Upper Barataria Basin, Louisiana Feasibility Study with Integrated Environmental Impact Statement

Appendix C: Environmental Information

November 2019

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1 Environmental Settings

1.1 Climate

The climate in the study area is influenced by the many water surfaces of the nearby wetlands, rivers, lakes, and streams. Warm, moist southeasterly winds from the Gulf of Mexico prevail throughout most of the year, with occasional cool, dry fronts dominated by northeast high pressure systems. Extreme changes in climate (temperature, rain, evaporation, wind) could result in conditions that cannot support the types of habitat restored, reducing the effectiveness of the proposed plan and any associated mitigation. Extreme climate change could essentially eliminate the benefits of any constructed flood protection in the basin.

Table 1 consists of the monthly temperature normals recorded from the Thibodaux 4 SE, LA monitoring station by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC). Retrieved 07 November 2019 from https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table 1: Temperature and Precipitation Normals from Thibodaux Monitoring Station

MONTH	PRECIP (IN)	MIN TMP (°F)	AVG TMP (°F)	MAX TMP (°F)
Jan	5.74	42.2	52.5	62.7
Feb	5.30	45.8	55.8	65.8
Mar	5.27	51.3	61.8	72.2
Apr	4.20	57.8	68.2	78.5
May	5.30	65.7	75.5	85.3
Jun	8.59	71.2	80.2	89.3
Jul	8.20	73.2	82.1	91.0
Aug	7.46	72.7	81.96	91.1
Sep	6.11	68.7	78.2	87.7
Oct	4.95	58.9	69.7	80.6
Nov	4.03	51.4	62.0	72.7
Dec	5.75	44.3	54.8	65.3

Normal annual precipitation for the Upper Barataria Basin (UBB) is 70.96 inches. Even for a 30-year averaging period annual precipitation at various weather stations throughout the UBB ranged from 68 to 72 inches. The wettest month is June with an average monthly normal rainfall of 8.59 inches. November is the driest month averaging 4.03 inches.

High cumulative rainfall events (e.g., 6 inches or more in less than 72 hours) over large areas of the UBB are caused under two typical scenarios: slow moving cold fronts encountering warm moist coastal air in late-winter or early spring; and slow moving tropical storms in summer or early fall. High short-term localized rainfall intensities (e.g., over one inch in an hour) can occur under these two scenarios, and are also experienced in a third scenario—heavy summer-time thunderstorms. Record floods often result when significant rainfall events occur in the context of above-average seasonal rainfall patterns, which sustain high soil moisture saturation and floodplain water levels. In addition to rainfall-riverine flood events, the lower portion of the basin is also subject to wind-driven coastal flooding associated with slow-moving tropical storms and prolonged heavy southerly winds cause high water levels along the southeastern Louisiana coast.

1.2 Wetland Loss

The Barataria Basin has lost over 1,120 square kilometers (276,757 acres) of marsh (1932-2016) second only to the Terrebonne Basin Basin (Table 2 from: Couvillion et al. 2017).

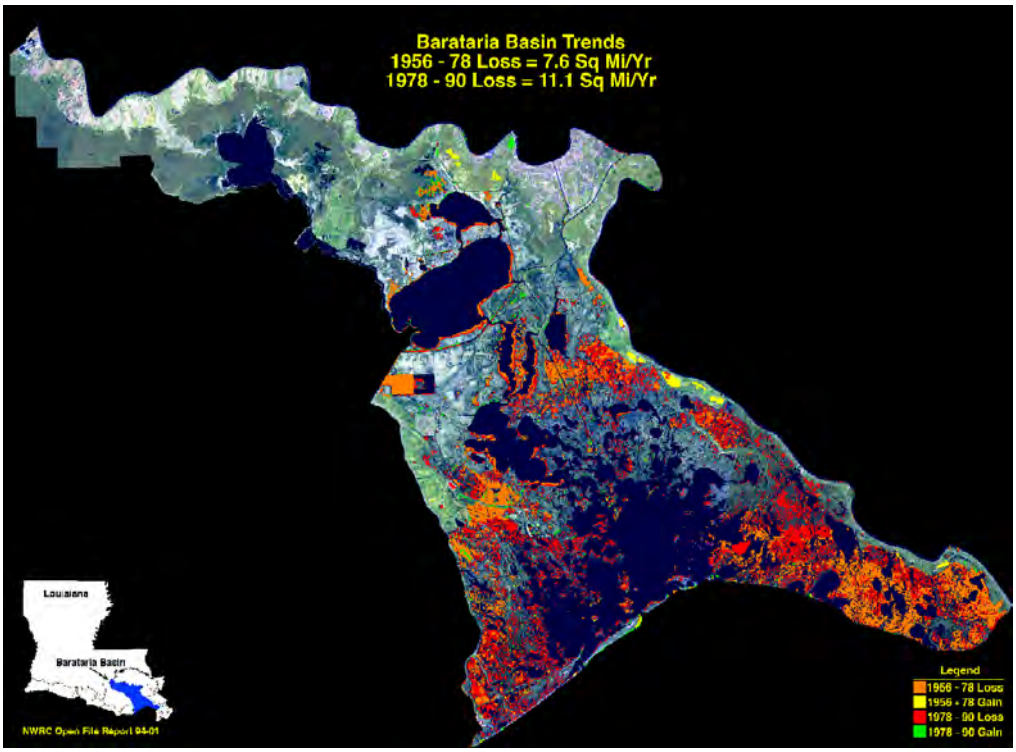
Table 2: Land area and change within Louisiana coastal basins 1932-2016 (square km)

