

National Park Service

National Park Service
U.S. Department of the Interior



Jean Lafitte

National Historical Park and Preserve
Louisiana



Debris Removal and Dredging of Canoe Trails within the Barataria Preserve, Jean Lafitte National Historical Park and Preserve

Environmental Assessment

May 2008

ENVIRONMENTAL ASSESSMENT

FOR

DEBRIS REMOVAL AND DREDGING OF CANOE TRAILS WITHIN THE BARATARIA PRESERVE, JEAN LAFITTE NATIONAL HISTORICAL PARK AND PRESERVE

SUMMARY

Jean Lafitte National Historical Park and Preserve proposes to remove debris and dredge detritus from canoe trails at the Barataria Preserve. The need for this project stems from the wide-spread damage caused by Hurricanes Katrina and Rita in August and September 2005, respectively. Strong winds and intense storm surge resulted in the snapping and uprooting of thousands of trees and extensive flooding and erosion throughout the Barataria Preserve. Since the storms, debris (including trees, limbs, household garbage, barrels, boats, hazardous materials, etc.) and detritus (organic debris formed by the decomposition of plants and animals) have not been removed and continue to interfere with park operations. Debris and detritus have rendered some waterways unusable and is impacting law enforcement, resource management, and interpretive activities. In addition, closure of these canoe trails has reduced recreational opportunities for park visitors. The proposed project would remove debris with the aid of mechanized equipment and remove detritus with a dredge. Woody debris would be cut into small pieces and left along the bank to rot while non-biodegradable material would be removed and disposed of properly offsite. Due to the size and weight of debris, a marsh buggy with a claw attachment is needed to move material. Detritus would be removed from waterways using a hydraulic dredge and material would be pumped into the surrounding wetlands as a thin layer of slurry. This process would mimic naturally occurring over-bank flooding which is common during periods of high water. Overbank flooding is responsible for providing nutrients to adjacent wetland vegetation and adding sediments to combat subsidence. This process is necessary to maintain the natural system and ensure adequate habitat quality for wildlife.

Evaluated in this Environmental Assessment are three alternatives: a no action alternative and two action alternatives. The action alternatives involve: 1) removing only debris, and 2) removing debris and dredging detritus.

This Environmental Assessment has been prepared in compliance with the National Environmental Policy Act to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet project objectives, 2) evaluates the potential issues and impacts to the Barataria Preserve's resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics that would be impacted by these alternatives include geology and soils, vegetation, fish and wildlife, wetlands and floodplains, hydrology and water quality, archeological resources, ethnographic resources, and visitor use and experience. No major impacts and/or resource impairment is anticipated as a result of this project. Internal and public scoping was conducted to assist with the development of this document and the alternatives.

PUBLIC COMMENT

If you wish to comment on the Environmental Assessment, you may mail comments to the name and address below or enter them online at the National Park Service Planning, Environment, and Public Comment website (<http://parkplanning.nps.gov/>). This Environmental Assessment would be on public review for 30 days. Please note that names and addresses of people who comment become part of the public record. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we would be able to do so. We would make all submissions from organizations, businesses, and from individuals identifying themselves as representatives or officials of organization or businesses available for public inspection in their entirety.

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U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
JEAN LAFITTE NATIONAL HISTORICAL PARK AND PRESERVE
BARATARIA PRESERVE

ENVIRONMENTAL ASSESSMENT
FOR
DEBRIS REMOVAL AND DREDGING OF CANOE TRAILS

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PURPOSE AND NEED

INTRODUCTION

The Barataria Preserve of Jean Lafitte National Historical Park and Preserve (JELA) is located in southeast Louisiana, approximately 15 miles from downtown New Orleans. Despite its close proximity to a metropolitan area, the Barataria Preserve exhibits exceptional examples of natural and cultural resources reflective of the Mississippi River delta. The park's location also makes it vulnerable to natural and man-made forces and the intensity of natural events is strengthened by previous man-made actions. Wide-spread damage that was caused by two severe hurricanes in 2005 is still evident at the park. The effects of Hurricanes Katrina and Rita have inhibited park activities and they continue to linger. While most park operations have resumed to normal, some areas and activities are still restricted due to hurricane damage.

PURPOSE OF AND NEED FOR ACTION

The purpose of this Environmental Assessment (EA) is to present and evaluate alternatives available for maintaining and re-opening canoe trails (which includes trenasses) at the Barataria Preserve. Canoeing is an important recreational activity that was specifically addressed in the JELA General Management Plan (National Park Service 1982). Currently, some trails are unusable due to the accumulation of detritus and hurricane generated debris, thus rendering them unnavigable to the public and park staff. The Barataria Preserve's canoe trails offer visitors the opportunity to visit swamp and marsh communities that are unique to the Mississippi River delta and experience the significant examples of natural and historical resources for which the park was established. Access to these areas by non-motorized, shallow-draft boat, such as canoe, kayak, or pirogue, provides experiences that are qualitatively different from the opportunities available on walking trails located elsewhere within the Barataria Preserve. The three alternatives presented in this document are as follows:

- Alternative A - No Action Alternative: No removal of hurricane debris or dredging of detritus from the canoe trails
- Alternative B: Hurricane debris removal only from canoe trails
- Alternative C: Hurricane debris removal and dredging of detritus from canoe trails

Since the Barataria Preserve is located in a highly populated area, approximately 100,000 local and out of town visitors recreate in the park annually. Within the boundary, are approximately 7 miles of roads, 30 miles of waterways, and 10 miles of foot trails. Parking lots, restrooms, picnic areas, and canoe launches are scattered throughout the park and are available year-round for

public use. To facilitate interpretive opportunities, a visitor center and education center were constructed. Examples of recreational activities enjoyed by park visitors include hiking, canoeing, wildlife viewing, photography, hunting, fishing, and trapping.

In August and September 2005, Hurricanes Katrina and Rita, respectively, severely impacted the Barataria Preserve. Damage caused by the storms forced a park closure for nearly two months while repair efforts were underway. While most of the repairs to facilities and trails are completed, some trails remain closed indefinitely. In addition to affecting visitor use, these storms transformed the natural landscape when their strong winds and high storm surge descended on the area. Hurricane Katrina's wind gusts, estimated at 130 miles per hour, ripped through forested areas uprooting trees and snapping trunks and limbs of those that remained standing. Numerous trees along the banks of waterways were tipped over and overhanging limbs broke off and fell into waterways. The lack of surface water movement allowed floating aquatic plant species a calm environment in which to thrive. Rapid plant growth and little water movement resulted in waterways that are covered with floating exotic plants which prevent navigation and degrade water quality.

Three weeks after Hurricane Katrina, Hurricane Rita again unleashed a fury on the Barataria Preserve. Despite making landfall on the other side of the state, the park was affected by a 5 to 7-foot storm surge which flooded the entire park. Flooding caused extreme canal bank erosion and was a vector that brought in debris from surrounding areas.

DESCRIPTION AND SIGNIFICANCE OF THE PARK

Significance of the Barataria Preserve

JELA was established by an Act of Congress on November 10, 1978 (Public Law 95-625) to "... preserve for the education, inspiration, and benefit of present and future generations significant examples of natural and historical resources of the Mississippi Delta region and to provide for their interpretation in such manner as to portray the development of cultural diversity in the region." JELA consists of three separate units, the Crescent City Unit (including the French Quarter site, Chalmette National Cemetery and Battlefield), the Barataria Preserve Unit, and the Acadian Unit (including Cultural Centers in Eunice, Lafayette, and Thibodaux, Louisiana)(Figure 1). Each of these sites provides a diversity of valuable natural and cultural resources which are preserved and interpreted by the National Park Service (NPS).

The Crescent City Unit consists of the French Quarter site which houses administrative offices and a Visitor Center, the Chalmette National Cemetery is the final resting place for more than 15,000 soldiers, and the Chalmette Battlefield which is the site of the 1815 Battle of New Orleans and is managed as a historically significant cultural landscape. The 20,000-acre Barataria Preserve is the largest "natural area" managed by JELA. The Acadian Unit interprets the Acadian culture of the Mississippi delta region at three small areas with visitor centers.



Figure 1. Locations of Jean Lafitte National Historical Park and Preserve Units.

Description of the Barataria Preserve

The Barataria Preserve is rich in natural and cultural resources that typify the Mississippi River delta and is located in an ecologically rich area of the United States (Figure 2). Images of winding bayous with Spanish moss dangling from baldcypress trees, wide expanses of marsh, and closed canopy forests are common. The rich deltaic soils that were formed thousands of years ago support a unique diversity and abundance of flora and fauna which led to human settlement and utilization of the resources in this area. The backbone of the Barataria Preserve is an abandoned distributary channel of the Mississippi River and its flanking natural levees. The levees are ribbons of firm alluvial soils, the only ground above sea level, on which grows a hardwood forest of ridge and bottomland species. On the backslopes of these natural levees, where the soils are inundated much of the year, grows a baldcypress-water tupelo swamp forest. Portions of both the ridge and swamp forests are nearing maturity and both contain a number of ancient specimens. The Barataria Preserve's forest is among the finest examples remaining in the delta of this original forest ecosystem. The Barataria Preserve's marshes occur beyond the swamps, where alluvial soils have subsided well below sea level. Above this sunken surface, generations of marsh plants laid down a layer of peat, often many feet thick. The peat supports a unique floating marsh, known as *floatant*.

The Barataria Preserve anchors the eastern end of one of the largest regions of floating marsh in the world, stretching westward across the delta in a broad, intermittent band to the Atchafalaya basin. In places within the Barataria Preserve, the floatant is so thick that it supports a unique floating community of shrubs and small trees; elements of this community have their closest affinities fifty miles to the north, in the pine savannahs north of Lake Pontchartrain.

Wildlife is particularly abundant in the delta and each of these communities supports a characteristic fauna. Sub-tropical warmth, high rainfall, and fertile soils combine to create a

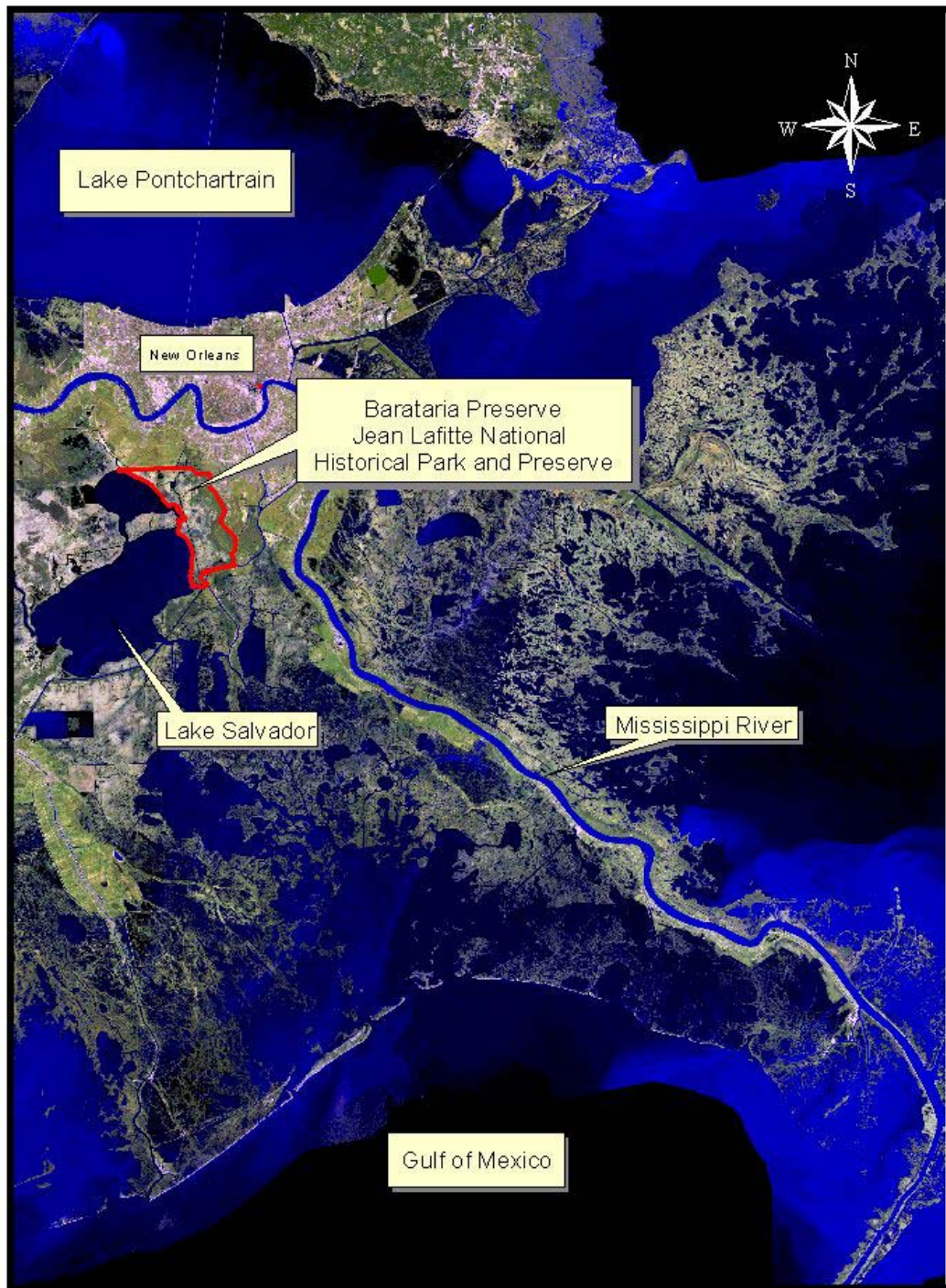


Figure 2. Location of the Barataria Preserve in southeast Louisiana.

highly productive ecosystem. Important components include furbearers, wading birds, wintering waterfowl, neotropical migrant songbirds, reptiles, amphibians, and estuarine fish. Invertebrate primary consumers, including crawfish, crabs, and shrimp, help anchor an intricate food chain that supports the more visible wildlife and are important to the commercial fishing industry.

