louisiana: New Orleans (504-862-2255), Vicksburg (601-631-7071), Galveston (409-766-3869), and Fort Worth (817-886-1731). Note that many wetlands are seasonally wet, which means that they may be seasonally dry. The Corps should be contacted if there is any question of whether a proposed project site could be in a jurisdictional wetland.

Compensatory mitigation may be required by the Corps for impacts to jurisdictional wetlands including perennial, intermittent, and ephemeral streams that are adversely impacted by authorized activities. Compensatory mitigation is required for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization have been achieved. The decision to use compensatory mitigation for Section 404 permits, or Section 10 permits, will be assessed on a case by case basis by the appropriate Corps district.

V. Best Management Practices

The Department of Interior - Bureau of Land Management's *Gold Book - Fourth Edition* (*Revised*-2007) and U.S. Fish and Wildlife Service's *Management of Oil and Gas Activities on National Wildlife Refuge System Lands* (2012) provide guidance for the operator about basic requirements for safe and environmentally sound construction and maintenance of oil and gas infrastructure. At a minimum, this guidance is recommended for publicly-owned lands and is recommended by this office in or near any sensitive habitats that harbor species of state or federal concern. These may include water management areas, scenic streams, wetlands/streams, and contiguous forested areas. Agency-specific standards (i.e., *U.S. Forest Service Revised Land and Resource Management Plan* [1999]) also may apply to certain publicly-owned properties. Species-specific BMPs and state or federal laws may apply. The following general guidelines are offered here, based on the aforementioned literature:

1. Interim and final reclamation plans for a drilling site should be considered in the initial site design plans. Interim reclamation can occur once the well is moved into the production phase. This may include reshaping and re-vegetating portions of the drilling pad site and access roads to restore the area to prior habitat conditions.

2. All surface soil materials (topsoil) should be removed from the entire cut and fill area and temporarily stockpiled for reuse during interim and final reclamation.

3. Topsoil should be segregated and stored separately from subsurface materials to avoid mixing during construction, storage, and interim reclamation.

4. Stockpiles should be located and protected to minimize erosion and maximize reclamation potential.

5. Well pads should be capable of supporting the drill rig, tanks, heater-treater, and other production equipment. All equipment should be located on compacted fill material. Slope the well pad to the well cellar or other low point to collect spills and contaminated storm water that collects within the lined area.

6. Well pads should be located adjacent to existing roads, when feasible. Projects may be routed in existing road corridors, and cut and fill should be minimized.

7. Seal the cellar, mouse hole, and rat hole by grouting with cement or other methods to prevent seepage of contaminants.

8. Directional drilling and multiple wells from approved well pads should be utilized to reduce the need for additional roads and production infrastructure.

9. Exhaust vents should be screened to exclude wildlife from entry, roosting, and perching.

10. Use of noise reduction mufflers to comply with noise standards is recommended. Also, consider using earthen berms, walls, sheds, and/or distance to reduce sound levels in important habitat for wildlife.

11. All flowlines/pipelines from well sites should be placed within existing road rights-of-way where practical; otherwise, adverse impacts from construction/maintenance of flowlines/pipelines should be minimized to the maximum extent practical.

12. All publicly-owned land with oil and gas wells should have a Spill Prevention, Control, and Countermeasure Plan available for containment of any spillage within the boundaries of the publicly-owned land.

13. A berm and fence with locked gate should be constructed around storage tanks to contain spills and protect wildlife, visitors, and guard against vandalism. A sign with site name, operator name, and emergency contact information should be posted at the gate.

14. Berms should be designed and constructed with sufficient perimeter and height to hold 1.5 times the volume of the largest tank. Containment systems with corrugated galvanized steel are available as an alternative to earthen dikes. Another option is to

place a synthetic liner beneath the tanks, fold the liner into the berm, which then can be reinforced with a cement mixture.

15. Well sites should be located to avoid sensitive habitats (i.e., state-owned natural areas, wildlife management areas, national wildlife refuges, and high quality jurisdictional wetlands). If a well site is permitted within a sensitive area, reserve pits and other wastewater pits or ponds including those constructed to store hydraulic fracturing fluids should not be used in sensitive habitats. A closed loop mud system should be utilized to drill wells in those sensitive habitats. The closed loop system is the safest method for avoiding environmental contamination. In a closed loop system, mud circulates down the shaft, up the shaft with the bottom hole cuttings, through a filtration system to remove the cuttings, and then recirculates down the shaft. This prevents environmental contamination of the area by chemicals that are added to the drilling mud (i.e diesel, oils, detergents, or other chemicals added to the mud to increase performance). The drill cuttings that are removed are stored in storage tanks and then should be hauled offsite for proper disposal. This method allows for a much cleaner operation by providing containerized storage for drilling fluid and cuttings. It also allows for smaller pad size, thus affecting fewer sensitive habitats and/or less sensitive habitat acreage. Sometimes reserve pits, mud pits, or emergency pits for drilling operations are used in upland systems. Using these pits may be economically attractive to the oil or gas companies because less equipment is needed and disposal costs are lower. However, the environmental costs of these pits can be significant, as the pits generally damage more habitat and require more space than other disposal methods. An excess of drilling waste is created because this system is not as efficient as a closed loop system. Releases can occur because of poorly managed drilling fluid operations and can affect adjacent areas and waterways. Freshwater drilling may be virtually nontoxic, but additives such as diesel and other oil-based products are used to provide greater lubrication and well control. Another concern associated with pits is disposal of the muds after drilling is complete. In particular, reserve pits are a major hazard to wildlife and birds. Although economically cheaper, reserve pits may result in a "take" of migratory birds and, potentially, other protected species. This situation could lead to an enforcement action that may result in significant fines and penalties to the operator.

16. Remote monitoring (telemetry) of wells and related production equipment is recommended. Use of this technology can reduce the number of maintenance and inspection trips made during critical time periods for wildlife and result in less wildlife disturbance.

17. In summary, minimize the footprint of energy development to reduce wildlife habitat fragmentation, loss, and degradation. Consider using common corridors for roads, power, and piping/flowlines; smaller pads with multiple wells drilled from a single pad site utilizing the closed loop system; and interim reclamation of roads and well pads.