Year	Atch Basin	Barataria Basin	Breton Sound Basin	Calc Sabine Basin	Miss. River Basin	Mermentau Basin	Pontchartrain Basin	Teche Vermilion Basin	Terre Basin
1932	550.58	3,832.61	1,107.56	2,136.71	678.75	2,481.92	2,862.43	1,421.74	4,471.55
2016	566.90	2,712.53	682.01	1,619.01	303.98	1,993.69	2,390.08	1,272.90	3,169.56
change	+16.32	-1,120.08	-425.55	-517.70	-374.77	-488.23	-472.35	-148.84	-1,301.99
% change	+3.96%	-29.22%	-38.42%	-24.23%	-55.24%	-19.67%	-16.50%	-10.47%	-29.12%

The majority of this marsh loss has occurred in the middle and lower basin (Figure 1). The fresh and low salinity marshes of the upper basin have not experienced much loss due in part to the ability of those marshes to accumulate organic matter to keep pace with subsidence and sea level rise. However, continued loss of the middle and lower basin marshes may expose the upper basin freshwater marshes and swamps to increased tidal action and salinities, resulting in accelerated losses of marshes and swamps in the project area. Continuing wetland loss constitutes a serious threat to the nationally important fish and wildlife resources of the study area.

Loss of middle and lower basin marshes may also result in higher project area storm surge elevations and will increase the likelihood that open water conditions may occur on the Gulf side of proposed levees, thus increasing levee maintenance costs.

Figure 1: Barataria Basin Land Loss



Currently the project is authorized to provide protection against tropical storm surges and heavy rainfall events. Floodgate operations to protect against tidal flooding is not an authorized project purpose. If the project sponsors wish to close floodgates to reduce tidal flooding, additional impact assessments will be needed to address associated impacts. A project alternative that would avoid this impact would be a construction of ring levee/floodwall system around communities such that the upper basin is not enclosed within a flood protection system.

If the water exchange capacity of floodgates in the cross-basin levee alternatives is insufficient to handle evacuation of heavy rainfall events, then the project may result in increased flooding of developed areas and wetlands already stressed due to the combined effects of subsidence and sea level rise. The project's storm water evacuation capacity should be designed to handle both rainfall evacuation and discharge of water diverted from the Mississippi River for wetland restoration purposes. That structure design capacity should be planned for future conditions when sea level is higher. Additionally, the proposed operation of the mid-Barataria Basin Sediment Diversion project may result in higher water elevations and may reduce the extent of low-tide events which would otherwise facilitate gravity drainage of the project area.

2 Relevant Resources

The resources described in this section are those recognized as significant by laws, Executive Orders (EOs), regulations, and other standards of federal, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public.

Relevant resources that could be impacted from implementation of the project are: wetlands; aquatic resources and fisheries; wildlife; geology and soils; water quality; air quality; aesthetic and recreational resources. Navigation, fisheries, noise, and essential fish habitat would not be affected by the proposed project.

2.1 Wetlands

The upper portion of the Barataria Basin is largely a freshwater-dominated system of natural levee ridges, swamps, and fresh marsh habitats. Marine processes, with barrier islands, brackish marsh, saline marsh, tidal channels, and large bays and lakes, dominate the lower portion of the basin. (O'Neil 1949) classified the project area as floating three-cornered grass marsh in 1949. (Chabreck and Linscombe 1968, 1978, and 1988) classified the area as brackish marsh until 1997 when the area was classified as intermediate marsh (Chabreck and Linscombe 1997). The project area supports an intermediate/brackish marsh community dominated by saltmeadow cordgrass (*Spartina patens*). Other species include black needlerush (*Juncus roemerianas*), saltmarsh cordgrass (*Spartina alterniflora*), Olney bulrush (*Schoenoplectus americanus*), saltmarsh bulrush (*Bolboschoenus maritimus*), deerpea (*Vicia ludoviciana*), eastern baccharis (*Baccharis halimifolia*), marsh morning-glory (*Ipomoea sagittata*), soft rush (J*uncus effuses*), and pretty dodder (*Cuscuta indecora*). Submerged aquatic vegetation includes widgeongrass (*Ruppia*), southern naiad (*Najas guadalupensis*), and Eurasian watermilfoil (*Myriophyllum spicatum*).

2.1.1 Cypress-tupelo swamp

These swamps are generally dominated with baldcypress *(Taxodium distichum*), water tupelo (*Nyssa aquatic)*, swamp red maple (*Acer rubrum*), and various understory plant species. In permanently flooded coastal swamps floating aquatic vegetation such as duckweed, Azolla, Salvinia, and water hyacinth may be common. Coastal swamp forests typically occupy the area between fresh marshes and areas of higher elevation, including the transition zones between bottomland hardwood forests on riverine interdistributary ridges and lower elevation marshes. Healthy cypress swamps occur in fresh water areas experiencing minimal daily tidal action and where the salinity range does not normally exceed 2 parts per thousand (ppt). Salinities of 3 ppt or higher may cause significant stress and mortality of baldcypress. However, short-term exposure to such salinities may be tolerated if it does not penetrate into and persist in the soil.

Figure 2: Cypress-Tupelo Swamp

Photo source: http://starkculturalvenues.org/shangrilagardens/cypress-tupelo-swamp

2.1.2 Bald cypress (*Taxodium distichum*)

A large deciduous conifer that has long been recognized for its decay resistant wood. These trees can grow to a height of 100 to 120 feet with a diameter of three to five feet. In the original old grove forests of the south, the average age of virgin bald cypress was over 500 years old and could reach a diameter of 6 to 8 feet. Young bald cypress tree trunks are considerably tapered and support an open, narrowly pyramidal crown. As the tree ages, the trunk becomes more cylindrical and the crown becomes irregularly fattened. Older trunks are often ashy-gray with swollen, fluted bases, and branches are bearded with Spanish moss. Older bald cypress trees also have a very distinctive root system that consists of several descending roots, providing anchorage and many wide-spreading roots commonly referred to as "knees." This type of root system makes the bald cypress exceptionally stable even on the most unstable sites. Permanent inundation results in a loss of regeneration, and eventually conversion to marsh (Hodges, 1997).