This fertile estuarine system has provided a rich matrix for human beings throughout its short geologic existence. Within the Barataria Preserve, are prehistoric sites representing a nearly complete chronology of habitation within the Mississippi Delta dating back more than 2,000 years. These sites include major ceremonial mounds, village midden complexes, and dozens of smaller sites. Historic sites date back to the late 18th century and include colonial and plantation era agricultural remains, a late-19th and early-20th century commercial swamp-logging canal system, the ditch system excavated by trappers (trennasses), and 20th century oil and gas exploration roads and canals. These sites are part of the Barataria Historic District on the National Register of Historic Places. The Barataria Preserve's trail system uses this historic overlay of roads, levees, and canals to provide access to its natural communities. Despite the natural and cultural importance of the Barataria Preserve, changes in the environment are degrading the natural system. Suburban development, oil and gas exploration, land subsidence, erosion, and extreme weather events are just some of the forces that are shaping the Barataria Preserve. In 2005, Hurricanes Katrina and Rita had a profound effect on the parks natural and cultural resources and public use. While most foot trails, parking lots, and interpretive centers have been cleared of debris and reopened, some foot and canoe trails and waterways remain closed and hazardous to navigate. Extreme winds and storm surge produced by the hurricanes resulted in many downed trees, increased sediment loading, erosion, and an increase in the amount of debris in waterways.

Description of Canoe Trails

Canoe trails (figure 3) offer the public a unique experience to immerse themselves in the parks resources. These trails are restricted to non-motorized boats in order to prevent conflict among boaters and enhance the public's experience. A description of the Barataria Preserve's canoe trails is listed below. For the purposes of this document, trenasses are included as canoe trails.

Bayou des Familles (length: 3.6 miles)

Bayou des Familles, some 2,000 years ago was a major distributary of the Mississippi River, carrying the sediments, which built this portion of the delta. The Spanish Government provided land grants for a Canary Islander (or Isleños) settlement in the late 1700s. Hurricanes and floods eventually drove them away, but the bayou's name, des Familles, French meaning "of the Families," immortalizes their brief sojourn along the bayou's banks. Today, cut off by the great river's meandering, the bayou is now a shady, lazy waterway. Baldcypress, and water tupelo now stand in the filled channel.

Bayou Coquille (Length: 1.1 miles)

This bayou is named for the mounds of shells (middens) visible along its banks. These shells provide evidence of human settlement. Clams were a major part of the American Indian diet in this region. When the French moved into the area, they named the bayou, *coquille*, their word for shell. Bayou Coquille is the passage to the swamp. Water tupelo

and baldcypress cast shadows over the bayou. Old stumps of enormous baldcypress, remnants of logging times, are seen along the route.

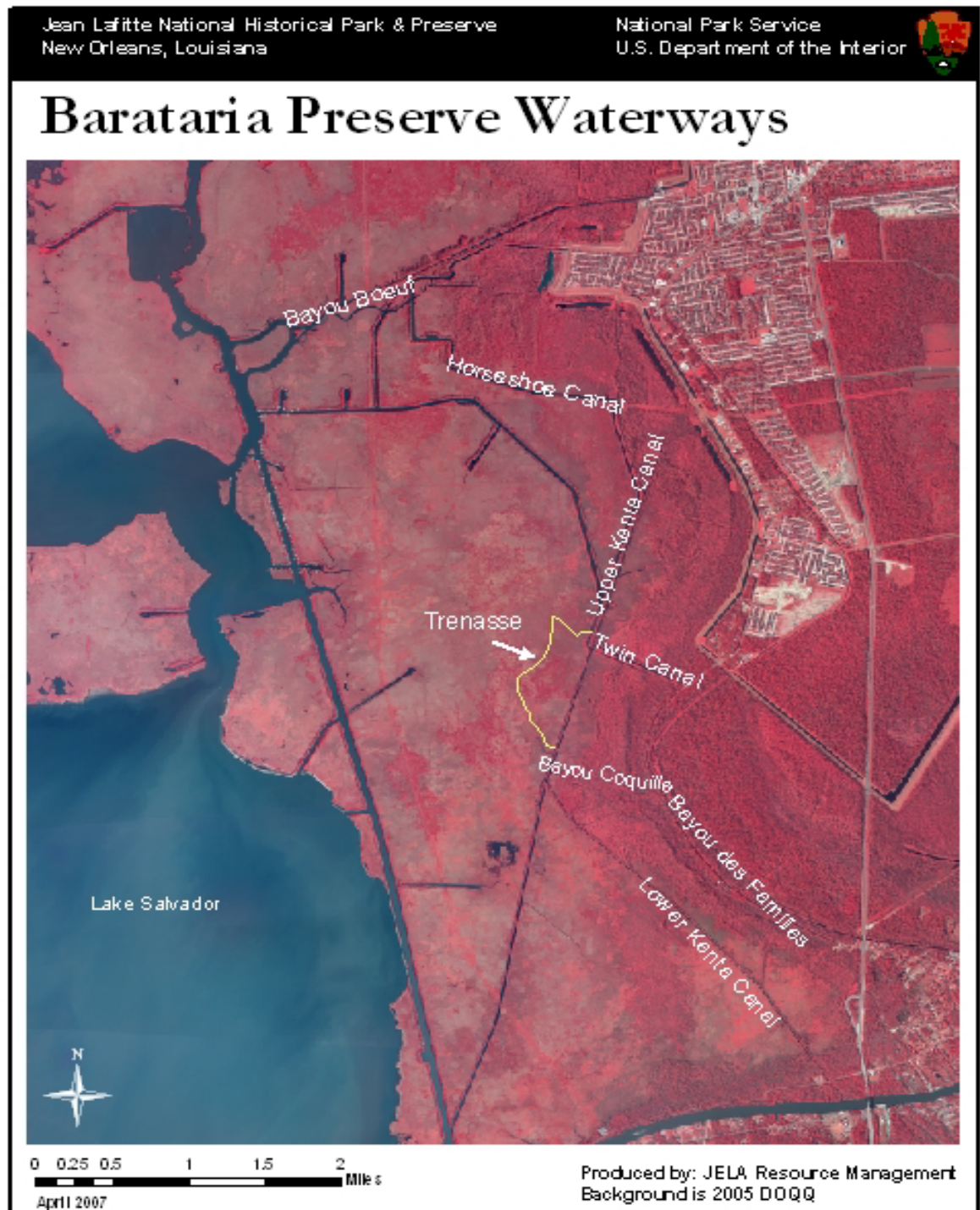


Figure 3. Location of Canoe Trails and Trenasse within the Barataria Preserve

Lower and Upper Kenta Canals (2.5 miles and 1.25 miles, respectively)

Located at the southern end of Lower Kenta Canal, near where it empties into Bayou Barataria (part of the Intracoastal Waterway) is a public canoe launch. A local name for the canal is “Priest Canal” from the Catholic Church nearby. Kenta was the first name of a woman, who with her husband and family established a sugar cane plantation in the mid to late 1800s. The canal was dug to transport goods and supplies and also for drainage for the plantation. Near the canoe launch are ditches dug to drain the plantation fields now closed off. Other than these ditches it is difficult to ascertain the plantation. Later in the early 1900s, the canal was used to float baldcypress out of the swamp and to the saw mill. Today, this canal is a popular canoe trail.

In the late 1950s, an oil company dredged a portion of Kenta Canal. Along the canal are “cuts” that were dug by oil companies during exploration during the 1940s to 1970s. Though little or no oil or gas was discovered those canals are still visible as scars on the land. From the canal, visitors can see downtown New Orleans.

Twin Canals (length: $\frac{3}{4}$ miles)

The Twin Canals were dug in the 1970s to develop a subdivision. The project developed legal problems and was not completed. A pumping station built near the parking lot, would have drained water from the south canal, lifted it over the levee, and dumped it into the north canal (the navigable canal). Twin Canals intersects with Upper Kenta and is frequently used by hunters, fishermen, and recreational non-motorized boaters.

Trenasses (length: 1.4 miles)

Trenasses are pathways that were dug through the floating marsh by hunters and trappers in order to access interior areas. Because these channels were dug many years before the park was established, many have filled in with detritus and aquatic plants. Some are passable during high water in the winter time when floating aquatic vegetation senesces. While trenasses are found throughout the park, Fuller’s trenasse was constructed as a canoe trail to provide visitors an opportunity to be immersed in the floating marsh. Full of wildlife and unique vegetation, this trail provides a spectacular wildlife viewing experience.

Bayou Boeuf (length: 1 mile)

Bayou Boeuf meanders through marsh and cypress swamps habitats in the northern portion of the park. While this bayou was formed by natural processes, it now connects many man-made canals that are used by recreational boaters.

Horseshoe Canal (length: 2.3)

Horseshoe Canal is a narrow, scenic waterway that is only open to non-motorized boats. This canal is lined with spoil banks that have majestic live oaks draped with Spanish moss. On the backslope of the banks, is a healthy baldcypress swamp. Further along the canal are patches of floating marsh. This area is utilized annually by sportsman hunting white-tailed deer.

SCOPING

The scoping process is used to identify issues that need to be addressed in the environmental evaluation. This process also serves to explore alternatives that minimize and mitigate adverse impacts. Both internal scoping with park staff and external scoping with the public and interested parties were conducted.

Internal scoping was fulfilled by establishing an interdisciplinary team (IDT) of National Park Service (NPS) staff who are knowledgeable about the resources and issues discussed in this document; as well as, NPS management policies. IDT members defined the purpose and need, identified potential alternatives, and contributed to the analysis and identification of impacts of the proposed actions. Disciplines represented by IDT members include natural resources, cultural resources, interpretation, law enforcement, and park management.

External scoping was accomplished by displaying fliers about the project at the Barataria Preserve's Visitor Center, Twin Canals parking lot, and Bayou Coquille trailhead. Interested parties were encouraged to provide comment regarding the parks proposed alternatives to remove debris and detritus from waterways.

IMPACT TOPICS CONSIDERED

In accordance with Federal laws, regulations, orders, and planning documents, the impacts on natural and cultural resources, and visitor use and experience must be fully considered in this document. These include the National Historic Preservation Act, as amended in 1992 (16 USC 470 et seq.), the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), and the NPS's Director's Order #28, *Cultural Resource Management Guideline, Management Policies 2006*, and Director's Order #12, *Conservation Planning, Environmental Impact Analysis, and Decision Making*. The impact topics defined below were identified by IDT members familiar with the associated environment as issues and concerns that would be affected by the proposed alternatives. Impact topics relating to the existing environment and relevant to understanding the alternatives are included. Listed below is a brief narration about the topics that are considered in analysis, followed by a justification as to why particular topics were dismissed from analysis.

Geology and Soils

The Barataria Preserve is positioned within the upper Barataria estuarine basin between two distributary arms of the Mississippi River (the current main stem of the river and Bayou Lafourche). It straddles an older distributary arm, the Bayou des Familles-Bayou Barataria deltaic lobe that was built and abandoned by the Mississippi River roughly 3,500 to 1,500 years ago. The Bayou des Familles-Barataria distributary arm of the river is flanked by natural levees that were formed from annual spring (over-bank) flooding and depositional processes, averaging a height of approximately 5 feet above mean sea level. Breaks in the natural levee formed crevasses, such as Bayou Coquille, which in turn built sub-distributary lobes. The former distributary bed slowly filled with sediments as the river changed course, leaving only narrow tidal drainage streams, or bayous in the former distributary bed.

The land is actively subsiding because the current delta sits above thousands of feet of unconsolidated sediments deposited during previous delta-building episodes. Soil formation is the result of topography, climate, parent material, soil organisms, vegetation, and time. Four major soil types are found in the area: Sharkey-Commerce, Barbary muck, Lafitte-Clovelly and Kenner-Allemands. The Sharkey-Commerce soils are firm mineral soils that are associated with the natural levee and silt filled distributary channel. Barbary soils are associated with swamps as the semi-fluid mineral soils that were deposited on the backslope of natural levees. Lafitte-Clovelly soils are semi-fluid organic soils typically found in intermediate to saline marshes. Kenner-Allemands soils are characterized by layers of thick organic layers underlaid with thin clays, found in fresh marshes. Other soil types which are less represented include Schriever clay and Cancienne silty clay loam which are found in “Prime and Unique Farmlands.” The Schriever series consists of very deep, poorly drained, slowly permeable soils. They are typically found on the lower portions of natural levees in backswamp positions on the lower Mississippi River alluvial plain. The Cancienne series consists of very deep, level to gently undulating, somewhat poorly drained mineral soils that are moderately permeable. These soils are on high and intermediate positions on natural levees and deltaic fans of the Mississippi River and its distributaries.