Roads and Access Ways

1. Use existing roads as much as practicable. Trails, primitive roads, or light duty roads often can be upgraded to handle the needs of a drilling access road.

2. Properly compact and crown road and place ditches along both sides to keep water off the road and reduce erosion and maintenance costs.

3. When designing and constructing new roads, consider soil and water conservation, severity and permanence of the road on the landscape, future access needs, and right-of-way needs. Locate all permanent roads to optimize resource accessibility and protection.

4. Avoid locating roads adjacent to water bodies unless alternative routes have been reviewed and rejected as more environmentally damaging and/or contrary to public interest.

5. Ensure good road drainage with a combination of properly constructed and well-spaced wing ditches, broad based dips, rolling dips, culverts, and/or bridges.

6. Culverts placed in perennial or intermittent streams should not block movement of aquatic organisms, and adverse impacts to stream bottom habitat of these type streams should be mitigated on site to the maximum extent practical. [NOTE: Bottomless culverts are recommended for crossings of perennial and intermittent streams. If standard, non-bottomless culverts are installed in streams, twenty percent (20%) of the culvert diameter (20 percent of the height of elliptical culverts) must be installed below the natural grade of the stream. Material excavated from the stream bottom or similar material should be placed inside the bottom of the installed culvert to reestablish affected stream bottom habitat].

7. One 24-inch culvert should be installed every 500 feet, at a minimum, when constructing access roads through wetlands to minimize disruption of normal hydrologic flow through the affected wetlands. Culverts should be maintained to be free of obstructions.

8. Road diversion ditches (lead-off ditches and wing ditches) and gradients should be designed to minimize off-site erosion and sedimentation from runoff.

9. Provide out-fall protection if cross drains, relief culverts, wing ditches, and lead-off ditches discharge onto erodible soils or over erodible fill slopes.

Vehicle Maintenance, Petroleum, and Chemicals

To prevent petroleum products from contaminating soils and water bodies, the following guidance should be implemented:

1. Construction equipment and vehicles should be properly maintained to prevent leaking of petroleum products.

2. Specific staging areas for equipment/vehicle maintenance and chemical storage should be established 250 feet or more away from wetlands and streams.

3. Drip pans and tarps or other containment systems should be used when changing oil and other vehicle and equipment fluids.

4. Any contaminated soils or materials should be disposed of off-site in proper receptacles or at an approved disposal facility.

5. Vehicle and equipment fueling should be attended at all times by site personnel. Spill cleanup materials should be stored on site and employees should be trained in spill control procedures.

6. Wash water (including mild detergents) from the body of vehicles should be allowed to infiltrate into a permeable area such as gravel, grass, or loose soil 250 feet or more from wetlands or streams. Vehicle engine or under-body and equipment wash water should be disposed of off-site at appropriate facilities depending on the contents of the waste water. Waste water should not be discharged directly into water bodies.

7. Petroleum products and other chemicals, including mud additives, should be properly stored in appropriately labeled containers in sheltered areas. Storage shelters should be designed with an impermeable floor.

8. Avoid mixing hazardous and non-hazardous waste. This includes keeping fuels in a separate secondary containment area from mud, rig wash, etc. Materials for containment and cleaning up spills should be kept on site. Spills should be cleaned up immediately in accordance with state and federal regulations.

Literature Cited

Bald Eagle Protection Act of 1940 (16 U.S.C. 668-668d, 54 Stat. 250) as amended -- Approved June 8, 1940, and amended by P.L 86-70 (73 Stat. 143) June 25, 1959; P.L. 87-884 (76 Stat. 1346) October 24, 1962; P.L. 92-535 (86 Stat. 1064) October 23, 1972; and P.L. 95-616 (92 Stat. 3114) November 8, 1978.

Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended -- Public Law 93-205, approved December 28, 1973, repealed the Endangered Species Conservation Act of December 5, 1969 (P.L. 91-135, 83 Stat. 275). The 1969 Act had amended the Endangered Species Preservation Act of October 15, 1966 (P.L. 89-669, 80 Stat. 926).

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APPENDIX A

GOPHER TORTOISE SURVEY GUIDELINES

The survey report should include:

1. Survey methods including dates, qualifications of survey personnel, size of survey area, and transect density;

2. general soil type, understory conditions, percent canopy cover, and species composition (several representative photographs should be included);

3. GPS coordinates and photographs of burrow(s) to clarify whether the hole is for tortoises or some other animal (i.e. fox, armadillo);

4. determination of burrow status as active, inactive, or old (see burrow descriptions below);

5. presence or absence of gopher tortoises outside or inside the burrow (only permitted individuals may videoscope burrows);

6. determination of whether the burrow is part of tortoise colony. (For each burrow found, a 600 foot radius around that burrow should be surveyed for additional burrows. This process should be continued for each new burrow until no new burrows are found, and will determine the extent of the colony); and,

7. topographic maps which illustrate areas of adequate gopher tortoise habitat, individual and/or colony locations, and burrow sites relative to proposed construction activities.

All persons surveying for gopher tortoise presence/absence should be familiar with the appearance of this species and its associated burrow. All tortoise burrows encountered should be categorized according to the following scheme:

1. Active – most likely occupied by a tortoise; as evidenced by presence of tortoise, freshly dug sand, tortoise tracks, or tortoise scat.

2. Inactive – most likely not currently occupied by a tortoise; as evidenced by absence of above signs, debris in burrow entrance. Future use of inactive burrows by tortoises occasionally occurs.

3. Abandoned (old) – most likely not occupied by a tortoise for many years; as evidenced by deteriorated nature of burrow entrance, (i.e. collapsed, growth of vegetation, sand washed in, etc.) Abandoned burrows are in such a condition that they are not considered to be good candidates for future use by tortoises.

If active burrows and/or gopher tortoises are found in the surveyed area, further consultation with the Service is recommended.