Figure 3: Bald Cypress

Photo source https://www.thoughtco.com/baldcypress-urban-tree-of-the-year-1343562

2.1.3 Red Maple (*Acer rubrum*)

Red maples are native across the eastern United States. The Drummond or swamp red maple, *Acer rubrum* var. *drummondii*, is native to Louisiana. This maple is particularly well-adapted to poor drainage but thrives in well-drained, average landscape conditions. The leaves are silvery on the back, and the females produce an unusually large and ornamental winged fruit ranging in color from burgundy to rusty red hanging from the bare branches in January and February. They are fast-growing, medium-sized shade trees reaching about 40 to 50 feet tall and 30 feet wide.

The trunk diameter often ranges from 18 inches to 35 inches depending on the growing conditions, however, open grown trees can attain diameters of up to 60 inches. The trunk will remain free of branches until some distance up the tree on forest grown trees, while individuals grown in the open are shorter and thicker with a more rounded crown. Generally the crown is irregularly ovoid with ascending whip-like curved shoots. The bark is a pale grey and smooth when the individual is young. As the tree grows the bark becomes darker and cracks into slightly raised long plates. (Mitchell 1974) Trees grown in poorer sites often become malformed and scraggly. (Seiler, et al, 2019)

Figure 4: Red Maple

Photo source http://apps.lsuagcenter.com/news_archive/2013/december/get_it_growing/Choose-the-right-maple-for-your-Louisiana-landscape-.htm

2.1.4 Water (Swamp) Tupelo (*Nyssa aquatic)*

The tupelo has a range nearly identical to the bald cypress tree and can be found in most swamps in Louisiana. The species has evolved a specialized root system with a wide base that provides stability, allowing it to live in regularly flooded environments, much like cypress. Tupelo fruit is an important wildlife food source, and serves as an important tree for nesting birds due to its typically numerous cavities.

The type of water regime is more important to growth of swamp tupelo than the soil type. Best growth is achieved on sites where the soil is continuously saturated with very shallow moving water. Growth can be reduced as much as 50 percent when the water is stagnant, as in ponds. Intermittent flooding, with periodic drying cycles, or continuous deep flooding even by moving water, also reduces growth. (McGee et al 1990)

Figure 5: Tupelo Swamp

Photo source https://www.123rf.com/photo_52590955_fall-colors-of-water-tupelo-nyssa-aquatica-and-cypress-tree-taxodium-distichum-in-merchants-millpond.html

2.1.5 Scrub-Shrub

Scrub-shrub habitat is often found along the flanks of distributary ridges. Typically it is bordered by marsh at lower elevations and by developed areas, cypress-tupelo swamp, or bottomland hardwoods at higher elevations. Typical scrub-shrub vegetation includes elderberry, wax myrtle, buttonbush, black willow, Drummond red maple, Chinese tallow-tree, and groundselbush.

Figure 6: Scrub Shrub Habitat

Photo source: https://www.fws.gov/refuge/julia_butler_hansen/wildlife_and_habitat/habitats/scrub_shrub_swamp.html

2.1.6 Fresh Marsh

Fresh marshes occur at the upper ends of interdistributary basins and are often characterized by floating or semi-floating vegetated mats. Most fresh marshes exhibit minimal daily tidal action. Vegetation may include maidencane, bulltongue, cattail, California bulrush, pennywort, giant cutgrass, American cupscale, spikerushes, bacopa, and alligatorweed. Associated open water habitats may often support extensive beds of floating-leafed and submerged aquatic vegetation including water hyacinth, Salvinia, duckweeds, American lotus, white water lily, water lettuce, coontail, Eurasian milfoil, hydrilla, pondweeds, naiads, fanwort, wild celery, water stargrass, elodea, and others.

Figure 7: Fresh Marsh Habitat

Photo source: http://www.americaswetlandresources.com/background_facts/detailedstory/types_wetlands.html

2.2 Wetland Impacts

Acreage of direct wetland construction impacts by habitat type were obtained from 2017 DOQQs and habitat types determined from that imagery in combination with field inspections conducted during October 2019. Given schedule constraints and lack of access to some future impact sites, the habitat type determination in areas is tentative. The direct impacts provided below include impacts associated with two construction access roads. The TSP is the least damaging of the alternatives in the final array of alternatives. (Table 3).

Table 3: Habitat Impacts Associated with Access Roads

Habitat Type	Alt 1 (acres)	Alt 2 (acres)
Bottomland Hardwood	41.68	86.66
Cypress-Tupelo Swamp	1.04	36.43
Fresh Marsh	136.54	148.93
Total Acres of Impact	**179.26**	**272.02**

Bottomland hardwood forest (BLH) impacts would occur within the forced drainage area of the Sunset Drainage District. A small acreage of the Paradis Mitigation Bank located within that forced drainage district would be impacted. An acre of cypress swamp within the Sunset District would also be impacted. Wetlands within the Sunset Drainage District are not exposed to increasing SLR effects as are the remaining impact areas.

Near the Raceland end of the proposed levee, impacted BLH consists of inundation stressed and stunted red maple. Along portions of the St. Charles levee, BLH is also stressed, but impacts to more healthy BLH stands would also occur. Due to its low quality, the inundation stressed BLH could be classified as a Resource Category 3 rather than Category 2. A more thorough field inspection would be needed to consider this change.