Vegetation

More than 430 species of plants are known to exist in the Barataria Preserve (Louisiana State University, unpublished data). A comprehensive survey of vascular plants is currently in progress and expected to be completed by August 2008. The major plant communities are directly associated with the underlying geomorphologic features associated with the natural levee ridge, backslope and interlevee swamp and bottomland forest, and marsh. Ninety-five percent of the Barataria Preserve is classified as emergent and forested wetlands with principal habitat types consisting of bottomland hardwood forests, baldcypress swamp, and freshwater floating marsh. Along the alluvial soils of the natural levee is the only ground above sea level. This region supports native natural levee crest species consisting of water oak (*Quercus nigra*), live oak (*Quercus virginiana*), American elm (*Ulmus americana*), sweetgum (*Liquidambar styraciflua*), and hackberry (*Celtis laevigata*). Dwarf palmetto (*Sabal minor*) is the dominant understory plant species, interspersed with hawthorn (*Crataegus viridis*), and deciduous holly (*Ilex deciduas*). Forest gaps are colonized by Chinese tallow (*Triadica sebifera*), French mulberry (*Callicarpa americana*), and vines including poison-ivy (*Rhus toxicodendron*), dewberry (*Rubus* spp.), muscadine (*Vitis rotundifolia*), and trumpet creeper (*Campsis radicans*) and numerous grasses.

The backslopes of natural levees are cloaked with more water tolerant species, including swamp red maple (*Acer rubrum* var. *drummondii*) and green ash (*Fraxinus pennsylvanica*). On the backslope the understory is comprised primarily of taller specimens of dwarf palmetto. The backslope elevations descend into swampy areas where soils are inundated most of the year and baldcypress (*Taxodium distichum*) and tupelo gum (*Nyssa aquatica*) that are the dominant canopy species and interspersed with black willow (*Salix nigra*) and pumpkin ash (*Fraxinus profunda*). Wax myrtle (*Morella cerifera*) shrubs are often found in the understory of this area.

The marshes of the Barataria Preserve transpose from fresh to intermediate as they extend westward toward the shoreline of Lake Salvador. These marshes form the eastern side of the largest floating marsh complex in the world, which extends westward to the Atchafalaya Basin. This globally unique resource was formed as alluvial soils subsided below sea level. The marsh is nearly devoid of woody species, except for wax myrtle and a recent invasion of Chinese tallow. Dominant marsh plant species include bulltounge (*Sagittaria lancifolia*), wiregrass (*Spartina patens*), three-cornered grass (*Schoenoplectus americanus*), panic grass (*Panicum* spp.), spike rush (*Eleocharis* spp.), cattail (*Typha* spp.), and alligatorweed (*Alternanthera philoxeroides*).

Submerged and floating aquatic vegetation can be found in bayous, canals, open water ponds, shallow depressions, and in shallow waters along the Lake Salvador and Lake Cataouatche shorelines. Dominant submerged aquatic species include coontail (*Ceratophyllum demersum*), wild celery (*Vallisneria americana*), milfoil (*Myriophyllum* spp.), southern naiad (*Najas guadalupensis*), and pondweed (*Potamogeton* spp.). Dominant floating species include water hyacinth (*Eichhornia crassipes*), duckweed (*Lemna minor*), floating pennywort (*Hydrocotyle ranunculoides*), alligatorweed (*Alternanthera philoxeroides*), and common salvinia (*Salvinia minima*).

In addition to the diversity of native plants, the Barataria Preserve is plagued by a multitude of non-native plants. Many of these exotic plants are extremely invasive and rapidly out-compete native species, thus preventing natural regeneration of native species. Common non-native aquatic plants include water hyacinth, common salvinia, and alligatorweed. Terrestrial exotic plants and vines include Chinese tallow, Japanese climbing fern (*Lygodium japonicum*), camphor tree (*Cinnamomum camphora*), and Japanese honeysuckle (*Lonicera japonica*).

Wildlife

According to NPS *Management Policies 2006* (NPS 2006), the NPS strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals.

The rich estuarine environment of coastal Louisiana supports an abundance and diversity of wildlife. The Barataria Preserve's ecological complex of terrestrial and aquatic habitats provides a generous supply of habitat for resident and migratory wildlife. Recent inventories have been completed for mammals, birds, reptiles, amphibians, and fish.

Mammals

Terrestrial wildlife is particularly abundant throughout the Barataria Preserve. Subtropical warmth, plentiful rainfall and fertile soils combine to create a highly productive ecosystem that provides ample cover, food, and nesting sites for 26 species of mammals (Hood 2006). Commonly seen species reported in Hood's (2006) survey include opossum (*Didelphis virginiana*), eastern gray squirrel (*Sciurus carolinensis*), swamp rabbit (*Sylvagus aquaticus*), and nine-banded armadillo (*Dasypus novemcinctus*). Other species include white-tailed deer (*Odocoileus virginianus*), coyotes (*Canis latrans*), raccoon (*Procyon lotor*), mink (*Mustela vison*),

and river otter (*Lutra canadensis*). Seven species of bats utilize habitats within the Barataria Preserve for feeding, roosting, and nesting. Documented bat species includes southeastern myotis (*Myotis austroroparius*), eastern pipistrelle (*Pipistrellus subflavus*), eastern red bat (*Lasiurus borealis*), yellow bat (*Lasiurus intermedius*), evening bat (*Nycticeius humeralis*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), and the Brazilian free-tailed bat (*Tadarida brasiliensis*). During a recent survey, three non-native species were reported to occur on the park, including nutria (*Myocastor coypus*), black rat (*Rattus rattus*), and the house mouse (*Mus musculus*). Although wild pigs (*Sus scrofa*) once inhabited the park, intense control efforts have successfully removed them from the park.

Fish and Aquatic Invertebrates

Fisheries inventories have documented 66 species of freshwater and saltwater fish in the park (Seale 1999, Swarzenski et al. 2004, Schultz 2005). Diverse aquatic systems, including slow moving bayous, deep water canals, shallow water ponds, and lakes provide a wide range of habitat for fish and aquatic organisms. Interior ponds, bayous, and canals are classified as freshwater system, while the western boundary lakes and adjacent waters are slightly saltier with salinities averaging less than 5 parts per thousand. The assemblage of fish species at the park may be limited to those capable of withstanding harsh environmental conditions, including low dissolved oxygen levels, increased temperature, and fluctuations in salinity.

Most of the species found in the park are typical of those found in fresh to estuarine, slow moving warm water habitats in southeast Louisiana. In, or in waters adjacent to, Lake Cataouatche and Lake Salvador are species more tolerant of brackish, estuarine conditions. Some of the most common species found in the park include gar (*Lepisosteus* spp.), sunfish (*Lepomis* spp.), bass (*Micropterus* spp.), and catfish (*Ictalurus* spp.). Invertebrate species including crawfish, crabs and shrimp form the basis of a complex food web that supports more aquatic and terrestrial wildlife species. Many species are important to the recreational and commercial fisheries in southeast Louisiana.

Reptiles and Amphibians

During a recent inventory by Anderson and Seigel (2003), 16 species of amphibians and 32 species of reptiles were documented. Eastern newts (*Notophthalmus viridescens*), green treefrogs (*Hyla cinerea*), and bronze frogs (*Rana clamitans*) are the most common species of amphibians. The American alligator (*Alligator mississippiensis*), ground skinks (*Scinella lateralis*), green anoles (*Anolis carolinensis*), and the Gulf Coast ribbon snake (*Thamnophis proximus*) were identified as the most common species of reptiles. While few species could be considered habitat specialists, species richness is highest in cypress-tupelo swamps, medium in bottomland hardwood forests, and lowest in marsh habitats (Anderson and Seigel 2003).

Birds

The diversity and abundance of resident and migratory birds is reflective of the rich environment which provides nesting, wintering, and stopover habitat for over 300 species. Shallow mudflats, deep water lakes, bayous, and ponds provide a diverse habitat for waterbirds. Common species

of wading birds include great blue heron (*Ardea herodias*), great egrets (*Ardea alba*), ibis (*Plegadis* sp.), laughing gull (*Larus arcticus*), double crested cormorant (*Phalacrocorax auritus*), and common moorhen (*Gallinula chloropus*).

Wintering waterfowl begin arriving in the fall where they primarily utilize shallow water ponds and lakes for feeding, resting, and pair-bonding. Mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), green-winged teal (*Anas crecca*), blue-winged teal (*Anas discors*), and lesser scaup (*Aythya affinis*) are commonly seen wintering waterfowl. Resident mottled ducks (*Anas fulvigula*) utilize well drained sites for nesting during the spring and early summer and shallow water ponds for feeding during the rest of the year.

Numerous resident and migratory species of raptors can be seen flying over the forests and marsh during all times of the year. Common raptors include red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), osprey (*Pandion haliaetus*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), turkey vulture (*Cathartes aura*), and black vultures (*Coragyps atratus*).

The diverse forest structure provides ample feeding and nesting habitat for landbirds. Species breeding on the Barataria Preserve include Northern parula (*Parula Americana*), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), blue-gray gnatcatcher (*Polioptila caerulea*), American crow (*Corvus ossifragus*), and blue jay (*Cyanocitta cristata*).

Wetlands and Floodplains

For regulatory purposes under the Clean Water Act, the term wetlands refers to “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” More than 95% of the Barataria Preserve is classified as emergent and forested wetlands according to the 1992 U.S. Fish and Wildlife Service’s National Wetlands Inventory (NWI) (Cowardin et al. 1979). According to the NWI, the most common wetland systems found in the park are palustrine and estuarine, with less amounts of lacustrine and riverine. Common subsystems include palustrine emergent, palustrine forested, palustrine scrub-shrub and estuarine intertidal emergent.

Factors affecting the parks wetlands include sea level rise, subsidence, shoreline erosion, and climate extremes. The health of the floating marsh is highly dependent on the ability of plants to produce below ground roots which hold the marsh mat together. Since these plants have limited tolerance for prolonged exposure to salt, gulf waters must be kept at bay in order to maintain the integrity of this system. In order to combat the influence of saltwater from the Gulf of Mexico and Barataria Bay, the Davis Pond Freshwater Diversion was constructed to divert freshwater from the Mississippi River into the northern part of the Barataria Basin. When fully operational, the diversion is capable of pumping over 10,000 cubic feet per second of Mississippi River water into its outflow pond and adjacent Lake Cataouatche. This input of freshwater will ensure that salinity levels do not reach elevations capable of destroying freshwater marshes in the upper and middle portions of the basin. Operation of the diversion will mimic that of the natural flooding regime of the river.

Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid, where possible, adversely impacting wetlands. Further, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge or dredged or fill material or excavation within waters of the United States. NPS policies for wetlands as stated in *Management Policies 2006* and Director's Order #77-1: *Wetlands Protection*, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with Directors Order #77-1: *Wetlands Protection*, proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings for wetlands. Since the Barataria Preserve is located within the Coastal Management Zone, a Consistency Determination would be submitted to the Louisiana Department of Natural Resources before any action is taken.

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The NPS, under the direction of *Management Policies 2006* and Director's Order #77-2: *Floodplain Management* would strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order #77-2: *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a Statement of Findings for floodplains. All alternatives evaluated in this document are consistent with NPS policy that dictates the preservation of floodplain values and functions. The preferred alternative specifically supports the NPS policy that states "the Service will protect and preserve the natural resources and functions of floodplains." Since these alternatives are consistent with NPS policy and do not involve the development or occupancy of floodplains, a Statement of Findings is not required.

Hydrology and Water Quality

Hydrologic regimes of the Barataria Preserve have been noticeably altered by both natural and anthropogenic changes. Within the Barataria Preserve, there are 30 miles of waterways, including bayous, canals, trenasses, small ponds, and lakes. Agriculture, urban development, oil and gas exploration, canal construction, and levee building have eliminated over-bank flooding and converted these systems to those based primarily on weather and tides. Wetland loss and canal construction south of the park in the lower Barataria Basin, have provided avenues for saline waters from the Gulf of Mexico to enter freshwater wetlands in the upper portion of the basin. To combat this influx, the Davis Pond Freshwater Diversion was constructed. The purpose of the diversion is to pump freshwater from the Mississippi River into the upper portion of the basin and maintain the freshwater ecosystem. Since the park is located in the upper portion of the Barataria Basin, saltwater is more has more of an influence in areas south of the park in the lower reaches of the basin. Input of freshwater thru the Davis Pond Freshwater Diversion will ensure the 5ppt salinity gradient remains south of the park, thus protecting the freshwater ecosystem. Numerous large and small-scale restoration projects have been undertaken to repair degraded coastal wetlands and hydrologic regimes. The value of freshwater and sediment diversions has been recognized and construction of additional structures is outlined in numerous wetland restoration plans.

Altering the course of the Mississippi River and its extensive levee system has eliminated the river's natural flood cycle. Over-bank flooding was important in that it provided nutrients and sediments which fertilized land and helped combat subsidence. Levees, canal banks, and roads are primarily responsible for eliminating sheet flow and changing hydrologic regimes of Mississippi River distributaries, such as Bayou des Familles and Bayou Coquille.

The Barataria Preserve's close proximity to New Orleans has resulted in expanding suburban development immediately adjacent to the park boundary. High levels of nutrient from agricultural runoff and urban discharge and sediment inputs have contributed to the eutrophication of park waters (Conner and Day 1987). Dissolved oxygen levels are highly variable depending on location, time of year, and the amount of floating plant material. During the long growing season, the rapid growth of floating plants forms dense mats that clog waterways and impede the natural hydrologic regime. These mats impede navigation and degrade water quality. Reduced levels of dissolved oxygen may fall below the thresholds that result in mortality of fish and macro invertebrates. Baseline water quality parameters have been collected within the Barataria Preserve as early as 1983. The USGS monitored several stations in order to compare levels of pesticides and trace metals within the surface waters, marsh porewaters and bottom materials with historical conditions. Results do not indicate a significant change in water quality from 1983 to present (Swarzenski 2004).