APPENDIX B

Executive Order 13186 – Responsibilities of Federal Agencies To Protect Migratory Birds
January 10, 2001

By the authority vested in me as President by the Constitution and the laws of the United States of America, and in furtherance of the purposes of the migratory bird conventions, the Migratory Bird Treaty Act (16 U.S.C. 703-711), the Bald and Golden Eagle Protection Acts (16 U.S.C. 668-668d), the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c), the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), the National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347), and other pertinent statutes, it is hereby ordered as follows:

Section 1. Policy. Migratory birds are of great ecological and economic value to this country and to other countries. They contribute to biological diversity and bring tremendous enjoyment to millions of Americans who study, watch, feed, or hunt these birds throughout the United States and other countries. The United States has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds. Such conventions include the Convention for the Protection of Migratory Birds with Great Britain on behalf of Canada 1916, the Convention for the Protection of Migratory Birds and Game Mammals-Mexico 1936, the Convention for the Protection of Birds and Their Environment-Japan 1972, and the Convention for the Conservation of Migratory Birds and Their Environment-Union of Soviet Socialist Republics 1978.

These migratory bird conventions impose substantive obligations on the United States for the conservation of migratory birds and their habitats, and through the Migratory Bird Treaty Act (Act), the United States has implemented these migratory bird conventions with respect to the United States. This Executive Order directs Executive departments and agencies to take certain actions to further implement the Act.

Section 2. Definitions. For purposes of this Order:

(a) "Take" means take as defined in 50 C.F.R. 10.12, and includes both "intentional" and "unintentional" take.
(b) "Intentional take" means take that is the purpose of the activity in question.
(c) "Unintentional take" means take that results from, but is not the purpose of, the activity in question.
(d) "Migratory bird" means any bird listed in 50 C.F.R. 10.13.
(e) "Migratory bird resources" means migratory birds and the habitats upon which they depend.
(f) "Migratory bird convention" means, collectively, the bilateral conventions (with Great Britain/Canada, Mexico, Japan, and Russia) for the conservation of migratory bird resources.
(g) "Federal agency" means an Executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.
(h) "Action" means a program, activity, project, official policy (such as a rule or regulation), or formal plan directly carried out by a Federal agency. Each Federal agency will further define what the term "action" means with respect to its own authorities and what programs should be included in the agency-specific Memoranda of Understanding required by this Order.

Actions delegated to or assumed by nonfederal entities, or carried out by nonfederal entities with Federal assistance, are not subject to this Order. Such actions, however, continue to be subject to the Migratory Bird Treaty Act.

(i) "Species of concern" refers to those species listed in the periodic report "Migratory Nongame Birds of Management Concern in the United States," priority migratory bird species as documented by established plans (such as Bird Conservation Regions in the North American Bird Conservation Initiative or Partners in Flight physiographic areas), and those species listed in 50 C.F.R. 17.11.

Section 3. Federal Agency Responsibilities:

(a) Each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations is directed to develop and implement, within 2 years, a Memorandum of Understanding (MOU) with the Fish and Wildlife Service (Service) that shall promote the conservation of migratory bird populations.

(b) In coordination with affected Federal agencies, the Service shall develop a schedule for completion of the MOUs within 180 days of the date of this Order. The schedule shall give priority to completing the MOUs with agencies having the most substantive impacts on migratory birds.

(c) Each MOU shall establish protocols for implementation of the MOU and for reporting accomplishments. These protocols may be incorporated into existing actions; however, the MOU shall recognize that the agency may not be able to implement some elements of the MOU until such time as the agency has successfully included them in each agency's formal planning processes (such as revision of agency land management plans, land use compatibility guidelines, integrated resource management plans, and fishery management plans), including public participation and NEPA analysis, as appropriate. This Order and the MOUs to be developed by the agencies are intended to be implemented when new actions or renewal of contracts, permits, delegations, or other third party agreements are initiated as well as during the initiation of new, or revisions to, land management plans.

(d) Each MOU shall include an elevation process to resolve any dispute between the signatory agencies regarding a particular practice or activity.

(e) Pursuant to its MOU, each agency shall, to the extent permitted by law and subject to the availability of appropriations and within Administration budgetary limits, and in harmony with agency missions:

(1) Support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions;

(2) Restore and enhance the habitat of migratory birds, as practicable;

(3) Prevent or abate the pollution or detrimental alteration of the Environment for the benefit of migratory birds, as practicable;

(4) Design migratory bird habitat and population conservation principles, measures, and practices, into agency plans and planning processes (natural resource, land management, and environmental quality planning, including, but not limited to, forest and rangeland planning, coastal management planning, watershed planning, etc.) as

practicable, and coordinate with other agencies and nonfederal partners in planning efforts;

(5) Within established authorities and in conjunction with the adoption, amendment, or revision of agency management plans and guidance, ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners-in-Flight, U.S. National Shorebird Plan, North American Waterfowl Management Plan, North American Colonial Waterbird Plan, and other planning efforts, as well as guidance from other sources, including the Food and Agricultural Organization's International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries;

(6) Ensure that environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern;

(7) Provide notice to the Service in advance of conducting an action that is intended to take migratory birds, or annually report to the Service on the number of individuals of each species of migratory birds intentionally taken during the conduct of any agency action, including but not limited to banding or marking, scientific collecting, taxidermy, and depredation control;

(8) Minimize the intentional take of species of concern by: (i) delineating standards and procedures for such take; and (ii) developing procedures for the review and evaluation of take actions. With respect to intentional take, the MOU shall be consistent with the appropriate sections of 50 C.F.R. parts 10, 21, and 22;

(9) Identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations, focusing first on species of concern, priority habitats, and key risk factors. With respect to those actions so identified, the agency shall develop and use principles, standards, and practices that will lessen the amount of unintentional take, developing any such conservation efforts in cooperation with the Service. These principles, standards, and practices shall be regularly evaluated and revised to ensure that they are effective in lessening the detrimental effect of agency actions on migratory bird populations. The agency also shall inventory and monitor bird habitat and populations within the agency's capabilities and authorities to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts;

(10) Within the scope of its statutorily-designated authorities, control the import, export, and establishment in the wild of live exotic animals and plants that may be harmful to migratory bird resources;

(11) Promote research and information exchange related to the conservation of migratory bird resources, including coordinated inventorying and monitoring and the collection and assessment of information on environmental contaminants and other physical or biological stressors having potential relevance to migratory bird conservation. Where such information is collected in the course of agency actions or supported through Federal financial assistance, reasonable efforts shall be made to share such information with the Service, the Biological Resources Division of the U.S. Geological Survey, and other appropriate repositories of such data (e.g, the Cornell Laboratory of Ornithology);

(12) Provide training and information to appropriate employees on methods and means of avoiding or minimizing the take of migratory birds and conserving and restoring migratory bird habitat;
(13) Promote migratory bird conservation in international activities and with other countries and international partners, in consultation with the Department of State, as appropriate or relevant to the agency's authorities;
(14) Recognize and promote economic and recreational values of birds, as appropriate; and
(15) Develop partnerships with non-Federal entities to further bird conservation.