More acres of fresh marsh are directly impacted by both alternatives than any other habitat type. Those impacts are greatest immediately southwest of Bayou Des Allemands where a new levee would be constructed across marsh. Lesser fresh marsh impact acreage is located adjacent to the St. Charles levee where inundation has converted former BLH to marsh. A more detailed breakdown of direct impacts by location is provided in Appendix A of the USFWS Draft CAR. Direct impacts in AAHUs are provided in Table 3 of the USFWS Draft CAR with a more detailed breakdown provided in Appendix B.

Because Alternative 1 has the narrowest footprint and is a shorter levee alignment, impacts for this alternative are less than those of alternative 2. Temporal impacts to BLH forest (for both alternatives) could be reduced if the northern construction access route were replanted after construction. It is assumed that borrow for levee construction will come from existing agricultural areas. If borrow is taken from forested or wetland areas, additional borrow-related impacts would need to be quantified.

Installation of the 270-foot-wide barge gate in Bayou Des Allemands has the potential to reduce water exchange and increase the hydroperiod of the upper Barataria Basin. Upper Barataria Basin forested wetlands are already near or at a permanently inundated condition. Consequently, growth rates of trees in those areas could be further reduced and tree mortality increased should the project cause stage increases of sufficiently long durations. Information needed to assess this possible impact is not available at this time. Hence, this impact assessment is incomplete in regard to this potentially large-scale indirect impact.

2.3 Wildlife

There are a variety of habitats in the study area for wildlife species use including: open fields used for foraging, forested wetlands, fresh marsh, lines of trees and shrubs along drainage ditches and denser tree growth along waterways that provide cover and connectivity. Over time, the study area has undergone extensive artificial modifications resulting in common fauna within the study area primarily being species that can tolerate a wide range of disturbed habitats.

Most developed areas provide low-quality wildlife habitat. Sites developed for agricultural purposes are located on low ridges and on lower elevation areas that have improved

drainage. In agricultural areas, wildlife habitat is primarily provided by unmaintained ditch banks and field edges, fallow fields, pasture lands, and rainfall-flooded fields. Cultivated crops can provide forage for some wildlife species. Game species that utilize agricultural lands include the white-tailed deer, mourning dove, bobwhite quail, eastern cottontail, and common snipe. Seasonally flooded cropland and fallow fields may provide important feeding habitat for wintering waterfowl, wading birds, and other waterbirds.

Mississippi Flyway

Starting in central Canada and stretching to the Gulf of Mexico, the Mississippi Flyway is the name given to the route followed by birds migrating from their breeding grounds in North America to their wintering grounds in the south. As the name suggests, the Mississippi Flyway follows the route of the Mississippi River in the United States – North America's largest river system. More than 2,300 miles long with a watershed of more than 1.5 million square miles, the Mississippi River is North America's greatest waterway and the most heavily used migration corridor for a large numbers of geese, ducks, shorebirds, sparrows, blackbirds, thrushes and warblers, the majority of which cut across the Gulf of Mexico, providing excellent birding opportunities along the coasts of Louisiana and Texas.

This flyway is composed of the states of Alabama, Arkansas, Indiana, Illinois, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin, as well as the Canadian provinces of Saskatchewan, Manitoba, and Ontario. Louisiana is part of the Mississippi Flyway and provides important winter habitat for waterfowl that are produced in the Prairie Pothole Region and Great Lakes states. In most years, the coastal marshes of Louisiana regularly hold half of the wintering duck population of the Mississippi Flyway. South Louisiana comprises an important portion of the Gulf Coast. Historically, coastal marshes of Louisiana provided reliable, high quality habitat for millions of pintails, gadwalls, wigeon and green-winged teal.

2.3.1 Birds

As the study area is located within the Mississippi Flyway, it experiences significant seasonal migrations of waterfowl species, which are of particular interest to recreational hunters. Numerous species of birds utilize the study area marshes, including migratory waterfowl which winter there. Small openings in project area cypress-tupelo swamps may provide habitat for puddle ducks like mallard and gadwall. Other ducks that occur in the study area include northern pintail, blue-winged teal, green-winged teal, American widgeon, wood duck, and northern shoveler. The resident mottled duck also utilizes project area coastal marshes. Diving ducks prefer larger ponds, lakes, and open water areas. Common diving duck species include lesser scaup, canvasback, redhead, ring-necked duck, red-breasted merganser, and hooded merganser. Other migratory game birds found in coastal marshes include the king, Virginia, and sora rails along with the American coot, purple moorhen, common moorhen, and common snipe.

Marshes and associated shallow open water areas in the project area provide habitat for a number of wading birds, shorebirds, and other nongame birds. Flooded fields are especially valuable to wildlife when they are located adjacent to flooded bottomland hardwood forests because they provide nocturnal roosting sites for many species. The

resident mottled duck, which nests in fresh to brackish marshes, is found throughout the year. Common wading bird species which utilize the project area include the little blue heron, the great blue heron, green-backed heron, yellow-crowned night heron, black-crowned night heron, great egret, snowy egret, cattle egret, white-faced ibis, white ibis and roseate spoonbill. Mudflats and shallow-water areas provide habitat for numerous species of shorebirds and seabirds. Shorebirds include the killdeer, black-necked stilt, and common snipe. Wading bird nesting colonies may occur within in the study. Other nongame birds such as boat-tailed grackle, red-winged blackbird, northern harrier, bald eagle, belted kingfisher, and sedge wren also utilize coastal marsh areas.