Excessive accumulation of floating aquatic plants has led to a decrease in water quality. The subtropical warmth and long growing season provide ideal conditions for plants to grow and reproduce. Rapidly, plants colonize entire water bodies and form thick mats. Vegetation mats prevent light from penetrating the water column and alter water chemistry. These changes in water chemistry frequently result in low levels of dissolved oxygen, increased water temperature, and lower specific conductivity. Dissolved oxygen measurements taken in areas of dense floating vegetation is usually around 0.0 mg/l, which is well below the desired 5.0 mg/l level for supporting fish (Schultz 2006). Schultz (2006) reported the lowest concentrations of dissolved oxygen were found in the spring and summer months in Horseshoe Canal, Pipeline Canal, Wood's Place Canal, and Bayou des Familles.

Archeological Resources

In addition to the National Historic Preservation Act and the NPS *Management Policies 2006* (NPS 2006), the NPS Director's Order #28A: *Cultural Resource Management: Archeology*, affirms a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. As one of the principal stewards of America's heritage, the NPS is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations.

Because of the Barataria Preserve's rich cultural history, numerous archeological investigations have been conducted to document this history. Within the Barataria Basin, archeological investigations have documented human occupation from 500 B.C. to the present (Speaker et al. 1986). More than 150 prehistoric archeological sites have been discovered within the park boundary, ranging from the earliest Tchefuncte, through the Marksville, Troyville, Coles Creek,

Plaquemine, and Mississippian periods. Detailed information relating to archeological sites and their conditions can be found in reports by Holmes (1986), Speaker et al. (1986), Swanson et al. (1991), Yakubik et al. (1989). Over the years, many sites have suffered disturbance and degradation caused by recent human activities, flooding, land subsidence, and erosion. More recently, the severity of Hurricanes Katrina and Rita has most likely impacted some of these sites. An archeological condition assessment has recently been completed for the park by the Southeast Archeological Center.

Scattered throughout the Barataria Preserve are prehistoric shell piles consisting of shell middens, shell mounds, and shell beaches. Shell middens are the result of discarded shells, primarily from clams (*Rangia cuneata*), and organic earthen material. The purposes of shell mounds varied depending on the time period in which they were constructed. Shell mounds were burial grounds during the Marksville times, while during the Coles Creek and Plaquemine-Mississippian times they were used as substructures to raise houses or ceremonial structures and to prevent them from flooding (Speaker et al. 1986). Shell beaches are formed from eroded midden and mound deposits of shell occurring along bodies of water that typically have a long, linear shape. Examples of shell beaches are evident along the Lake Salvador shoreline.

As a distributary of the Mississippi River, Bayou des Familles and its distributary Bayou Coquille, were important waterways linking early settlers to an expanse of rich and fertile lands. Seasonal flooding distributed sediments and nutrients along the river banks which created natural levees. Changes in elevation, soils, and hydroperiod dictated the types and abundance of flora and fauna along the waterways. These sites were desirable areas for human settlement because of their proximity to waterways, higher elevation, and fertile soils.

Ethnographic Resources

NPS Director's Order #28: *Cultural Resource Management (Ch. 10: Management of Ethnographic Resources)* defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. The NPS is committed to protecting and preserving ethnographic resources, both natural and cultural. Ethnographic resources are traditionally associated with living people and communities that represent an integral part of the national heritage.

A compilation of ethnographic resources was generated by the park's Cultural Resource Specialist in 2006 and entered into the NPS Ethnographic Resource Inventory database. Included were a variety of ethnographic resources that are interwoven with the landscape and resources at the Barataria Preserve. Ethnographic resources include a myriad of plant, animals, and physical features that are associated with American Indian tribes, African-American communities, and Isleño people. The 1998 Traditional Use Study: Barataria Preserve outlines the traditional forms and varieties of resources that people regard as significant, whether for religious, subsistence, occupation or other traditional reasons (Downs et al. 1998). One example of ethnographic resources include plants that were harvested for food and medicinal purposes. These include wild onion (*Allium canadense*), saffrass (*Sassafras albidum*), muscadine, dewberry, and bitterweed (*Helenium* sp). Fish and wildlife have always

played an important role in the lives of humans that have inhabited the region. Rich, fertile wetlands produce an abundance of fin and shell fish. Redfish, bass, clams, crawfish, and shrimp are some of the most harvested species. Mink, muskrat, river otter, and nutria were trapped for their fur and white-tailed deer, swamp rabbits, and grey squirrel provided food (Downs et al. 1998).

One of the most widely recognized ethnographic resources that represents the park and areas throughout the Mississippi River Delta is baldcypress. In the late 19th and early 20th centuries, the logging industry had a prominent impact in the Barataria Basin (Holmes 1986). Rapid and expansive growth of the logging industry was fueled by a growing demand for cypress, the ability to move products by railroad, increased access to timber, and a surplus of labor to work in the industry.

Visitor Use and Experience

The 1916 NPS Organic Act and NPS *Management Policies 2006* (NPS 2006) mandate that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. In addition, the parks' enabling legislation and General Management Plan provides for public use opportunities. The resources and surrounding natural landscapes of the Barataria Preserve provide significant opportunities for public recreational use. Some of the most popular recreational uses include hiking, wildlife viewing, photography, canoeing, fishing, and hunting. Ranger-guided walks, canoe trips, summer camps, and environmental education programs are available at the Barataria Preserve; in addition, there is a Visitor Center which interprets the parks diverse resources and complex history. Approximately 10 miles of walking trails provide park visitors with an avenue to explore the forests, swamps and marshes of the Barataria Preserve. Ten miles of non-motorized (canoe) trails plus an additional 20 miles of natural bayous, canals, and waterways are available for recreational boating and fishing. The park maintains three canoe launches which are located at Twin Canals, Kenta Canal, and Bayou des Familles. In addition, there are numerous boat launches located near the park.

Some of the most popular canoe trails, Bayou des Familles, Bayou Coquille, the Kenta Canal complex, and Twin Canals offer visitors the opportunity to immerse themselves in natural and cultural resources found in the park. Adjacent to the park's boundary on Bayou des Familles, is a livery which rents canoes to the public year-round. In addition, ranger-led canoe tours are conducted during the year. Over time, reduced water flow, increased sedimentation, and the accumulation of detritus have decreased overall water levels, rendering them non-navigable. Currently, Bayou Coquille is closed and others are navigable only during certain times of the year and when strong winds and tides raise the water level. Visitors are forced to use other canoe trails and launches.

The majority of recreational activities enjoyed by the public at the Barataria Preserve are compatible with each other. However, in order to prevent confrontation among user groups, the park restricts public use and access in certain areas. For example, where bank fishing and canoeing are popular along Twin Canals, motorized boats are prohibited. Individuals wanting to hunt and trap are required to apply for a permit and are restricted to designated hunting zones.

Hunting is prohibited within 500 feet of a roadway, trail, waterway, or building to ensure visitor safety and prevent user conflicts.

IMPACT TOPICS ELIMINATED FROM FURTHER ANALYSIS

The following impact topics have been dismissed from further analysis for the reasons described.

Air Quality

Under the NPS 1916 Organic Act and the 1963 Clean Air Act, the park has the responsibility to protect air quality. The expected impacts of this project on air quality would be negligible. Increases in machinery and chain saw exhaust and emissions would occur on a temporary basis. Due to the project location, short duration of use, and environmental conditions, these fumes would rapidly dissipate and the levels would not be any higher than those produced by park equipment used during normal park maintenance activities. Based on these factors, air quality was dismissed as an impact topic from this analysis.

Environmental Justice

Executive Order 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires all federal agencies to address the effects of policies on minorities and low-income populations and communities. None of the management alternatives would have disproportionate effects on minorities or low-income populations as defined by the U.S. Environmental Protection Agency's 1996 guidance on environmental justice.

Indian Trust Resources

Indian trust assets are owned by American Indians but are held in trust by the United States. Secretarial Order 3175 *Departmental Responsibility for Indian Trust Resources* requires that any anticipated impacts to Indian Trust resources from a proposed project or action by U.S. Department of the Interior agencies be explicitly addressed in environmental documents. According to the park Cultural Resource Specialist, Indian trust assets do not occur within the park and would not be affected by any alternatives; therefore, this topic was dismissed.

Museum Collections

According to Directors Order #28: *Cultural Resource Management (Ch. 9: Management of Museum Objects)*, the NPS defines a museum object as "a material thing possessing functional, aesthetic, cultural, symbolic, and/or scientific value, usually movable by nature or design. Museum objects include prehistoric and historic objects, artifacts, works of art, archival material, and natural history specimens that are part of a museum collection." The National Historic Preservation Act, 36 CFR 800, Archaeological Resources Protection Act, American Antiquities Act, Archaeological and Historic Preservation Act, Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Director's Order #28: *Cultural Resource Management* and NPS *Management Policies 2006* (NPS 2006) guide the analysis of effects on

museum collections under NEPA. Museum items are located at the Barataria Preserve, Chalmette Battlefield, and French Quarter visitor centers. Items located at visitor centers are available for public viewing during normal business hours and this schedule would not be interrupted by any of the proposed actions. The parks museum curator is the custodian for all items which include historical objects, archives, and biological specimens. The proposed project would not impact museum collections as no curatorial facilities would be disturbed nor would items be added or removed from the park's collection; therefore, this topic was dismissed.

Prime and Unique Farmland

The Council of Environmental Quality (1980) states that federal agencies must assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture's Natural Resource Conservation Service as prime farmlands or unique farmlands. Prime farmland defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops, such as fruits, vegetables and nuts.

Within the project area, there are lands designated as prime farmlands (U.S. Department of Agriculture 2004). However, these areas have not been in agricultural production since the early 1900's. While park rangers interpret previous farming practices and agricultural uses, there are no plans to put these lands back in production. Therefore, the topic of prime and unique farmlands has been dismissed from further consideration.

Socioeconomics

The proposed action would neither change local or regional land use nor appreciably impact local businesses or other agencies. Contracted work for this project would be temporary and any potential increase in workforce revenue would be temporary and negligible. Local businesses (gas stations, restaurants, canoe rentals, and shops) may benefit from additional park visitors; however, this increase is expected to be negligible; therefore, this topic has been dismissed from further consideration.

Soundscape

As directed by NPS *Management Policies 2006* and Director's Order #47: *Sound Preservation and Noise Management*, the NPS would preserve, to the greatest extent possible, the natural soundscapes of parks. Examples of natural sounds include sounds produced by natural and physical processes including territorial calls of birds and wind passing through forests. Natural soundscape may be interrupted by the sound of humans, chain saws, and equipment on a temporary and negligible basis. Noise produced by the actions proposed in this project would not be at levels higher than those produced during normal park maintenance projects. The spatial and temporal restrictions associated with these actions are not expected to exceed acceptable levels. The frequency, duration, and magnitude would not exceed those already taking place by park staff and visitors during maintenance and recreational activities. The negligible and

temporary interruption of natural sounds caused by this project resulted in the dismissal of this topic from further analysis.

Threatened and Endangered Species

The Endangered Species Act of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (or designated representative) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, the NPS *Management Policies 2006* and Director's Order #77: *Natural Resources Protection* requires the NPS to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive wildlife and vegetation species. According to park staff and recent biological inventories, no threatened or endangered species reside in the proposed project area.

Federally listed endangered species that have been recorded in the park include the non-resident bald eagle (*Haliaeetus leucocephalus*), which nests within one mile of the Barataria Preserve boundary and can be seen foraging near the marsh and waters associated with Lakes Salvador and Cataouatche; brown pelican (*Pelicanus occidentalis*) which occasionally wanders to Lake Salvador from its habitat in the lower Barataria Bay; least terns (*Sterna antillarum*) which are believed to be from the endangered interior population; and both American peregrine falcons (*Falco peregrinus*) and tundra peregrine falcons (*F. p. tundrius*) which can occasionally be seen within the Barataria Preserve in spring and fall. None of these species are likely to forage or roost in the proposed project area or be affected by any of the proposed actions.

State animal species of special concern found within the Barataria Preserve include saltmarsh topminnow (*Fundulus jewkinsi*), as species of unknown status within the state; and Cooper's hawk (*Accipiter cooperii*), a species of concern as a breeder in Louisiana, which has been observed in the park during the breeding season. Also listed as a state species of concern is the alligator snapping turtle (*Macrochelys temminckii*), a species that has been observed in the park.

No threatened and endangered species reside in the project area or would be impacted by the project activities; therefore, this topic was dismissed from further evaluation.

2

ALTERNATIVES CONSIDERED

A range of viable alternatives were developed from internal and external scoping, meetings, and site visits. Discussions among team members were critical in determining project objectives and ensuring that alternatives would meet these objectives. Alternatives that did not adequately meet

the project purpose and need were dismissed from further analysis and are listed in the “Alternatives Considered, but Dismissed” section.

Three alternatives were developed and are presented in this document for evaluation and selection: a No Action Alternative and two action alternatives. Following is a list of the alternatives accompanied by an explanation.

ALTERNATIVE A - NO ACTION ALTERNATIVE

Under this alternative, current management practices would continue and there would be no action taken to remove debris or detritus blocking waterways. Debris and detritus would remain in waterways.