(a) Notwithstanding the requirement to finalize an MOU within 2 years, each agency is encouraged to immediately begin implementing the conservation measures set forth above in subparagraphs (1) through (15) of this section, as appropriate and practicable.
(b) Each agency shall advise the public of the availability of its MOU through a notice published in the Federal Register.

Section 4. Council for the Conservation of Migratory Birds.

(a) The Secretary of Interior shall establish an interagency Council for the Conservation of Migratory Birds (Council) to oversee the implementation of this Order. The Council's duties shall include the following:

(1) Sharing the latest resource information to assist in the conservation and management of migratory birds;
(2) Developing an annual report of accomplishments and recommendations related to this Order;
(3) Fostering partnerships to further the goals of this Order; and
(4) Selecting an annual recipient of a Presidential Migratory Bird Federal Stewardship Award for contributions to the protection of migratory birds.

(b) The Council shall include representation, at the bureau director/administrator level, from the Departments of the Interior, State, Commerce, Agriculture, Transportation, Energy, Defense, and the Environmental Protection Agency and from such other agencies as appropriate.

Section 5. Application and Judicial Review.

(a) This Order and the MOU to be developed by the agencies do not require changes to current contracts, permits, or other third party agreements.

(b) This Order is intended only to improve the internal management of the Executive branch and does not create any right or benefit, substantive or procedural, separately enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

William J. Clinton
The White House
January 10, 2001

APPENDIX C

Initial Meeting Participants (October 27, 2014) and Preparers/Reviewers

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LESO staff

APPENDIX D

Louisiana Department of Wildlife and Fisheries – Natural Heritage Program

The Louisiana Natural Heritage Program's (LNHP) mission is to conserve the rare fauna, flora, and natural communities of Louisiana. The goals of LNHP include preventing and reversing species declines, conservation and stewardship of natural communities, private landowner management assistance, public education and outreach, and reviewing projects to determine any potential impacts to wildlife or the environment.

The Louisiana Department of Wildlife and Fisheries (LDWF), LNHP, maintains a database on rare, threatened and endangered (r/t/e) species of plants, animals, and natural communities for Louisiana. We have accumulated over 6,000 element occurrences of r/t/e species, unique natural communities and other distinctive elements of natural diversity, and identified some 400 ecologically significant sites statewide. Information for element occurrence records is generally gathered from LNHP staff field surveys, but is also obtained from survey contracts, state and federal government agencies, research studies, university contacts, herbaria, and Louisiana nature enthusiasts. Records for new occurrences are continuously being added to the database, and current records are updated as new information becomes available. LNHP data is applied to land use decisions, environmental impact assessments, resource management, conservation planning, endangered species review, research and education. Please contact the LNHP Database Section for inquiries on sensitive species and communities, or for additional information at 225-765-2357 or 225-765-2643 or visit the LNHP website at www.wlf.louisiana.gov/wildlife/louisiana-natural-heritage-program . This Appendix presents an explanation of Louisiana species ranking and a state list of rare species that may occur in shale extraction areas.

To determine if a threatened or endangered species and/or suitable habitat falls within a proposed project area and for further guidance, please contact Carolyn Michon, Assistant Data Manager, with the LNHP at 225-765-2357. If a proposed project falls within the range of a threatened or endangered species and/or suitable habitat does exist, the project area should be surveyed by a qualified biologist for the presence of these species. If the project area does not contain suitable habitat for any threatened or endangered species, no further consultation with LDWF is necessary.

EXPLANATION OF RANKING CATEGORIES EMPLOYED BY NATURAL HERITAGE PROGRAMS NATIONWIDE

Each element is assigned a single global rank as well as a state rank for each state in which it occurs. Global ranking is done under the guidance of NatureServe, Arlington, VA. State ranks are assigned by each state's Natural Heritage Program, thus a rank for a particular element may vary considerably from state to state. Federal ranks are designated by the U.S. Fish & Wildlife Service under the provisions of the Endangered Species Act of 1973. DISCLAIMER: This document is not an official copy of the laws in effect and should not be utilized or relied upon as such. For this reason, the accuracy of the

information contained in this appendix cannot be guaranteed and the reader is cautioned that it is his/her responsibility to be apprised of the laws in effect at any given time. These laws include those contained within the Louisiana Revised Statutes, particularly Title 56, the official regulations of the Louisiana Wildlife and Fisheries Commission, federal laws, and any local or parish ordinances. For more information, Carey Perry can be reached at 225-765-3982.

FEDERAL RANKS (USESA FIELD):
LE = Listed Endangered
LT = Listed Threatened
PE = Proposed endangered
PT = Proposed Threatened
C = Candidate
PDL = Proposed for delisting
E (S/A) or T (S/A) = Listed endangered or threatened because of similarity of appearance
XE = Essential experimental population
XN = Nonessential experimental population
No Rank = Usually indicates that the taxon does not have any federal status. However, because of potential lag time between publication in the Federal Register and entry in the central databases and state databases, some taxa may have a status which does not yet appear.
(Rank, Rank) = Combination values in parenthesis = The taxon itself is not named in the Federal Register as having U.S. ESA status; however, all of its intraspecific taxa (worldwide) do have official status. The statuses shown in parentheses indicate the statuses that apply to intraspecific taxa or populations within this taxon. THE SPECIES IS CONSIDERED TO HAVE A COMBINATION STATUS IN LOUISIANA.
(PS) = partial status = Status in only a portion of the species' range. Typically indicated in a "full" species record where an intraspecific taxon or population has U.S. ESA status, but the entire species does not. THE SPECIES DOES NOT HAVE A STATUS IN LOUISIANA.
(PS: Rank) = partial status = Status in only a portion of the species' range. The value of that status appears because the entity with status does not have an individual entry in Natureserve. THE SPECIES MAY HAVE A STATUS IN LOUISIANA.