Forested wetlands and scrub-shrub areas provide habitats for songbirds such as the mockingbird, yellow-billed cuckoo, northern parula, yellow-rumped warbler, prothonotary warbler, white-eyed vireo, Carolina chickadee, and tufted titmouse. Additionally, these areas also provide important resting and feeding areas for songbirds migrating across the Gulf of Mexico. Other avian species found in forested wetlands include the American woodcock, common flicker, brown thrasher, white-eyed vireo, belted kingfisher, pileated woodpecker, red-headed woodpecker, downy woodpecker, common grackle, and common crow. Numerous other bird species use forested wetlands throughout the study area.

Forested habitats and associated waterbodies also support raptors such as the red-tailed hawk, red-shouldered hawk, Mississippi kite, northern harrier, screech owl, great horned owl, and barred owl. Wading bird colonies typically occur in cypress swamp and scrub-shrub habitat. Species found in those nesting colonies include great egret, white ibis, black-crowned night heron, tricolored heron, little blue heron, snowy egret, white-faced ibis, and glossy ibises. Waterfowl species found in forested wetlands and adjacent waterbodies in the project area include, but are not limited to, wood duck, mallard, green-winged teal, gadwall, and hooded merganser.

The construction of levees and borrow canals can result in temporary and/or permanent impacts to migratory birds and the habitats upon which they depend for various life requisites. The Service has concerns regarding the direct and cumulative impacts resulting from the loss and fragmentation of forest and grassland habitats, and the direct and indirect impacts that these losses will have upon breeding migratory birds of conservation concern within the Mississippi Alluvial Valley Bird Conservation Region (http://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf). Many migratory birds of conservation concern require large blocks of contiguous habitat to successfully reproduce and survive.

In Louisiana, the primary nesting period for forest-breeding migratory birds occurs between April 15 and August 1. Some species or individuals may begin nesting prior to April 15 or complete their nesting cycle after August 1, but the vast majority nest during this period. The proposed project may directly impact migratory birds of conservation concern because habitat clearing that occurs during the aforementioned primary nesting period may result in unintentional take of active nests (i.e., eggs and young) in spite of all reasonable efforts to avoid such take. The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except

when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing incidental take, the Service recognizes that some birds may be taken during project construction/operation even if all reasonable measures to avoid take are implemented.

In addition to the direct loss of grassland and forested habitat, the proposed project may indirectly impact migratory birds of conservation concern because construction of large-scale projects within forested habitats typically results in habitat fragmentation. Forest fragmentation may contribute to population declines in some avian species because fragmentation reduces avian reproductive success (Robinson et al. 1995). Fragmentation can alter the species composition in a given community because biophysical conditions near the forest edge can significantly differ from those found in the center or core of the forest. As a result, edge species could recruit to the fragmented area and species that occupy interior habitats could be displaced. The fragmentation of intact forests could have long-term adverse impacts on some forest interior bird species.

The primary impact to forest habitat conditions from the proposed project would result from the conversion of forest habitat to levees and open water borrow sites. We recommend that the Corps avoid impacts to forested areas (particularly those containing a hardwood species component) to the maximum extent practicable.

2.3.2 Mammals

The study area provides important habitat for several species of mammals, reptiles and amphibians. Mammals occurring within the study area include nutria *(Myocastor coypus)*, muskrat *(Ondatra zibethicus)*, American mink *(Neovison vison)*, river otter *(Lontra canadensis)*, and raccoon *(Procyon lotor)*, all of which are commercially important furbearers. Game mammals associated with the study area include feral hogs, eastern cottontail *(Sylvilagus floridanus)*, swamp rabbit *(Sylvilagus aquaticus)*, gray squirrel *(Sciurus carolinensis*), fox squirrels *(Sciurus niger)*, and white-tailed deer *(Odocoileus virginianus)*. Other mammals found in forested wetlands include striped skunk *(Mephitis mephitis)*, coyote *(Canis latrans)*, Virginia opossum *Didelphis virginiana)*, bobcat *(Lynx rufus)*, nine banded armadillo *(Dasypus novemcinctus)*, gray fox *(Urocyon cinereoargenteus)*, and red bat *(Lasiurus borealis)*. Smaller mammal species serve as forage for both mammalian and avian carnivores and include the cotton rat, marsh rice rat (*Oryzomys palustris)*, white-footed mouse *(Peromyscus leucopus)*, eastern wood rat *(Neotoma floridana)*, harvest mouse *(Micromys minutus)*, least shrew *(Cryptotis parva*), and southern flying squirrel *(Glaucomys volans)*.

2.3.3 Reptiles and Amphibians

Reptiles and amphibians are fairly common in the low-salinity brackish marshes found within the study area and include the American alligator *(Alligator mississippiensis)*, western cottonmouth *(Agkistrodon piscivorus leucostoma)*, water snakes, mud snake, speckled kingsnake *(Lampropeltis getula)*, ribbon snake *(Thamnophis sauritus)*, rat snake, red eared turtle *(Trachemys scripta elegans)*, common snapping turtle *(Chelydra serpentine)*, eastern mud turtle *(Kinosternon subrubrum)* and soft shell turtles.