Under this alternative, canoe trails that are currently non-navigable due to hurricane-generated debris and detritus would remain closed. As a substitute, waterways that are not blocked may be used. Floating or submerged debris that is in the waterways would remain in place and continue to obstruct navigation, recreational opportunities, hydrologic functions, and wildlife movements. Gradually, woody debris would rot, further adding to the accumulation of detritus. Over time, detritus would continue to accumulate in the bayous, impede natural hydrologic regimes, navigation, and degrade aquatic systems. As water depth decreases and flow is impeded, water chemistry would change. Dissolved oxygen, specific conductance, and temperature would be at levels that would not support a healthy, diverse fish and wildlife population. Floating aquatic vegetation, which thrives in shallow slow moving systems, would completely cover waterways and impede navigation.

Should the no action alternative be selected, park staff and the public would not be able to access some of the park’s canoe trails which are blocked by debris and are too shallow to navigate through.

ALTERNATIVE B. HURRICANE DEBRIS REMOVAL ONLY FROM CANOE TRAILS

This alternative would utilize chain saws and equipment to remove hurricane debris that is obstructing canoe trails. Woody debris would be cut with saws and moved to the canal bank. Due to the large size and weight of the debris, a lightweight marsh buggy (with a claw attachment) would lift floating and submerged debris from the waterways and place it on the canal banks. Woody debris would be left on the bank and allowed to rot. Trash and non-biodegradable debris would be removed off-site and taken to an authorized waste disposal facility. Implementing this alternative would ensure that waterways are cleared of all debris which resulted from the hurricanes. Debris removal would begin in Bayou des Families (3.6 miles), with additional work continuing in Twin Canals (3/4 mile), Upper Kenta Canal (1.25 miles), and Horseshoe Canal (2.3 miles). Debris is scattered throughout these waterways and accounts for approximately 15-20% of the total surface area. An unknown amount of material is below the waters surface and the amount can not be approximated.

Under this alternative, detritus would not be removed from any waterways and they would remain non-navigable except in times of extreme high water. As an alternative, visitors could use deeper, unobstructed waterways such as Twin Canals.

ALTERNATIVE C. HURRICANE DEBRIS REMOVAL AND DREDGING OF DETRITUS FROM CANOE TRAILS – THE PREFERRED ALTERNATIVE

This alternative would involve the same debris removal work as described in Alternative B but would also include dredging detrital sediments from selected canoe trails. Removal of detritus would allow the natural flow of the waterways to resume and increase the health of the aquatic systems. Over time, decaying plant and animal material and sediments have accumulated in the bottom of waterways. Increased sedimentation was also a result of Hurricanes Katrina and Rita. This excessive amount of detritus reduces water depth, increases turbidity, and restricts water flow. Due to the unconsolidated nature of the material, it prevents rooted vegetation from becoming established. Hurricane-related flooding and storm surge severely increased the amount of sediments and material in waterways.

Canal bank erosion occurring over time and recently exacerbated by Hurricane Rita's flooding generated large amounts of detrital sediments in waterways. While water depths are variable, in some reaches the average water depth is less than 1 ½ feet. This alternative proposes to dredge shallow areas and remove detrital material so that the entire waterways are navigable and water flow is improved. After debris is removed (as described in Alternative B), a hydraulic dredge would be used to remove detritus from the bottom of waterways and dredged material would be evenly placed as a thin layer of slurry in the surrounding forested wetlands. Material would not be allowed to accumulate more than six inches as to prevent spoil banks from forming. Dredged material would add sediments to adjacent swamps, enhance seedling recruitment, and nourish existing vegetation. This process would simulate the natural over-bank flooding which occurred prior to wide-spread levee construction. The amount of dredged material would vary depending on the particular waterway being dredged and the amount of available funding. Dredging operations would begin in Bayou Coquille and include approximately 9,700 cubic yards. Other waterways that may be dredged include portions of Upper Kenta Canal (2,500 cubic yards) and Fullers Trenasse (1,300 cubic yards). According to *Management Policies 2006*, the NPS is permitted to intervene with natural biological or physical processes if it is "for the purposes of restoring natural ecosystem functioning that has been disrupted by past or ongoing human activities". The Preferred Alternative is consistent with this and other NPS policies. Dredging Bayou Coquille not only restores hydrology of the waterway but also provides badly needed sediments and nourishment to degraded swamps.

While implementing this alternative would improve water flow and depth, it would not increase salinity levels within park waterways. Higher salinities are typically only recorded in the southwestern portion of the park along Lake Salvador and during severe weather events. None of the waterways impacted by this project are located in the southern portion of the park and do not connect to Lake Salvador. Additionally, the large volume of freshwater coming through the

Davis Pond Freshwater Diversion will ensure that the saline waters remain well south of the park. Salinity gradients in the Barataria Basin are monitored and the diversion is controlled in such a manner to maintain the upper portion of the Barataria Basin as a freshwater ecosystem.

Once the project is completed, natural hydrologic patterns and water flow would resume. Increased water depth would restore canoeing activities and allow park rangers to resume canoe tours – an important avenue for interpreting the unique cultural and natural resources found along the waterways.

Alternative C has been identified as the NPS preferred alternative and defines the proposed rationale for the action in terms of resources protection and management, visitor and operational use, costs, and other applicable factors. All actions described in the preferred alternative are consistent with the parks General Management Plan (NPS 1982).

The following mitigation measures have been identified to minimize or negate the degree and/or severity of adverse effects. These measures would be adhered to during implementation of the preferred alternative:

1. All archeological sites in the area would be identified and clearly marked before operations began. All personnel involved with the project would be familiar with the sites to ensure that contractors avoid impacting the sites. Should unknown archeological sites be discovered, work would be stopped and the park's Cultural Anthropologist would consult with the State Historic Preservation Office and the Advisory Council on Historic Preservation, as necessary.
2. NPS representatives would monitor all activities to ensure that natural and cultural resources are protected and there is compliance with all regulations and guidelines.
3. To minimize disturbance to soils and wetland vegetation, equipment would be confined to the waterways. Equipment would be left in the field until the project is completed.
4. Discharged dredged material would not be allowed to accumulate more than six inches. Once sediment discharge reaches six inches, the discharge pipe would be moved to another location as to prevent the creation of spoil piles.
5. To ensure visitor safety, work sites and staging sites would be clearly identified and secured from public access.
6. Light weight equipment producing low ground pressure and having shallow draft would be used to minimize resource impacts. Equipment staging would be limited to developed areas. Equipment will be thoroughly cleaned to prevent the spread of invasive species and emergency spill kits will be staged on all equipment.

ALTERNATIVES CONSIDERED, BUT DISMISSED

The only other alternative considered was the use of marsh buggy mounted with a backhoe bucket. In such an alternative, all of the detrital material excavated from the channel would be

picked up in the bucket and placed as a spoil bank along the channel, as in traditional dredging operations. Because the purpose of the waterway clearing is to enhance visitor experience, and since one of the goals is to improve hydrology and wetland health, this alternative was rejected. This method would establish distinct piles of material instead of mimicking the natural sediment dispersal that occurs with over-bank flooding.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

According to the Council on Environmental Quality, the environmentally preferred alternative is defined as "...the alternative that would promote the national environmental policy as expressed by the National Environmental Policy Act's §101." Section 101(b) of NEPA identifies specific criteria to help determine the environmentally preferred alternative. The act states that "...it is the continuing responsibility of the Federal Government to...

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environmental which supports diversity, and variety of individual choice;
5. achieve a balance between population and resource use which would permit high standards of living and a wide sharing of life's amenities, and
6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

This alternative has been described as "the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historic, cultural and natural resources". Considering the alternatives proposed in this analysis, Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails was determined by the IDT to be the environmentally preferred alternative and would best meet the six criteria described above.

Alternative C is considered the environmentally preferred alternative because it best fulfills park responsibilities as the trustee of sensitive habitat; would ensure a safe, healthful, productive, and aesthetically and culturally pleasing surroundings; and attain a wider range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

PROJECT OBJECTIVES AND ALTERNATIVE SUMMARIES

The following project objectives were identified by the IDT with consideration of the park's enabling legislation, goals and objectives described in the GMP, and NPS policies and servicewide objectives.

Table 1. Project objectives, issues, and concerns and the ability for each alternative to meet the objective.

<i>Project Objectives, Issues, and Concerns</i>	<i>Alternative A - No Action Alternative</i>	<i>Alternative B</i>	<i>Alternative C - the Preferred Alternative</i>
Restore canoeing and interpretive activities to improve visitor use and enjoyment	Debris and detritus that is currently blocking canoe trails would remain and continue to render them unusable by visitors and staff.	This alternative would remove debris from all waterways and restore canoeing activities in waterways with deep water. Shallow waterways which are unnavigable due to the accumulation of detrital sediments would remain unusable. Therefore, canoeing and interpretive activities would only be restored to a portion of park waterways.	All debris and detritus would be removed and water depths in shallow areas would be increased to a level that is suitable for canoeing. This alternative would fully restore canoeing and interpretive activities and improve visitor use and enjoyment.
Improve water quality by removing debris and detritus to protect park resources	This alternative would not meet this objective because no material would be removed. Debris and detritus would remain in waterways and continue to degrade fish and wildlife habitat.	Water quality would improve in those areas where debris was removed. Removal of non-biodegradable debris would ensure pollutants do not remain in aquatic systems. In areas where there is excessive detritus, water quality would still be impaired, thus remaining substandard and continuing to adversely impact fish and wildlife habitat.	This alternative would provide the greatest improvement to water quality since it would remove both debris and detritus. Water flow would be restored, non-biodegradable pollutants would be removed, and water depth would be increased. The greatest level of improvement to water quality would occur under this alternative.
Restore water depth to pre-Hurricane Katrina levels	Water depths would not change since this alternative would not provide for the removal of debris and/or detritus. This alternative would not restore water depths to pre-Hurricane Katrina levels.	Since this alternative does not include the removal of detritus, water depth would not be affected. This alternative would not restore water depths to pre-Hurricane Katrina levels.	Dredging detrital material and removing debris would restore water depths to pre-Hurricane Katrina levels.
Improve access to cultural and natural resources	Currently, some cultural and natural resources are not accessible due to excessive amounts of debris and detritus that is	Access to unique resources along canoe trails would improve. However, debris removal would not increase water depth; therefore, some	This alternative would provide the greatest increase in access to cultural and natural resources throughout the park. Dredging

	clogging waterways. Access to sites would not be improved under this alternative.	sites would remain inaccessible.	waterways would increase the depth and allow visitors and staff to access remote areas by boat. Debris removal would ensure that waterways to not block access or require portaging.
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Following is a summary concerning the impacts for each alternative identified.

Table 2. Summary of impacts to resources by alternative.

<i>Impact Topic</i>	<i>Alternative A - No Action</i>	<i>Alternative B - Debris Removal Only from Canoe Trails</i>	<i>Alternative C - Hurricane Debris Removal and Dredging of Detritus from Canoe Trails</i>
Geology and Soils	Under this alternative, there would be no impacts to geology or soils. Implementation of this alternative would not result in the impairment of geology and soils.	Under this alternative, there would be negligible to minor, short-term, adverse impacts to geology and soils caused by soil disturbance from the use of equipment. Disturbance would be localized and not widespread throughout the project area. Implementation of this alternative would not result in the impairment of geology and soils.	Under this alternative, there would be moderate, short-term, adverse impacts to geology and soils resulting in soil disturbance and compaction caused by equipment. Implementation of this alternative would not result in the impairment of geology and soils.
Vegetation	Under this alternative, there would be no impacts to vegetation. Implementation of this alternative would not result in the impairment of vegetation.	Under this alternative, impacts to vegetation would be minor, short-term, and adverse. Impacts may occur from machinery and people trampling and disturbing vegetation in the project area. Since the majority of woody debris that needs to be removed is already dead, there would be negligible impacts to living vegetation. Implementation of this alternative would not result in the impairment of	Under this alternative, there would be minor to moderate, short-term, and adverse impacts to vegetation. Debris removal and dredging operations would result in disturbance to aquatic and terrestrial vegetation in the project location. Conversely, there would be moderate, long-term, and beneficial impacts from the placement of dredged material in degraded swamps. The lack of over-bank flooding has prohibited

		vegetation.	sediments and nourishment from reaching these areas and the land is subsiding. Adding dredged material in the swamp would provide significant benefits to herbaceous and woody vegetation and provide sediments needed combat deleterious subsidence. Implementation of this alternative would not result in the impairment of vegetation.
Fish and Wildlife	Under this alternative, the impacts to fish and wildlife would vary according to the species in question. There would be minor to moderate, long-term, and adverse impacts to fish and wildlife that prefer deeper water systems. The continued accumulation of detrital sediments would severely reduce the water depth rendering waterways as shallow depressions instead of flowing water bodies. As water levels decrease, so would the quality of the habitat. Increased water temperature, low levels of dissolved oxygen, and stagnant water would adversely impact some fish and wildlife species. Implementation of this alternative would not result in impairment of fish and wildlife.	Under this alternative, there would be negligible, long-term, and beneficial impacts and minor, short-term, and adverse impacts to fish and wildlife. Beneficial impacts would result from removing debris that may be polluting the environment. Operation of equipment, chain saws, and increased human presence would cause short-term, localized disturbance to fish and wildlife. Once operations are completed, normal activities and behavioral patterns are expected to resume. There would be no direct mortality or permanent displacement. However, failure to remove debris and deepen waterways would result in long-term, adverse impacts. Implementation of this alternative would not result in the impairment of fish and wildlife.	Under this alternative, moderate, long-term, and beneficial impacts are expected since removing debris and detritus would improve overall habitat quality. In particular, species that prefer deeper water habitats with free flowing water would benefit the greatest. Increasing the water depth would improve water clarity, temperature, dissolved oxygen, and specific conductance thus resulting in a greater diversity and abundance of aquatic organisms. Minor, short-term, and adverse impacts to fish and wildlife caused by disturbance associated by equipment and human presence. Once operations are completed, normal activities and behavioral patterns are expected to resume. There would be no direct mortality or permanent displacement. Implementation of this alternative would not result in the impairment of fish and wildlife.