GLOBAL ELEMENT RANKS:
G1 = critically imperiled globally because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extinction.
G2 = imperiled globally because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3 = either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single physiographic region) or because of other factors making it vulnerable to extinction throughout its range (21 to 100 known extant populations).
G4 = apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery (100 to 1000 known extant populations).

G5 = demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery (1000+ known extant populations).
GH = of historical occurrence throughout its range; i.e., formerly part of the established biota, with the possibility that it may be rediscovered (e.g., Bachman's Warbler).
GU = possibly in peril range-wide, but status uncertain; need more information.
G? = rank uncertain. Or a range (e.g., G3G5) delineates the limits of uncertainty.
GQ = uncertain taxonomic status.
GX = believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered.
T = subspecies or variety rank (e.g., G5T4 applies to a subspecies with a global species rank of G5, but with a subspecies rank of G4).

STATE ELEMENT RANKS:
S1 = critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation.
S2 = imperiled in Louisiana because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extirpation.
S3 = rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other factors making it vulnerable to extirpation (21 to 100 known extant populations).
S4 = apparently secure in Louisiana with many occurrences (100 to 1000 known extant populations).
S5 = demonstrably secure in Louisiana (1000+ known extant populations). (B or N may be used as qualifier of numeric ranks and indicating whether the occurrence is breeding or nonbreeding.)
SA = accidental in Louisiana, including species (usually birds or butterflies) recorded once or twice or only at great intervals hundreds or even thousands of miles outside their usual range.
SH = of historical occurrence in Louisiana, but no recent records verified within the last 20 years; formerly part of the established biota, possibly still persisting.
SR = reported from Louisiana, but without conclusive evidence to accept or reject the report.
SU = possibly in peril in Louisiana, but status uncertain; need more information.
SX = believed to be extirpated from Louisiana.
SZ = transient species in which no specific consistent area of occurrence is identifiable.

STATE PROTECTION STATUS:
State statuses are contained in Title 56 of the Louisiana Revised Statutes as well as relevant rules and regulations adopted by the Louisiana Wildlife and Fisheries Commission and the Secretary of the Department of Wildlife and Fisheries. The Secretary of the Department of Wildlife and Fisheries is authorized to implement additional restrictions in emergency situations in order to protect fish and wildlife resources.

Endangered = Taking or harassment of these species is a violation of state and federal laws.

Threatened = Taking or harassment of these species is a violation of state and federal laws.
Prohibited = Possession of these species is prohibited. No legal harvest or possession.
Restricted Harvest = There are restrictions regarding the taking and possession of these species.

Tuscaloosa Marine Shale

Mollusks

Common Name	Scientific Name	S Rank
Alabama Hickorynut	*Obovaria unicolor*	S1
Black Sandshell	*Ligumia recta*	S1
Inflated Heelsplitter	*Potamilus inflatus*	S1
Louisiana Pearlshell	*Margaritifera hembeli*	S1
Louisiana Pigtoe	*Pleurobema riddellii*	S1S2
Mississippi Pigtoe	*Pleurobema beadleianum*	S2
Rayed Creekshell	*Anodontoides radiatus*	S2
Sandbank Pocketbook	*Lampsilis satura*	S2
Southern Creekmussel	*Strophitus subvexus*	S1
Southern Hickorynut	*Obovaria jacksoniana*	S1S2
Southern Rainbow	*Villosa vibex*	S2

Crustaceans

Common Name	Scientific Name	S Rank
Calcasieu Painted Crawfish	*Orconectes blacki*	S1
Flatwoods Digger	*Fallicambarus oryktes*	S2
Gulf Crawfish	*Procambarus shermani*	S2
Javelin Crawfish	*Procambarus jaculus*	S1
Kisatchie Painted Crawfish	*Orconectes maletae*	S2
Ouachita Fencing Crawfish	*Faxonella creaseri*	S2
Ribbon Crawfish	*Procambarus bivittatus*	S2

Non-crustacean Arthropods

Common Name	Scientific Name	S Rank
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*	S1
Louisiana Needlefly	*Leuctra szczytkoi*	S1
Scarlet Catchfly	*Silene subciliata*	S2
Yellow Brachycercus Mayfly	*Sparbarus flavus*	S2

Fishes

Common Name	Scientific Name	S Rank
Alabama Shad	*Alosa alabamae*	S1
Bluntface Shiner	*Cyprinella camura*	S2
Broadstripe Topminnow	*Fundulus euryzonus*	S2
Crystal Darter	*Crystallaria asprella*	S2
Flagfin Shiner	*Pteronotropis signipinnis*	S2
Frecklebelly Madtom	*Noturus munitus*	S1
Freckled Darter	*Percina lenticula*	S1
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	S1
Pallid Sturgeon	*Scaphirhynchus albus*	S1
Rainbow Darter	*Etheostoma caeruleum*	S2
River Redhorse	*Moxostoma carinatum*	S1

Southeastern Blue Sucker	*Cycleptus meridionalis*	S1
Suckermouth Minnow	*Phenacobius mirabilis*	S1
Western Sand Darter	*Ammocrypta clara*	S2

Amphibians & Reptiles

Common Name	Scientific Name	S Rank
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*	S1
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*	S1
Four-toed Salamander	*Hemidactylium scutatum*	S1
Gopher Tortoise	*Gopherus polyphemus*	S1
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*	S1
Harlequin Coralsnake	*Micrurus fulvius*	S2
Louisiana Pinesnake	*Pituophis ruthveni*	S2
Louisiana Slimy Salamander	*Plethodon kisatchie*	S1
Northern Mole Kingsnake	*Lampropeltis rhombomaculata*	S1S2
Pine Woods Littersnake	*Rhadinaea flavilata*	S1
Ringed Map Turtle	*Graptemys oculifera*	S2
Southern Red Salamander	*Pseudotriton ruber vioscai*	S2
Stripe-necked Musk Turtle	*Sternotherus minor peltifer*	S1
Webster's Salamander	*Plethodon websteri*	S1