Reptiles which utilize study area bottomland hardwoods, cypress swamps, and associated shallow water include the American alligator *(Alligator mississippiensis)*, ground skink *(Scincella lateralis)*, five-lined skink *(Plestiodon fasciatus)*, broad-headed skink *(Plestiodon laticeps)*, green anole *(Anolis carolinensis)*, Gulf coast ribbon snake *(Thamnophis proximus)*, yellow-bellied water snake *(Nerodia erythrogaster)*, speckled kingsnake *(Lampropeltis getula)*, southern copperhead *(Agkistrodon contortrix)*, western cottonmouth *(Agkistrodon piscivorus leucostoma)*, pygmy rattlesnake *(Sistrurus miliarius)*, broad-banded water snake *(Nerodia fasciata confluens)*, diamond-backed water snake *(Nerodia rhombifer)*, spiny softshell turtle *(Apalone spinifera)*, red-eared turtle *(Trachemys scripta elegans)*, southern painted turtle *(Chrysemys picta)*, Mississippi mud turtle *(Kinosternon subrubrum)*, stinkpot (*Sternotherus odoratus)*, common snapping turtle *(Chelydra serpentina*) and alligator snapping turtle *(Macrochelys temmincki)*, in addition to numerous other species.

Some of the amphibians believed to be in study-area forested wetlands include dwarf salamander (*Eurycea quadridigitata)*, three-toed amphiuma (*Amphiuma tridactylum)*, lesser western siren (*Siren intermedia)*, central newt (*Notophthalmus viridescens)*, Gulf coast toad (*Incilius valliceps)*, eastern narrow-mouthed toad (*Gastrophryne carolinensis)*, green treefrog (*Hyla cinerea)*, squirrel treefrog (*Hyla squirella)*, pigfrog (*Lithobates grylio)*, bullfrog (*Lithobates catesbeianus)*, southern leopard frog (*Lithobates sphenocephalus)*, bronze frog (*Rana clamitans)*, upland chorus frog (*Pseudacris feriarum)*, southern cricket frog (*Acris gryllus)*, spring peeper (*Pseudacris crucifer)* sirens, and several species of toads.

2.4 Threatened and Endangered Species and Other Protected Species

To aid the USACE in complying with proactive consultation responsibilities under the Endangered Species Act, the USFWS provided a Planning Aid Letter dated 31 January 2019 which lists those threatened and endangered species and their critical habitats within the study area. Species addressed as being of concern for being found in or near the study area include the pallid sturgeon and the West Indian manatee. While pallid sturgeon are a riverine species and not likely to be of concern within the project area, the Service expressed concern about any dredging in the Mississippi River, which could potentially impact the species. The West Indian manatee is sometimes seen in the coastal waters of Louisiana, as their range extends throughout the coast of the Gulf of Mexico, into the waters off the Yucatan peninsula, and throughout the Caribbean.

2.4.1 West Indian Manatee (*Trichechus manatus*)

The West Indian manatee is one of the largest coastal mammals in North America. Manatees are classified as a marine species but they require access to deep water and freshwater, and thus can be found in inland rivers, coastal estuaries, seagrass beds, and marinas (Marmontel et al., 1997). Preferred habitats include areas near the shore featuring underwater vegetation like seagrass and eelgrass. Manatees range widely in between fresh, brackish, and marine waters throughout the Gulf of Mexico, Caribbean, and South America and cannot tolerate temperatures below 68 degrees Fahrenheit for extended periods of time. During the winter months colder temperatures keep the population concentrated in peninsular Florida. (USFWS) Many manatees rely on the

warm water from natural springs and they are known to sometimes congregate in and around water control structures and the warm wastewater discharge of power plants. During the summer, manatees expand their range, and on rare occasions are seen as far north as Massachusetts on the Atlantic coast and as far west as Texas on the Gulf coast.

Encounters with recreational and commercial watercraft significantly reduced the population levels of manatees along the Gulf coast and in 1967, the manatee was listed under the Endangered Species Act with critical habitat designated in 1976. In 2017, the manatee was reclassified from endangered to threatened in response to a rebound in population. Manatees are also protected under the Marine Mammal Protection Act, which prohibits the take (i.e., harass, hunt, capture, or kill) of all marine mammals.

Figure 8: West Indian Manatee

Photo source: https://www.livescience.com/53381-west-indian-manatees-rebound.html

2.4.2 Pallid sturgeon (*Scapirhynchus albus*)

The pallid sturgeon is listed as a federally endangered species. It is an ancient species of fish that requires large, turbid, free-flowing riverine habitat with rocky or sandy substrate. They are usually found on the bottoms of the rivers on sand flats or gravel bars, and appear to prefer areas with strong currents in or near the main channel. The pallid sturgeon is one of the largest and rarest fish in the Mississippi and Missouri River basins. Pallid sturgeon are opportunistic feeders and forage on insects, crustaceans, mollusks, annelids, fish and eggs of other fish. Scant information exists on the range and habitat preferences of pallid sturgeon for this part of the Mississippi River. Most of the collected data is from populations in upper Missouri and other Midwest rivers, as well as the Atchafalaya River in Louisiana, however, it is possible that limited numbers of the species also exist in the Red River.

Figure 9: Pallid Sturgeon

Photo source: https://www.fws.gov/mountain-prairie/es/pallidSturgeon.php

2.4.2.1 At-Risk Species

The Service's Southeast Region has defined "at-risk species" as those that are:

1) Proposed for listing under the ESA by the Service;
2) Candidates for listing under the ESA, which means the species has a "warranted but precluded 12-month finding"; or
3) Petitioned for listing under the ESA, which means a citizen or group has requested that the Service add them to the list of protected species. Petitioned species include those for which the Service has made a substantial 90-day finding as well as those that are under review for a 90-day finding.

Discussed below are species currently designated as "at-risk" that may occur within the project area. While not all species identified as at-risk will become ESA listed species, typically their reduced populations warrant their identification and attention in mitigation planning.