Wetlands and Floodplains	Under this alternative, there would be no impacts to wetlands and floodplains. Implementation of this alternative would not result in impairment of wetlands and floodplains.	Under this alternative, there would be negligible, short-term, and adverse impacts to wetlands and floodplains. The use of equipment in the project area would result in result in compaction to wetland soils and disturbance to wetland vegetation. Implementation of this alternative would not result in impairment of wetlands and floodplains.	Under this alternative, there would be negligible, short-term, and adverse impacts to wetlands. The use of equipment in the project area would result in result in compaction to wetland soils and disturbance to wetland vegetation. However, these impacts would be mitigated by using lightweight equipment with low ground pressure. Additionally, there would be moderate, long-term, and beneficial impacts resulting from the beneficial use of dredge material used to replenish sediments in the parks degraded wetlands. Material would provide nourishment and stimulate wetland plant growth and regeneration. Best Management Practices would be followed to prevent adverse impacts. Implementation of this alternative would not result in impairment of wetlands and floodplains.
Hydrology and Water Quality	Under this alternative, there would be minor, long-term, and adverse impacts to hydrology and water quality. Failure to remove debris and detritus that is clogging waterways would continue to disrupt natural hydrologic regimes and degrade water quality. The continued accumulation of detrital sediments would further reduce water depth rendering waterways as shallow depressions instead of flowing water bodies. As water levels decrease, water chemistry and quality would change. Water temperature would	Under this alternative there would be minor, long-term, and adverse and beneficial impacts to hydrology and water quality. Removal of debris would improve surface water flow; however, adverse impacts would result from not removing detrital sediments (same as described in the No Action Alternative). Implementation of this alternative would not result in impairment of hydrology and water quality.	Implementation of this alternative would result in moderate, long-term, and beneficial impacts to hydrology and water quality. Removal of debris and detritus would restore hydrologic regimes within the park waterways and improve water quality. Implementation of this alternative would not result in impairment of hydrology and water quality.

	increase, dissolved oxygen would decrease, and specific conductance would be affected. Impacts would be considered minor since they would occur over a long period of time and not be readily detected over the short-term. Implementation of this alternative would not result in impairment of hydrology and water quality.		
Archeological Resources	Under this alternative, there would be no impacts to archeological resources. Implementation of this alternative would not result in impairment of archeological resources.	Under this alternative, there would be no impacts to archeological resources. In order to ensure there are not impacts to archeological sites, they would be clearly marked and a buffer zone established. A park representative would be onsite during project construction to ensure that archeological sites are avoided. If unknown archeological sites are discovered, work would cease until the park Cultural Resource Specialist or another archeologist has been notified and the area adequately surveyed. Work would not proceed in this area until proper coordination with SHPO has been completed. Implementation of this alternative would not result in impairment of archeological resources.	Under this alternative, there would be no impacts to archeological resources. In order to ensure there are not impacts to archeological sites, they would be clearly marked and a buffer zone established. A park representative would be onsite during project construction to ensure that archeological sites are avoided. If unknown archeological sites are discovered, work would cease until the park Cultural Resource Specialist or another archeologist has been notified and the area adequately surveyed. Work would not proceed in this area until proper coordination with SHPO has been completed. Implementation of this alternative would not result in impairment of archeological resources.

Ethnographic Resources	Under this alternative, there would be negligible, long-term, and adverse impacts to ethnographic resources. Plant and animal species that are classified as ethnographic resources would be adversely impacted by degrading habitat conditions. Debris and detritus would continue to impede access to some ethnographic resources. Impacts are considered negligible since ethnographic resources are distributed throughout the park and the project area represents a small portion of the park. Implementation of this alternative would not result in impairment of ethnographic resources.	Under this alternative, there would be negligible, long-term, and adverse impacts to ethnographic resources. Plant and animal species that are classified as ethnographic resources would be adversely impacted by degrading habitat conditions. Debris and detritus would continue to impede access to some ethnographic resources. Impacts are considered negligible since ethnographic resources are distributed throughout the park and the project area represents a small portion of the park. Implementation of this alternative would not result in impairment of ethnographic resources.	Under this alternative, there would be minor, long-term, and beneficial impacts to ethnographic resources. Removing debris and detritus would greatly improve habitat conditions for numerous plant and animals that are identified as ethnographic resources. Implementation of this alternative would not result in impairment of ethnographic resources.
Visitor Use and Experience	Under this alternative, there would be minor to moderate, long-term, and adverse impacts to visitor use and experience. Sediments and debris would prevent waterways from being used as canoe trails. Park rangers would not be able to conduct canoe trips in these waterways and interpret the unique cultural and natural resources of the area. Implementation of this alternative would not result in impairment of visitor use and experience.	Under this alternative, there would be minor, long-term, and adverse impacts to visitor use and experience. Sediments and debris would prevent waterways from being used as canoe trails. Park rangers would not be able to conduct canoe trips in these waterways and interpret the unique cultural and natural resources of the area. Implementation of this alternative would not result in impairment of visitor use and experience.	Under this alternative, there would be minor, short-term, and adverse impacts; as well as, moderate, long-term, and beneficial impacts to visitor use and experience. Minor, short-term, and adverse impacts would result from abnormally high noise levels caused by equipment and power tools. Since some waterways are currently non-navigable and can not be used as canoe trails, there would be no effects on visitor use and experience in these areas. In the long-term, visitor use and experience would benefit from this alternative. Implementation of this alternative would not result in impairment of visitor use and experience.

3

ENVIRONMENTAL CONSEQUENCES

This section describes the potential for environmental consequences, or impacts, which may occur as a result of implementing an alternative. Following is a list of impact topics that were identified through the scoping process and would be analyzed in detail in this section.

Natural and physical resources examined in detail include:

- geology and soils
- vegetation
- fish and wildlife
- wetlands and floodplains
- hydrology and water quality

Cultural resources examined in detail include:

- archeological resource
- ethnographic resources

Also included in analysis are visitor use and experience.

Environmental consequences are described in terms of type, duration, context, and intensity or threshold. Definitions for type, duration, and context of potential impacts are given below. Intensity, or threshold, of topics is specific to each impact topic being analyzed and defined in the appropriate section.

Type – describes the classification of the impact as beneficial or adverse, direct or indirect.

Beneficial	A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
Adverse	A change that moves the resource away from a desired condition or detracts from its appearance or condition
Direct	An impact that is caused by an action and occurs at the same time and place
Indirect	An impact that is caused by an action that is later in time or farther removed in distance but still reasonably foreseeable.

Duration – the length of time for each impact, either short-term or long-term.

Short-term	Impacts that occur only during construction or last less than one year.
Long-term	Impacts lasting longer than one year.

Context – the setting where the impact is expected to occur.

Site-specific	Impacts would only affect the project site only
Local	The impact would affect the park
Regional	The impacts would affect areas outside of the park

Intensity – levels of intensity (**negligible, minor, moderate, and major**) are specific to each impact topic and are described accordingly.

CUMULATIVE EFFECTS

According to the Council on Environmental Quality (CEQ) regulations which implement NEPA, cumulative effects must be assessed and evaluated in the assessment process. Cumulative effects are evaluated for each alternative and impact topic. Cumulative effects are defined as

*“the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions”
(40 CFR 1508.7).*

In order to fully determine cumulative effects, past, present, and expected projects at the park and within the surrounding area, were analyzed. The geographic scope covered in this analysis includes private and public lands surrounding the park. A specific geographic boundary is not specifically defined as it may vary according to impact topic.

IMPAIRMENT

The NPS *Management Policies 2006* and Directors Order #12: *Conservation Planning, Environmental Impact Analysis, and Decision Making* require thorough analysis of potential effects to determine if the proposed actions would result in resource impairment. The fundamental purpose of the NPS, as established by the Organic Act in 1916, and reaffirmed by the General Authorities Act in 1970, as amended in 1978, begins with a mandate to conserve park resources and values. Under this mandate, park managers are responsible for avoiding or minimizing impacts to park resources and values to the greatest degree possible. However, laws do provide NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of the park, provided it does not result impairment of the resource or value.

Although Congress has given the NPS the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. **The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values.**

According to *NPS Management Policies 2006*, impairment depends on the particular resources and values that might be affected; the severity, duration, and timing of the impact; and the direct and indirect cumulative effects. Impairment can occur to any park resource or value, but an impact would be more likely to constitute impairment to the extent that it has a major severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. A determination of impairment for park resources and values is evaluated under each impact topic and presented in the "conclusion" section.

GEOLOGY AND SOILS

To analyze the impacts to geology and soils, background information was compiled from park documents, USDA soil survey maps, scientific publications, and professional expertise. The impacts to geology and soils from previous NPS activities and actions occurring off parklands were also evaluated.

The following thresholds of change were used to determine the intensity of an impact:

- Negligible:** The impact would not be detectable or would be at the lowest levels of detection and result in very little or no physical disturbance, compaction, and erosion.
- Minor:** The impact would be slightly detectable with small amounts of physical disturbance, compaction, and erosion.
- Moderate:** The impact would be detectable in a few areas and physical disturbance, compaction, and erosion would result.

Major The impact would be readily apparent in numerous areas and physical disturbance, compaction, and erosion would be severe.

Alternative A – No Action

Under this alternative, current management practices would continue and there would be no action taken to remove debris and detritus from canoe trails. Since no activity would occur, there would be no impacts to geology and soils

Cumulative Impacts: Adverse impacts to geology and soils are occurring in areas nearby the park. Rapid expansion in the Westbank area of Jefferson Parish has resulted in extensive construction of roads and commercial and residential buildings. Massive clearing of vegetation has increased the amount of soil disturbance, compaction, and erosion. Once devoid of vegetation, soils are washed into ditches and canals, increasing turbidity and run-off. Recent plans to construct hurricane protection levees would cause extensive soil disturbance near the Barataria Preserve. These plans include the installation of flood gates, construction of new earthen levees, and increasing the width and height of existing levees – all of which would affect soils and geology of the area. In 1999 and 2001, six borrow pits totaling 110 acres were excavated along the eastern portion of the park boundary. Soil was used to construct nearby hurricane protection levees. Today, the pits remain and have filled with water.

Soil compaction and land subsidence is a naturally process occurring in recent deltaic land formations. However, this process is accelerated by anthropogenic forces attributed to altered land use, increased development, changes in hydrology, and oil and gas extraction. Average land subsidence rates in the New Orleans region average 5mm/year (Burkett et al. no date). These rates are expected to continue and possibly increase, which would impact areas throughout southeast Louisiana.

Disturbance to geological features and soil also occurs from oil and gas activities, including exploration and pipeline maintenance. In 2004, two wells were directionally drilled in the park. Both were determined to be dry holes and plans to drill two additional wells were abandoned. During June 2006, a new well was drilled in Lake Salvador within a mile of the Barataria Preserve. Recent seismic activity was conducted along the parks western boundary in Lake Cataouatche in 2006. In April 2007, the park was approached about directionally drilling a gas well in the park. These cumulative activities have the potential to cause disturbance to geology and soils.

The past, present, and reasonably foreseeable future actions, may have minor, long-term and adverse impacts on park geology and soils. These actions would be localized and not wide-spread.

Alternative B – Hurricane Debris Removal from Canoe Trails

Soil disturbance and compaction may result under this alternative due to the use of equipment. Equipment is necessary to move the high volume of large, debris. In order to mitigate these impacts, lightweight marsh buggies would be used. Marsh buggies have wide, aluminum tracks

which would reduce the ground pressure and ensure minimal soil compaction. Equipment would remain in existing waterways to limit the impacts to the surrounding wetlands. After the project is completed, full recovery of the area is expected and there would not be any long-term impacts. Impacts resulting from this alternative would be negligible to minor, short-term, and adverse.

Cumulative Impacts: Same as Alternative A – No Action Alternative.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

This alternative would have moderate, short-term, adverse impacts on soils. As described in Alternative B, equipment needed to remove debris would cause minor soil disturbance and compaction; however, mitigation measures would be employed to reduce impacts (see Alternative B). A small hydraulic dredge (less than 15 feet in width) would be used to dredge detritus from waterways and be distributed into adjacent wetlands. This process would impact soils in the project area. Once detritus is dredged, it would be sprayed in a thin layer into the adjacent cypress swamp. Dredged material would provide long-term benefits to the surrounding swamp by adding nourishment and sediments that are needed to combat subsidence.

Cumulative Impacts: Same as Alternative A – No Action Alternative.

Conclusions and Impairment Findings: Under **Alternative A**, there would be **no impacts** to geology and soils. Impacts to geology and soils under **Alternative B** would be **negligible to minor, short-term, and adverse**. Impacts resulting from **Alternative C**, the Preferred Alternative would be **moderate, short-term, and adverse** impacts to geology and soils. After analyzing direct and cumulative impacts, it was determined that no alternatives would result in impairment to geology and soils.