Birds

Common Name	Scientific Name	S Rank
Grasshopper Sparrow	*Ammodramus savannarum*	S1B,S3N
Interior Least Tern	*Sterna antillarum athalassos*	S1B
Red-cockaded Woodpecker	*Picoides borealis*	S2
Sandhill Crane	*Antigone canadensis*	S2N
Swallow-tailed Kite	*Elanoides forficatus*	S1S2B
Warbling Vireo	*Vireo gilvus*	S1B

Mammals

Common Name	Scientific Name	S Rank
Big Brown Bat	*Eptesicus fuscus*	S2
Eastern Spotted Skunk	*Spilogale putorius*	S1
Hispid Pocket Mouse	*Chaetodipus hispidus*	S2
Southeastern Shrew	*Sorex longirostris*	S2
West Indian Manatee	*Trichechus manatus*	S1N

Plants

Common Name	Scientific Name	S Rank
Acid-swamp Yellow-eyed-grass	*Xyris serotina*	S1
Alabama Grape-fern	*Botrychium jenmanii*	S2
Allegheny-spurge	*Pachysandra procumbens*	S2
American Ginseng	*Panax quinquefolius*	S1
Barbed Rattlesnake-root	*Prenanthes barbata*	S2
Baygall Caric Sedge	*Carex venusta*	S1

Bearded Grass-pink	*Calopogon barbatus*	S1
Birdbill Spike Grass	*Chasmanthium ornithorhynchum*	S2
Black Snakeroot	*Zigadenus densus*	S2
Black Titi	*Cliftonia monophylla*	S1
Bloodroot	*Sanguinaria canadensis*	S2
Bog Flame Flower	*Macranthera flammea*	S2
Bog Moss	*Mayaca fluviatilis*	S2
Bog Spicebush	*Lindera subcoriacea*	S1
Boykin's milkwort	*Polygala boykinii*	S1
Branched Hedge-hyssop	*Gratiola ramosa*	S1S2
Broadleaf Barbaras-buttons	*Marshallia trinervia*	S1
Canada Enchanter's-nightshade	*Circaea lutetiana ssp. canadensis*	S2
Canada Wild-ginger	*Asarum canadense*	S1
Canby's Bulrush	*Schoenoplectus etuberculatus*	S1
Carolina Fluff Grass	*Tridens carolinianus*	S2
Carpenter's Ground-cherry	*Physalis carpenteri*	S1
Central Stoneroller	*Campostoma anomalum*	S2
Chapman's Milkwort	*Polygala chapmanii*	S1
Coast Indigo	*Indigofera miniata*	S1
Coastal False Asphodel	*Tofieldia racemosa*	S2S3
Coastal Plain Beak Sedge	*Rhynchospora stenophylla*	S1
Coastal Plain False Foxglove	*Agalinis aphylla*	S1
Common Shootingstar	*Dodecatheon meadia*	S2
Cottony Goldenaster	*Chrysopsis gossypina ssp. hyssopifolia*	S1
Creeper	*Strophitus undulatus*	S2
Crested Coralroot	*Hexalectris spicata*	S2
Death Camas	*Zigadenus leimanthoides*	S1
Drummond's Nailwort	*Paronychia drummondii*	S2
Dwarf Filmy-fern	*Trichomanes petersii*	S2
Dwarf Gray Willow	*Salix humilis var. tristis*	S2
Earleaf Greenbrier	*Smilax auriculata*	S2
Flax-leaf False-foxglove	*Agalinis linifolia*	S2
Four-point Evening Primrose	*Oenothera rhombipetala*	S1?
Georgia Tickseed	*Coreopsis nudata*	S2
Glade Fern	*Diplazium pycnocarpon*	S2
Goldencrest	*Lophiola aurea*	S2S3
Green-fringe Orchid	*Platanthera lacera*	S1
Gulf Spikemoss	*Selaginella ludoviciana*	S1
Harper's Yellow-eyed-grass	*Xyris scabrifolia*	S2
Hemlock Water-parsnip	*Sium suave*	S1S2
Hooker's Milkwort	*Polygala hookeri*	S1
Incised Groovebur	*Agrimonia incisa*	S1
Indian Cucumber-root	*Medeola virginiana*	S1
Lady Lupine	*Lupinus villosus*	S2
Large White Fringed Orchid	*Platanthera blephariglottis var. conspicua*	S1
Le Conte's Thistle	*Cirsium lecontei*	S2
Leggett's Pinweed	*Lechea pulchella*	S1S2

Long-horned Habenaria	*Habenaria quinqueseta*	S1
Longleaved Wild-buckwheat	*Eriogonum longifolium*	S2
Louisiana Quillwort	*Isoetes louisianensis*	S2
Low Erythrodes	*Platythelys querceticola*	S1
Low Nut Sedge	*Scleria verticillata*	S1
Many-flowered Grass-pink	*Calopogon multiflorus*	S1
Michaux's Milkweed	*Asclepias michauxii*	S2
Millet Beak Sedge	*Rhynchospora miliacea*	S2
Missouri Coneflower	*Rudbeckia missouriensis*	S2
Myrtle Holly	*Ilex myrtifolia*	S2
Narrowleaf Whitetop Aster	*Sericocarpus linifolius*	S2
Night-flowering Wild-petunia	*Ruellia noctiflora*	S1
Nodding Pogonia	*Triphora trianthophora*	S2
Odorless Bayberry	*Morella inodora*	S2
Oklahoma Grass-pink	*Calopogon oklahomensis*	S1
One-flowered Broomrape	*Orobanche uniflora*	S1
Pale False Foxglove	*Agalinis skinneriana*	S1S2
Pale Grass-pink	*Calopogon pallidus*	S2
Perennial Sand Grass	*Triplasis americana*	S1
Pineland Scaly-pink	*Stipulicida setacea*	S1
Pineland Yellow-eyed-grass	*Xyris stricta var. stricta*	S2
Pink Bog Button	*Sclerolepis uniflora*	S1
Purple Coneflower	*Echinacea purpurea*	S2
Pyramid Magnolia	*Magnolia pyramidata*	S2
Rooted Spike Sedge	*Eleocharis radicans*	S1?
Rough-hair Witchgrass	*Dichanthelium strigosum var. leucoblepharis*	SH
Rough-hair Witchgrass	*Dichanthelium strigosum var. glabrescens*	S1
Sand Hickory	*Carya pallida*	S2
Sarvis Holly	*Ilex amelanchier*	S2
Saw Palmetto	*Serenoa repens*	S1
Scalloped Milkwort	*Polygala crenata*	S2
Scarlet Oak	*Quercus coccinea*	S2S3
Sessile-leaved Bellwort	*Uvularia sessilifolia*	S2
Shadow-witch Orchid	*Ponthieva racemosa*	S2
Short-beard Plumegrass	*Saccharum brevibarbe var. brevibarbe*	S1
Shortleaf Sneezeweed	*Helenium brevifolium*	S1
Silky Camellia	*Stewartia malacodendron*	S2S3
Silver Croton	*Croton argyranthemus*	S2
Single-head Pussytoes	*Antennaria solitaria*	S2
Slender Gayfeather	*Liatris tenuis*	S1
Slender Heliotrope	*Heliotropium tenellum*	S2
Snow Melanthera	*Melanthera nivea*	S2
Southern Horse-balm	*Collinsonia serotina*	S1
Southern Lady's-slipper	*Cypripedium kentuckiense*	S1
Southern Red Lily	*Lilium catesbaei*	S1
Southern Shield Woodfern	*Dryopteris ludoviciana*	S2
Southwestern Bedstraw	*Galium virgatum*	S2