2.4.2.1.1 Eastern Black Rail (*Laterallus jamaicensis ssp.*)

The eastern black rail, an at-risk species, is the smallest of North America's rail species. It has a broad distribution inhabiting higher elevations of tidal marshes and freshwater

wetlands throughout the Americas. The eastern black rail breeds from New York to Florida along the Atlantic Coast and in Florida and Texas along the Gulf Coast. There is little known about the spring and fall migration as well as wintering distribution of the eastern black rail, but it has been documented to winter on the Gulf Coast from southeast Texas to Florida.

Figure 10: Eastern Black Rail

Photo source: https://www.fws.gov/southeast/wildlife/birds/eastern-black-rail/

Winter habitat for the eastern black rail is presumed to be similar to breeding habitat. They are found in a variety of salt, brackish, and freshwater marsh habitats that can be tidally or non-tidally influenced. Plant structure is considered more important than plant species composition in predicting habitat suitability (Flores and Eddleman, 1995). In Louisiana, occurrences have been documented in high brackish marsh vegetated with saltgrass (*Distichlis spicata),* sea oxeye *(Borrichia frutescens)*, gulf cordgrass (*Spartina spartinae*) and saltmeadow cordgrass (*S. patens)* and often interspersed with shrubs such as marsh elder (*Iva frutescens*) or saltbush (*Baccharis hamilifolia*). The high marsh is only inundated during extreme high tide events. In general, the character of the high marsh is a short grassy savannah. It may also occur in working wetland habitats such as rice fields.

2.4.2.1.2 Alligator Snapping Turtle (*Macrochelys temminckii*)

The alligator snapping turtle occurs in waterways that drain into the Gulf of Mexico. Although the species range is large, population densities are likely low throughout the range. They occur in various habitats including rivers, oxbows, lakes, and backwater swamps adjacent to large rivers. It is most common in freshwater lakes and bayous, but also found in coastal marshes and sometimes in brackish waters near river mouths. Typical habitat is mud bottomed waterbodies having some aquatic vegetation. The

alligator snapping turtle is slow growing and long lived. Sexual maturity is reached at 11 to 13 year of age. Because of this and its low fecundity, loss of breeding females is thought to be the primary threat to the species. Threats include habitat alteration, exploitation by trappers, pollution, and pesticide accumulation (IUCNredlist.org).

Figure 11: Alligator Snapping Turtle

Photo source: https://www.cbsnews.com/news/alligator-snapping-turtle-found-southern-illinois-creek/

2.4.2.1.3 Golden-Winged Warbler (*Vermivora chrysoptera*)

The golden-winged warbler breeds in higher elevations of the Appalachian Mountains and northeastern and north-central U.S. with a disjunct population occurring from southeastern Ontario and adjacent Quebec northwest to Minnesota and Manitoba. Wintering populations occur in Central and South America. The loss of wintering habitat in Central and South America and migratory habitat may also contribute to its decline. The golden-winged warbler is also known to hybridize with the blue-winged warbler (*Vermivora cyanoptera*).

This species may be found in forested habitats throughout Louisiana during spring and fall migrations. This imperiled songbird is dependent on forested habitats along the Gulf, including coastal Louisiana, to provide food and water resources before and after trans-Gulf and circum-Gulf migration. Population declines correlate with both loss of habitat owing to succession and reforestation and with expansion of the blue-winged warbler into the breeding range of the golden-winged warbler.

Figure 12: Female Golden Winged Warbler

Photo source: https://www.allaboutbirds.org/guide/Golden-winged_Warbler/id

Figure 13: Male Golden Winged Warbler

Photo source: https://www.allaboutbirds.org/guide/Golden-winged_Warbler/id

2.4.2.2 Migratory Birds and Other Trust Resources

2.4.2.2.1 Bald Eagle (*Haliaeetus leucocephalus*)

The proposed project area may provide nesting habitat for the bald eagle, 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 Migratory Bird Treaty Act (MBTA) and BGEPA. Comprehensive bald eagle survey data have not been collected by the Louisiana Department of Wildlife and Fisheries (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. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants. 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.

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 Bald and Golden Eagle Protection Act (BGEPA). A copy of the NBEM Guidelines is available at: http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf.

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); and
(3) avoiding certain activities during the breeding

Figure 14: Bald Eagle

Photo source: https://www.fws.gov/refuge/quivira/wildlife_and_habitat/bald_eagles.html

2.5 Aquatic Resources and Water Bottoms

Primary fresh and intermediate water bodies in the Barataria Basin include Lake Salvador, Lake Des Allemands, Lake Cataouatche, The Pen, Lake Boeuf and Bayous Boeuf, Des Allemands, Chevreuil, Grand (12 miles), Citamon, Segnette, and Bayou Verret. In addition, there are many miles of manmade canals throughout the basin including the Gulf Intracoastal Waterway and Barataria Waterway.

The Barataria Basin has undergone significant hydrological changes both natural and anthropogenic. Historically the Mississippi River was the source of freshwater, nutrients and sediment for the basin. The construction of Mississippi River main line levees and the closure of Bayou Lafourche at Donaldsonville ceased the input of freshwater and sediment. Navigation canals like the Barataria Waterway, Wilkinson Canal, the GIWW and the hundreds of miles of oil field canals plus natural processes such as subsidence and sea-level rise have increased saltwater intrusion and shoreline erosion.

Submerged aquatic vegetation (SAV) is the most significant form of complex cover for aquatic animals in Barataria Basin. Beginning in the 1950s, salt water intrusion contributed to SAV coverage declines in the middle and upper basin. In 2003, the U.S. Army Corps of Engineers Davis Pond Freshwater Diversion project began operation. Fresh water from the Mississippi River stimulated growth of submerged aquatic vegetation in the project outfall area. By 2007, Lake Cataouatche had an estimated 90% coverage of SAV. Species included eelgrass, coontail, milfoil and hydrilla.