VEGETATION

Impacts to vegetation were analyzed from NPS professional expertise and observation, previous and current research, and an ongoing inventory. In addition, scientific documents and reports relating to this and similar activities were reviewed.

- Negligible:** The impact would result in no or a slight change to a population or individual plants, but the change would be so small that it would not be of any measurable or perceptible consequence.
- Minor:** The impact would result in a change to a population or individual plants, but the change would be small and of little perceptible consequence.
- Moderate:** The impact would result in a change to a population or individual plants, and the change would be measurable and of some perceptible consequence.

Major The impact would result in an apparent change to a population or individual species, the change would have measurable and perceptible consequence.

Alternative A – No Action

Under this alternative, there would be no activities to remove debris and detritus in park waterways; therefore, no impacts to vegetation would result.

Cumulative Impacts: Rapid urban development in Jefferson Parish, especially near the Barataria Preserve, has led to a decrease of native vegetation and forested areas. Increased development and habitat fragmentation also provides a conduit for exotic species to impair native vegetation communities. Park managers have seen an increase in the presence of invasive exotic species along the park's boundary.

Impacts to vegetation result from illegal use of all terrain vehicles, creating unauthorized foot trails, and cutting vegetation. Outlined in the *Superintendents Compendium*, visitors are permitted to legally take small quantities of certain plants, nuts, and fruits for personal consumption. Since this practice is fairly uncommon, impacts to vegetation are not perceptible.

The park anticipates receiving funds to repair the Palmetto Trail which was heavily damaged as a result of Hurricane Katrina. The 0.9 mile trail runs parallel to HWY 45 from the Visitor Center to the Bayou Coquille parking lot. Removal and replacement of damaged sections would involve use of power tools, equipment, increased human presence, and a staging area for materials. Depending on the final trail design and repair methodology that is selected, it may be necessary to cut and remove some vegetation.

The past, present, and reasonably foreseeable future actions, may have negligible to minor, long-term and adverse impacts to park vegetation.

Alternative B – Debris Removal from Canoe Trails

Under this alternative, impacts to vegetation would be minor, short-term, and adverse. Impacts are classified as minor since the vast majority of vegetation that would be removed is already dead. Minor disturbance may occur to live vegetation from the use of large equipment and an increase in the number of people in the project area. Since equipment would be operating in waterways, there may be disturbance to floating and rooted aquatic vegetation. This impact is expected to be short-term and vegetation is expected to quickly re-colonize the area. A small portion of living vegetation on the canal banks may be impacted if material is placed on top. Some branches may need to be cut in order for the equipment to get to the project site.

Cumulative Impacts: Cumulative impacts to vegetation under this alternative include those described under Alternative A. Additional impacts to vegetation may occur outside the immediate project area at equipment offloading and loading sites and staging areas or when equipment is moved from one work site to another. To mitigate these impacts, marsh buggies would be required to remain in existing waterways and not traverse over land. The introduction of non-native species is not a concern since they are already present in the project area and it is not expected that this alternative would increase their distribution.

The past, present, and reasonably foreseeable future actions, may have negligible to minor, long-term and adverse impacts to park vegetation.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

As a result of this alternative, minor to moderate, short and long-term, adverse impacts to vegetation would occur. Disturbance would occur to aquatic and terrestrial vegetation from the use of large equipment and an increase in the number of people in the project area. Since equipment would be operating in waterways, there would be disturbance to floating and rooted aquatic vegetation. This impact is expected to be short-term since vegetation is expected to quickly re-colonize the area. A small portion of living vegetation on the canal banks may be impacted if material is placed on top of it and some branches may need to be cut in order for the equipment to get to the project site.

There would be moderate, long-term, beneficial impacts to the baldcypress swamps receiving dredge material. Changes in hydrology and land use have prevented the natural occurrence of over-bank flooding. This flooding cycle was an important natural process that provided nourishment and sediments to the swamps and helped offset land subsidence. Natural and man-made changes have prevented sediments and nourishment from reaching these areas, thus stressing mature trees and preventing natural regeneration. Beneficial use of dredged material is one alternative that mimics the natural flooding and sediment deposition process. This process has been used in many areas of coastal Louisiana and at other locations on the park. Research has documented the long-term beneficial effects of this process.

Cumulative Impacts: Cumulative impacts to vegetation under this alternative include those described under Alternatives A and B. Additional cumulative impacts to be considered include dredging projects that have recently occurred within the park. Dredge material has been placed in dead-end canals and in other approved disposal sites in order to restore degraded wetlands. Beneficial use of dredge material is a widely accepted wetland restoration strategy utilized throughout coastal areas. Impacts to vegetation are expected to contribute a negligible amount of vegetation loss when considered with other past, present, and reasonably foreseeable future actions in the greater area.

The past, present, and reasonably foreseeable future actions, may have negligible to minor, long-term and adverse impacts to park vegetation.

Conclusions and Impairment Findings: **Alternative A** would result in **no impacts** to vegetation. Since equipment used in **Alternative B** would cause disturbance and trampling of vegetation, **minor, short-term**, and **adverse** impacts are expected to occur. **Alternative C** would result in adverse and beneficial impacts. Equipment and project activities would result in **minor to moderate, short-term**, and **adverse** impacts to floating and terrestrial vegetation. Meanwhile, this project would result in **moderate, long-term**, and **beneficial** impacts. After analyzing direct and cumulative impacts, it was determined no alternative would not result in impairment of vegetation.

FISH AND WILDLIFE

Impacts to wildlife were analyzed from NPS professional expertise, previous and current research, consultation with other experts, and park documents. In addition, related scientific documents relating to this and similar activities were reviewed.

Negligible: The impact would result in no or a slight change to a population or individual, but the change would be so small that it would not be of any measurable or perceptible consequence.

Minor: The impact would result in a change to a population or individual, but the change would be small and of little perceptible consequence. It is unlikely that direct mortality or displacement would occur. The viability of wildlife populations would not be affected.

Moderate: The impact would result in a change to a population or individual, and the change would be measurable and of some perceptible consequence. Direct mortality of a small number of individuals may result and some individuals may be temporarily displaced. The viability of wildlife populations in the immediate project area would be affected.

Major The impact would result in a change to a population or individual, and the change would be measurable and of perceptible consequence. Direct mortality of multiple species would result and numerous individuals would be permanently displaced. The viability of wildlife populations in the immediate and surrounding areas would be affected.

Alternative A – No Action

Under this alternative, no debris or detritus would be removed and there would be minor to moderate, long-term, adverse impacts on fish and wildlife that prefer deeper water habitats. Detritus and sediments washed in from Hurricanes Katrina and Rita severely reduce water flow and depth. Over time, woody debris would rot and detritus would reduce the water depth and amount of available habitat for fish, aquatic mammals, and reptiles. Bayous would slowly become shallow depressions composed of organic material instead of free-flowing waterways. Decreased water depth results in low dissolved oxygen levels and higher water temperatures which reduces the abundance and diversity of aquatic species. Species that prefer deeper water systems, such as the American alligator, snapping turtle, bass, and river otter would be most affected.

Cumulative Impacts: Reasonably foreseeable past, present, and future actions at the park are subject to having an impact on fish and wildlife. Recent urban development in the surrounding area has reduced the available habitat, particularly for large mammals. The importance of the habitats represented in the park is becoming more apparent as the surrounding landscape changes. Neighboring habitat destruction and increased human presence reaffirms the ecological importance of the park for fish and wildlife.

As the neighboring population increases, so does the demand for places to satisfy recreational activities. The park's hiking and canoeing trails serve as popular destinations for local and out of town visitors. Park visitors are required to remain on trails which reduce the likelihood of encountering or disturbing wildlife. An increase in visitor use could have adverse effects on fish and wildlife.

Included in the parks enabling legislation are provisions for fishing, hunting, and trapping which have a direct impact on fish and wildlife. Fishing occurs in park waterways and adjacent to the park boundary in Lakes Salvador and Cataouatche. While the park makes no attempt to record annual fish harvest, fishing pressure is low enough to reasonably assume that harvest rates are not adversely impacting fish populations. Additional information provided from recent fisheries studies, indicates fish populations are stable or increasing. Hunted species include waterfowl, gray squirrel, rabbit, and white-tailed deer. Hunter participation and harvest has declined in the last four years. White-tailed deer harvest rates for the 2000-2001 season were the highest in park history and totaled 62 individuals harvested. In contrast, only 25 individuals were harvested during the 2006-2007 season. Over the last 15 years, the annual harvest averaged 29 individuals. These numbers are far lower than the recommended annual harvest rate of 90-100 individuals that was proposed in a recently completed deer management plan (Chamberlain and Nyman 2006). Harvest of rabbits and gray squirrel is minimal with 0 rabbits and 3 squirrels being killed during the 2006-2007 season. Trapping is managed under a Special Use Permit and is focused on controlling the nutria population (a non-native, invasive species). Nutria trapping success and permit requests have declined in recent years due to the decline in fur prices and escalating costs associated with trapping. Harvest rates in 2003-2004 approached 4,500 individuals. Since then, the harvest has declined yielding 1,688 and 882 during the 2004-2005 and 2005-2006 trapping seasons, respectively.

Occurrences of wildlife poaching are minimal and do not have significant impacts on the parks wildlife population. The most commonly poached species are white-tailed deer, American alligator, and waterfowl.

The park anticipates receiving funds to repair the Palmetto Trail which was heavily damaged during Hurricane Katrina. Removal and replacement of damaged sections would involve use of power tools/equipment, increased human presence, and a staging area for materials. Human disturbance and increased noise levels would have negligible to minor, short-term, adverse impacts on fish and wildlife. These consequences may temporarily displace individuals and alter their normal behavioral patterns. Once construction is complete, wildlife behavior and use of the area are expected to return to that which occurred prior to the project.

The past, present, and reasonably foreseeable future actions, may have negligible to minor, long-term and adverse impacts to park vegetation.

Alternative B – Debris Removal from Canoe Trails

Under this alternative, impacts would be similar to Alternative A but there would be additional impacts caused by the use of equipment and increased human activity. Wildlife disturbance

would result from abnormal noise levels caused by machinery and chain saws. To mitigate these impacts, project activities would only be allowed during the day to reduce the amount of time wildlife is disturbed. In addition, activities would occur only in localized areas and not throughout the entire project area at any given time. Increased human presence would result in wildlife disturbance, although it would also be localized and minimal. Once debris removal operations are completed, normal wildlife activities and behavior would resume. Wildlife is expected to move from the project area once activities begin and return after the project is completed.

There would also be negligible, long-term, beneficial impacts to wildlife by removing debris that may pollute the natural system. Some debris may contain hazardous materials which could leach into the surrounding water and soils. Non-biodegradable materials would be removed offsite and properly disposed of at an approved waste disposal site. Once obstructions are removed, they would not impede wildlife movements. This alternative would remove debris only; therefore, detritus would remain in the waterways and adversely impact fish and wildlife.

Cumulative Impacts: Same as Alternative A.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

Impacts associated with this alternative are variable depending on the time frame under consideration. There would be moderate, long-term, and beneficial impacts due to an overall improvement in the quality of fish and wildlife habitat. However, there would be minor, short-term, and adverse impacts from noise and increased human activity during the project.

Debris and detritus removal would improve habitat conditions for fish and wildlife dependent on these aquatic systems. The resulting improvement in dissolved oxygen, turbidity, water flow, depth, and specific conductance would increase the amount and quality of habitat for a greater abundance and diversity of species. Specifically, fish, reptile, and amphibian species that prefer deeper, flowing water systems, such as alligator snapping turtles are expected to benefit from this project. The snapping turtle is very rare in the park and found only in cypress-tupelo swamp habitats and in natural aquatic systems. The only recorded locations of this species were in Bayou des Familles and Bayou Coquille. This species is listed as a “species of concern” in Louisiana. Historically present furbearers, such as river otter, would benefit from these habitat improvements and might expand their range back into these areas.

This alternative is also expected to have minor, short-term, and adverse impacts on wildlife while debris removal and dredging activities are taking place. Adverse impacts to wildlife would occur due to the disturbance caused by the operation of equipment and an increased human presence. Increased noise levels would be caused by the use of machinery. Machinery would only operate during daylight hours and in localized areas; therefore, only impacting a small area within the project location. Increased human presence would result in wildlife disturbance, although it would also be localized. Once debris and detritus removal operations are completed, normal wildlife activities and behavior would resume.

It is unlikely that any direct mortality would result under this alternative. Since project activities would not occur throughout the entire project area at any given time, disturbance would be localized. Wildlife would most likely move away from the project area once construction begins and return after it is completed.

Cumulative Impacts: Same as Alternative A.

Conclusions and Impairment Findings: Under **Alternative A**, there would be **minor to moderate, long-term** and **adverse** impacts to wildlife since debris and detritus would remain in waterways and continue to impede wildlife movements and degrade habitat quality. Both Alternatives B and C would result in adverse and beneficial impacts. Use of equipment and an increase in human activities associated with Alternatives B and C would disturb fish and wildlife and cause them to temporarily leave the area, thus having adverse impacts. However, habitat improvements resulting from these two alternatives would ensure long-term, beneficial impacts would occur. **Alternative B** would result in **minor, short-term** and **adverse** impacts and **negligible, long-term**, and **beneficial** impacts to fish and wildlife. **Alternative C** would result in **minor, short-term**, and **adverse** impacts and **moderate, long-term**, and **beneficial** impacts to fish and wildlife. After analyzing direct and cumulative impacts, it was determined that implementation of this alternative would not result in impairment of fish and wildlife.