Soxman's Milk-vetch	*Astragalus soxmaniorum*	S2
Spoonleaf Sundew	*Drosera intermedia*	S2
Sprawling Hoary-pea	*Tephrosia hispidula*	S2?
Spreading Beak Sedge	*Rhynchospora divergens*	S1
Spreading Pogonia	*Cleistes bifaria*	S1
Spring Hill Flax	*Linum macrocarpum*	S1
Square-stem Monkeyflower	*Mimulus ringens*	S2
Staghorn Clubmoss	*Lycopodiella cernua var. cernua*	S2
Starry Campion	*Silene stellata*	S2
Summer Farewell	*Dalea pinnata*	S1
Texas Grama	*Bouteloua rigidiseta*	S1
Thread-stem False-foxglove	*Agalinis filicaulis*	S2
Threeway Sedge	*Dulichium arundinaceum*	S2
Thymeleaf Pinweed	*Lechea minor*	S2
Turkey Oak	*Quercus laevis*	S1
Turk's-Cap Lily	*Lilium superbum*	S1
Viperina	*Zornia bracteata*	S2
Western Umbrella Sedge	*Fuirena simplex var. aristulata*	S1
White Baneberry	*Actaea pachypoda*	S2
Wild Coco Orchid	*Pteroglossaspis ecristata*	S2
Wild Crane's-bill	*Geranium maculatum*	S1
Winged Seedbox	*Ludwigia alata*	S1
Wiry Witchgrass	*Panicum flexile*	S2
Woodland Bluegrass	*Poa sylvestris*	S1
Yellow Butterwort	*Pinguicula lutea*	S2
Yellow Pimpernel	*Taenidia integerrima*	S2
Yellowroot	*Xanthorhiza simplicissima*	S1

Natural Communities

Common Name	Scientific Name	S Rank
Eastern Hillside Seepage Bog		S2
Eastern Longleaf Pine Savannah		S1
Eastern Upland Longleaf Pine Forest		S1
Estuarine Submergent Vascular Vegetation		S1S2
Flatwoods Pond		S2
Fleming Calcareous Prairie		S1
Fleming Glade		S1
Freshwater Marsh		S2
Pondcypress-Blackgum Swamp		S1
Sandstone Glade		S2
Shortleaf Pine/Oak-hickory Forest		S1
Slash Pine-Pondcypress/Hardwood Forest		S2
Small Stream Forest		S2
Southern Mesophytic Forest		S2
Spruce Pine-hardwood Mesic Flatwoods		S2
Western Acidic Longleaf Pine Savannah		S2

Western Hillside Seepage Bog		S1
Western Xeric Sandhill Woodland		S1

Haynesville Shale

Crustaceans

Common Name	Scientific Name	S Rank
Sabine Fencing Crawfish	*Faxonella beyeri*	S2

Fishes

Common Name	Scientific Name	S Rank
Crystal Darter	*Crystallaria asprella*	S2

Amphibians & Reptiles

Common Name	Scientific Name	S Rank
Louisiana Pinesnake	*Pituophis ruthveni*	S2
Southern Prairie Skink	*Plestiodon septentrionalis obtusirostris*	S1
Southern Red-backed Salamander	*Plethodon serratus*	S1
Strecker's Chorus Frog	*Pseudacris streckeri*	S1

Birds

Common Name	Scientific Name	S Rank
Interior Least Tern	*Sterna antillarum athalassos*	S1B
Red-cockaded Woodpecker	*Picoides borealis*	S2
White-breasted Nuthatch	*Sitta carolinensis*	S3
Warbling Vireo	*Vireo gilvus*	S1B

Plants

Common Name	Scientific Name	S Rank
American Alumroot	*Heuchera americana*	S2
American Pinesap	*Monotropa hypopithys*	S2
Arkansas Caric sedge	*Carex arkansana*	S1
Awl-shaped Scurfpea	*Pediomelum hypogaeum var. subulatum*	S2
Barbara's Buttons	*Marshallia caespitosa var. signata*	S1
Bloodroot	*Sanguinaria canadensis*	S2
Bur Oak	*Quercus macrocarpa*	S1
Clustered Poppy-mallow	*Callirhoe alcaeoides*	S1
Common Shootingstar	*Dodecatheon meadia*	S2
Cotton-rose	*Evax verna*	S1
Crested Coralroot	*Hexalectris spicata*	S2
Downy Yellow Violet	*Viola pubescens*	S1
Drummond's Nailwort	*Paronychia drummondii*	S2
Drummond's Sandwort	*Minuartia drummondii*	S2
Earth-fruit	*Geocarpon minimum*	S2
Evening Rainlily	*Cooperia drummondii*	S2
Fire Pink	*Silene virginica*	S2