Eutrophication of aquatic resources within the basin is an ongoing historical issue as the result of poor drainage, and lack of a groundwater connection. Riparian areas typically serve as a physical and chemical buffer for the capture of excess nutrients that fuel algal blooms that alter aquatic communities, but the excess phosphorous and nitrogen are still incredibly high, indicating their lack of ability to adequately mitigate the issue through natural cycling (Stow et al, 1985). Due to the extensive nutrient runoff from the numerous agricultural lands surrounding the study area and reliance on precipitation for wetland recharge, aquatic wildlife communities have and will continue to shift. Eutrophication within the study area reflects the impacts of the extensive levees built to prevent riverine input from the Mississippi river combined with the obstructed outflow due to the presence of US-90 across the middle of the basin.

2.5.1 Essential Fish Habitat (EFH)

As required by the Magnuson-Stevens Fishery Conservation and Management Act, all marine and estuarine waters of the northern Gulf of Mexico have been designated as Essential Fish Habitat (EFH). The 2005 amendments to the MSFCMA set forth a mandate for the NMFS of the National Oceanic and Atmospheric Administration, regional Fishery Management Councils (FMC), and other federal agencies to identify and protect EFH of economically important marine and estuarine fisheries. The MSFCMA (50 CFR 600) states that EFH is described as “those waters and substrate necessary for fish for spawning, breeding or growth to maturity” (16 United States Code [USC] 1802(10); 50 CFR 600.10).

A provision of the MSFCMA requires that FMCs identify and protect EFH for every species managed by a Fishery Management Plan (FMP) 16 USC 1853. The public places a high value on seafood and recreational and commercial opportunities provided by EFH. Specific categories of EFH include all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities), subtidal vegetation (seagrasses and algae), and adjacent intertidal vegetation (marshes and mangroves).

In the northern Gulf of Mexico, EFH has generally been defined as "areas where individual life-stages of specific federally-managed species are common, abundant or highly abundant". In estuarine areas, EFH is defined as "all estuarine waters and substrates (mud, sand, shell, rock and associated biological communities), including the subtidal vegetation (submerged aquatic vegetation and algae) and adjacent intertidal vegetation (marshes and mangroves)". To assist in meeting our consultation requirements, the National Marine Fisheries Service local field office reviewed the study area and provided comments on 30 January 2019 that identified the following species as being of concern for this study: brown shrimp, white shrimp, and red drum.

In their Draft CAR, USFWS stated that the proposed stoplog water control structure on the Godchaux Canal would reduce the canal width from 125 feet to 15 feet (82% reduction when structure open). Consequently, this structure may reduce fishery access to fresh marsh areas southwest of that structure. The Bayou Des Allemands floodgate may also reduce water exchange and fisheries access. Additional channel cross-section information is needed to assess this possible impact.

2.5.1.1 Red drum (*Sciaenops ocellatus*)

Red drum is an important recreational gamefish found in coastal waters throughout the Gulf of Mexico (Matlock, 1987; Exec. Order No. 13449, 2007). Adults inhabit nearshore waters, particularly areas within the surf zone or in the vicinity of inlets (Matlock, 1987). Spawning occurs in nearshore areas, and eggs and larvae are transported by tides and wind currents into estuaries (Matlock, 1987; Brown et al, 2004). Larvae and juveniles typically occupy estuarine environments until maturation (Matlock, 1987; Bachelor, 2008). Red drum are predatory in all stages of life; however, the type of prey consumed varies with life stage. Early juvenile red drum primarily consume small marine invertebrates including mysids and copepods, while adults feed on large marine invertebrates, including shrimp and crabs, and small fishes (Bass and Avault Jr., 1975).

Figure 15: Red Drum

Photo source: https://www.seagrantfish.lsu.edu/biological/drum/reddrum.htm

2.5.1.2 Brown shrimp (*Farfantepenaeus aztecus*) and White Shrimp (*Litopenaeus setiferus*)

Brown shrimp and white shrimp are two species of prawns found in the study area and serve as an important commercial resource in Louisiana. Brown shrimp spawn on the Gulf of Mexico continental shelf, and then drift toward the shore, before eventually returning to the continental shelf to reproduce (Li and Clarke, 2005). The white shrimp lifecycle follows a similar pattern, with the primary difference being brown shrimp usually spawn earlier in the year, and are most abundantly harvested in May, June and July whereas white shrimp are most abundantly harvested in August, September, and October. (Baker et al, 2014). Marshes in and adjacent to the study area serve as a nursery for both species of shrimp and harvests are regulated by the Louisiana Department of Wildlife and Fisheries.

Figure 16: Brown shrimp

Photo source: https://www.fisheries.noaa.gov/species/brown-shrimp

Figure 17: White Shrimp

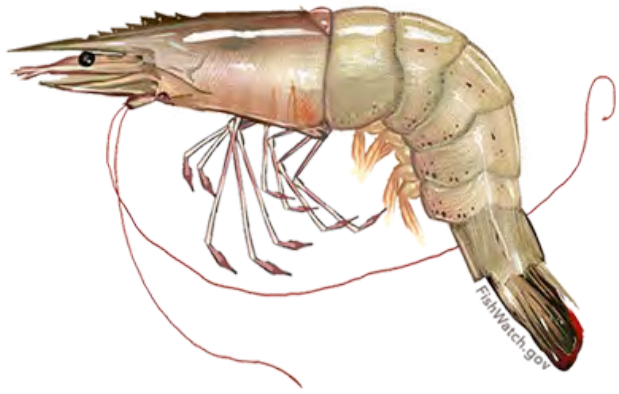


Photo source: https://www.fisheries.noaa.gov/species/white-shrimp