Flame Hedgehyssop	*Gratiola flava*	S1
Four-point Evening Primrose	*Oenothera rhombipetala*	S1?
Fringed Poppy-mallow	*Callirhoe digitata*	S1
Granite Gooseberry	*Ribes curvatum*	S2
Green-fringe Orchid	*Platanthera lacera*	S1
Hall's Panic Grass	*Panicum hallii var. filipes*	S1
June Grass	*Koeleria macrantha*	S1
Large Clammyweed	*Polanisia erosa*	S2
Nodding Pogonia	*Triphora trianthophora*	S2
Nuttall's Deathcamas	*Zigadenus nuttallii*	S1
Pale Umbrella-wort	*Mirabilis albida*	S2
Prairie Cord Grass	*Spartina pectinata*	S2
Prairie Evening Primrose	*Oenothera pilosella ssp. sessilis*	S1?
Prairie Pleatleaf	*Nemastylis geminiflora*	S2S3
Prairie Redroot	*Ceanothus herbaceus*	S1
Purple Coneflower	*Echinacea purpurea*	S2
Reflexed Trillium	*Trillium recurvatum*	S2
Rosemary Rockrose	*Helianthemum rosmarinifolium*	S2
Sessile-leaved Bellwort	*Uvularia sessilifolia*	S2
Sicklepod	*Arabis canadensis*	S1
Smooth Twistflower	*Streptanthus hyacinthoides*	S2
Southern Lady's-slipper	*Cypripedium kentuckiense*	S1
Southern Thimbleweed	*Anemone berlandieri*	S2
Starry Campion	*Silene stellata*	S2
Stiff Tickseed	*Coreopsis palmata*	S2
Texas Sunnybell	*Schoenolirion wrightii*	S2
Texas Yellowstar	*Lindheimera texana*	S1
Tumble Grass	*Schedonnardus paniculatus*	S1
Waxyleaf Meadowrue	*Thalictrum revolutum*	S1
Western Horse-nettle	*Solanum dimidiatum*	S2S3
White Trout-lily	*Erythronium albidum*	S2
Yellow Pimpernel	*Taenidia integerrima*	S2
Yellowleaf Tinker's-weed	*Triosteum angustifolium*	S2

Narural Communities

Common Name	Scientific Name	S Rank
Calcareous Forest		S2
Morse Clay Calcareous Prairie		S1
Saline Prairie		S2
Shortleaf Pine/Oak-hickory Forest		S1
Small Stream Forest		S2
Wet Hardwood Flatwoods		S2S3

Brown Dense Shale

Mollusks

Common Name	Scientific Name	S Rank
Black Sandshell	*Ligumia recta*	S1
Butterfly	*Ellipsaria lineolata*	S1
Creeper	*Strophitus undulatus*	S2
Fat Pocketbook	*Potamilus capax*	S1
Fatmucket	*Lampsilis siliquoidea*	S2
Monkeyface	*Quadrula metanevra*	S1
Ouachita Kidneyshell	*Ptychobranchus occidentalis*	S1
Pink Mucket	*Lampsilis abrupta*	S1
Plain Pocketbook	*Lampsilis cardium*	S1
Pyramid Pigtoe	*Pleurobema rubrum*	S2
Rabbitsfoot	*Quadrula cylindrica*	S1
Silty Hornsnail	*Pleurocera canaliculata*	S2
Spike	*Elliptio dilatata*	S2S3

Crustaceans

Common Name	Scientific Name	S Rank
Elegant Creek Crawfish	*Procambarus elegans*	S2
Twin Crawfish	*Procambarus geminus*	S2

Non-crustacean Arthropods

Common Name	Scientific Name	S Rank
Yellow Brachycercus Mayfly	*Sparbarus flavus*	S2

Fishes

Common Name	Scientific Name	S Rank
Bluehead Shiner	*Pteronotropis hubbsi*	S2
Channel Darter	*Percina copelandi*	S2
Crystal Darter	*Crystallaria asprella*	S2
Steelcolor Shiner	*Cyprinella whipplei*	S2
Western Sand Darter	*Ammocrypta clara*	S2

Amphibians & Reptiles

Common Name	Scientific Name	S Rank
Western Wormsnake	*Carphophis vermis*	S1

Birds

Common Name	Scientific Name	S Rank
Bell's Vireo	*Vireo bellii*	S1B
Interior Least Tern	*Sternula antillarum athalassos*	S1B

Red-cockaded Woodpecker	*Picoides borealis*	S2
Sandhill Crane	*Antigone canadensis*	S2N
White-breasted Nuthatch	*Sitta carolinensis*	S3

Plants

Common Name	Scientific Name	S Rank
American Hazelnut	*Corylus americana*	S1
American Pinesap	*Monotropa hypopithys*	S2
Arkansas Oak	*Quercus arkansana*	S2
Bloodroot	*Sanguinaria canadensis*	S2
Crested Coralroot	*Hexalectris spicata*	S2
Dwarf Gray Willow	*Salix humilis var. tristis*	S2
Fire Pink	*Silene virginica*	S2
Fowl Manna Grass	*Glyceria striata*	S1
Zigzag Goldenrod	*Solidago flexicaulis*	S1
Hickorynut	*Obovaria olivaria*	S1
Log Fern	*Dryopteris celsa*	S1
Prairie Evening Primrose	*Oenothera pilosella ssp. sessilis*	S1?
Ozark Chinquapin	*Castanea pumila var. ozarkensis*	S1
Prairie Cord Grass	*Spartina pectinata*	S2
Purple Coneflower	*Echinacea purpurea*	S2
Sessile-leaved Bellwort	*Uvularia sessilifolia*	S2
Staggerbush	*Lyonia mariana*	S1
Starry Campion	*Silene stellata*	S2
Virginia Anemone	*Anemone virginiana*	S1
Waxyleaf Meadowrue	*Thalictrum revolutum*	S1
Yellow Water-crowfoot	*Ranunculus flabellaris*	S1
Yellowleaf Tinker's-weed	*Triosteum angustifolium*	S2

Natural Communities

Common Name	Scientific Name	S Rank
Mesic Hardwood Flatwoods		S2S3
Morse Clay Calcareous Prairie		S1
Small Stream Forest		S2
Wet Hardwood Flatwoods		S2S3