WETLANDS AND FLOODPLAINS

Impacts to wetlands and floodplains were analyzed from NPS professional expertise, previous and current research, consultation with other experts, and park documents. In addition, related scientific documents relating to this and similar activities were reviewed.

Negligible: Impacts are chemical, physical, or biological effects that would not be detectable, but would be well below water quality standards or criteria and would be within historical or desired water quality conditions.

Minor: Impacts are chemical, physical, or biological effects that would be detectable, but would be well below water quality standards or criteria and would be within historical or desired water quality conditions.

Moderate: Impacts are chemical, physical, or biological effects that would be detectable, but would be at or below water quality standards or criteria; however, historical baseline or desired water quality conditions would be altered on a short-term basis.

Major: Impacts are chemical, physical, or biological effects that would be detectable, but would be well below water quality standards or criteria and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would be slightly and singularly exceeded on a short-term basis.

Alternative A – No Action

Under this alternative, there would be no impacts to wetlands and floodplains. No removal of debris or detritus would occur and wetlands and floodplains in the project area would be undisturbed.

Cumulative Impacts: In southeast Louisiana, wetland loss and degradation is occurring due to natural and man-made processes. Urban development, oil and gas exploration, and changes in land use and hydrology have reduced the extent and quality of wetlands surrounding the Barataria Preserve. Some of the most significant changes are associated with the large-scale hydrologic changes. The construction of levees along rivers and canals has reduced natural flooding regimes and denied sediment input to adjacent wetlands and contributed significantly to land subsidence. Oil and gas exploration is attributed to direct loss as new canals were cut through wetlands resulting in deep open water.

It is foreseeable that forested wetlands in the park would be impacted by nearby levee construction under the direction of the U.S. Army Corps of Engineers. As a result of Hurricane Katrina, the state and federal governments are devising a coastal protection and restoration plan in order to address the need for levee improvement and coastal wetland restoration. New levee alignments and strengthening of existing levees are being proposed. In order to obtain material suitable for constructing or increasing the height of existing earthen levees, there is a need for borrow material. Lands adjacent to the park are suitable for use in levee construction. Preliminary meetings with park officials and the public have been held to discuss construction plans and alternatives. After excavation is complete, borrow pits would fill with water and create deep water ponds. Due to their anticipated depth, ponds would not be suitable for the establishment of emergent wetland or submerged aquatic vegetation. Floating aquatic vegetation may become established.

Despite significant wetland loss in southeast Louisiana, restoration projects have been initiated to combat these losses. The benefits of coastal wetlands have moved to the forefront of public attention since the devastation caused by Hurricanes Katrina and Rita in 2005. Projects vary in size and magnitude and are being conducted throughout the state on private and public lands. Large-scale restoration projects in nearby wetlands may have indirect, beneficial impacts on the park as they buffer the parks habitats by reducing the storm surge, wave energy, and wind effects. The park has identified wetland restoration projects and is working with officials from state and federal agencies to implement these projects. The park has implemented successful restoration projects including backfilling two dead-end oil and gas canals and using dredge material to fill open water ponds which were previously floating marsh. Wetland restoration is on-going and highly dependent on available funding. The park annually submits wetland restoration projects for funding consideration through the NPS Disturbed Lands program and the Coastal Wetlands Restoration, Planning, and Protection Act. Restoration projects result in long-term, beneficial impacts.

The past, present, and reasonably foreseeable future actions, may have negligible to minor, long-term, and beneficial and adverse impacts to wetlands and floodplains.

Alternative B – Hurricane Debris Removal from Canoe Trails

Under this alternative, project activities would impact wetlands and floodplains. The use of equipment in the project area would result in the negligible compaction of wetland soils and temporarily destroy some wetland vegetation. Since the project would only occur in a small portion of the parks wetlands, impacts would be temporary and localized. Due to the extensive seed source and a small amount of disturbance in a localized area, vegetation would be expected to rapidly recolonize the area once work is completed. Low ground pressure equipment would be used to minimize damage. Loading, unloading, and equipment staging would be in restricted to previously disturbed sites. Additionally, overall equipment size (including tracks) would be the minimum needed to complete the job, thus reducing the overall footprint in the area. Overall, these impacts would not have a significant impact on the parks wetlands and floodplains.

Since this project would take place in wetlands, Director's Order #77-1: Wetland Protection must be addressed. Generated from Executive Order 11990: Protection of Wetlands, the NPS established Director's Order #77-1 to set policies, requirements, and standards for implementing this Executive Order. As defined in Director's Order #77-1 Section 4.2 (A)(1)(f), this alternative would constitute "maintenance, repair or renovation of currently serviceable facilities or structures." According to this definition, this action is considered an "Excepted Action" and no Statement of Findings is required for implementation of this alternative.

Appendix 2 of Director's Order #77-1, Appendix 2 outlines best management practices (BMP) that are applied to actions when there is the potential for proposed actions to have adverse impacts on wetlands. The incorporation of BMP's and mitigation measures will ensure any adverse impacts are negligible. BMP's have been addressed by imposing measures such as utilizing light weight aluminum marsh buggies with low ground pressure; ensuring equipment is in good working order to avoid spills and having spill kits readily available; minimizing faunal disturbance by limiting the time, duration, and location of project actions; and appropriate permits and a Consistency Determination are obtained from the Louisiana Department of Natural Resources and the U.S. Army Corps of Engineers for compliance with Coastal Management Zone requirements.

Cumulative Impacts: Same as Alternative A.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

Under this alternative, there would be negligible, short-term, and adverse impacts and moderate, long-term, and beneficial impacts to wetlands. Adverse impacts would result from using equipment; however, these impacts will be negligible due to the small size and light weight nature of the equipment. To further minimize damage, equipment will remain in existing waterways and staging areas will be restricted to existing developed areas. The use of equipment in the project area would result in the compaction of wetland soils and temporarily destroy or alter wetland vegetation. Impacts would be temporary and localized since equipment would not be present in all areas of project at any given time. Due to the extensive seed source and small amount of disturbance in a localized area, wetland vegetation would only be impacted in a small area and is expected to rapidly recolonize disturbed sites once work is completed. Overall, these impacts would not have a significant impact on the parks wetlands and floodplains.

Dredge material would be used beneficially to replenish sediments in areas severely degraded by subsidence and provide nourishment to increase plant growth. Beneficial use of dredged material is a commonly used coastal restoration strategy that has been used successfully in the past. This technique mimics the natural process of over-bank flooding which historically occurred.

Discharge points for dredge material would be determined by the parks Chief of Planning and Resource Stewardship, Natural Resource Management Specialist and Cultural Resource Specialist to avoid impacting sensitive resources. Dredge material would not be allowed to accumulate more than six inches at the end of the discharge pipe. The fluid nature of the material would allow it to spread into the discharge area which would prevent stacking and creation of spoil banks. The thin layer of material would be conducive to plant growth and regeneration. An estimated 15-20 acres of forested wetlands would receive material.

Since this project would take place in wetlands, Director's Order #77-1: Wetland Protection must be addressed. Generated from Executive Order 11990: Protection of Wetlands, the NPS established Director's Order #77-1 to set policies, requirements, and standards for implementing this Executive Order. As defined in Director's Order #77-1 Section 4.2 (A)(1)(e), this project would constitute an "action designed specifically for the purpose of restoring degraded (or completely lost) natural wetland, stream, riparian, or other aquatic habitats or ecological processes." According to this definition, this action is considered an "Excepted Action" and no Statement of Findings is required for implementation of this alternative. The proposed action is designed not only to avoid and minimize adverse impacts to wetlands, but would restore degraded wetlands. Degraded wetlands would benefit from the addition of nutrient rich sediments which would be dredged from the waterways. Sediment input would reflect the natural process which occurred previously before development altered the amount of sheet flow. Nutrients and sediments would stimulate native plant growth and help offset the effects of subsidence.

Appendix 2 of Director's Order #77-1, Appendix 2 outlines best management practices (BMP) that are applied to actions when there is the potential for proposed actions to have adverse impacts on wetlands. The incorporation of BMP's and mitigation measures will ensure any adverse impacts are negligible. BMP's have been addressed by imposing measures such as utilizing light weight aluminum marsh buggies with low ground pressure; ensuring equipment is in good working order to avoid spills and having spill kits readily available; minimizing faunal disturbance by limiting the time, duration, and location of project actions; ensuring dredged material does not accumulate and form spoil banks; and appropriate permits and Consistency Determination are obtained from the Louisiana Department of Natural Resources and the U.S. Army Corps of Engineers for compliance with Coastal Management Zone requirements. Implementation of this alternative would aid in park restoration of degraded wetlands.

Cumulative Impacts: Numerous wetland restoration projects have been completed or are underway at, or in the vicinity of, the Barataria Preserve. While these projects create temporary disturbance and displacement of wetland flora and fauna during construction, they result in long-term, beneficial impacts. Types of restoration projects include terracing, rock revetment, vegetative plantings, and constructed crevasses. Implementation of this alternative would contribute to the various wetland restoration plans throughout the state, including the Coast 2050

plan and the Louisiana Coastal Areas - Ecosystem Restoration Study. Cumulative impacts would be minor to moderate, long-term, and beneficial and contribute to help restoring wetlands in southeast Louisiana.

The past, present, and reasonably foreseeable future actions, may have negligible to minor, long-term, beneficial and adverse impacts to wetlands and floodplains.

Conclusions and Impairment Findings: **Alternative A** would result in **no impacts** to wetlands and floodplains since no action would occur. Equipment used in **Alternative B** would cause compaction of wetland soils and vegetation, although the impacts would be **negligible, short-term, and adverse**. **Alternative C** would result in adverse and beneficial impacts that constitute **negligible, short-term, and adverse** impacts and **moderate, long-term, and beneficial** impacts to wetlands. Adverse impacts would be similar to those described for Alternative B. Alternative C is the only alternative that would provide long-term, beneficial impacts and restore degraded swamps. After analyzing direct and cumulative impacts, it was determined that implementation of this alternative would not result in impairment of wetlands and floodplains.

HYDROLOGY AND WATER RESOURCES

- Negligible:** Impacts to hydrology and water resources would not be detectable or fall outside of the normal range of fluctuation and remain well below water quality standards or criteria. Ranges would be consistent with historical conditions.
- Minor:** Impacts would be measurable, but remain within the normal range of fluctuation but would remain below water quality standards or criteria. Ranges would be consistent with historical conditions.
- Moderate:** Impacts would be detectable and measurable but remain at or below water quality standards or criteria. Ranges would fall outside of historical baseline conditions, but fluctuations would be temporary and mitigation efforts would offset adverse effects.
- Major:** Impacts would be detectable and measurable and would exceed water quality standards and criteria. Ranges would fall outside of historic baseline conditions and mitigation would be, required but results would not be guaranteed.

Alternative A – No Action

Under this alternative, no action would be taken to remove any material from the waterways. This action would result in minor, long-term, and adverse impacts to hydrology and water quality. Failure to remove debris would temporarily disrupt natural patterns of water movement and degrade water quality. Woody material would decay within a few years. Floating aquatic vegetation, which is normally dispersed due to tidal and wind fluctuations, would accumulate between logs blocking waterways and impeding water flow. Excessive accumulation of floating

plants would lower light availability within the water column and decrease water clarity and dissolved oxygen levels. Over time, debris such as tires, cans, appliances, and plastics would break and leach hazardous materials into the water column and degrade water quality.

Cumulative Impacts: Hydrologic changes have occurred extensively throughout the surrounding area and have had an effect on water quality and quantity. Man-made levees have changed the natural course and flooding regime of many rivers and bayous. Rapid urban development and infrastructure construction have changed the amount and pattern of sheet flow. Additional levee construction may influence lands adjacent to the park and decrease sheet flow.

Water quality has been affected by various natural and man-made processes. Bayou Segnette, which bisects the western portion of the Barataria Preserve, is listed as impaired for dissolved oxygen, nutrients, and pathogens.

The construction of the Davis Pond Freshwater Diversion (approximately 3 miles north of the Barataria Preserve) has the potential to affect park water resources. The diversion was constructed to deliberately introduce Mississippi River water into the Barataria Bay in order to restore nutrients and fresh water. The amount of water diverted at any given time is controlled by gates and would mimic annual flooding patterns which would have occurred naturally before channelization of the river. However, water quality of the Mississippi River has changed since it was hydrologically connected to the Barataria Bay thousands of years ago. Agricultural run-off (including fertilizers and herbicides) has impaired water quality in the river. The potential for this diverted river water to affect park resources is possible.

The past, present, and reasonably foreseeable future actions, may have minor, long-term, beneficial and adverse impacts to hydrology and water quality.

Alternative B – Hurricane Debris Removal from Canoe Trails

Removal of debris would partially restore hydrologic functions. Removing trees, limbs, and garbage from within and those which lay across waterways would allow water to move and prevent unnatural ponding. Under current conditions, surface water is prevented from flowing freely. Equipment would be used to cut and remove obstructions that are impeding water movement. Removal of non-woody debris (tires, appliances, cans, and plastics) would ensure that these items do not decay and leach hazardous materials into aquatic systems. A slight increase in water turbidity is expected to occur in where equipment is operating. However, water clarity is expected to return to normal shortly after equipment is moved out of the area.

Long-term, adverse impacts would result from detritus remaining in waterways. Failure to remove debris would temporarily disrupt natural patterns of water movement and degrade water quality. Woody material would decay within a few years resulting in short-term impacts. Floating aquatic vegetation, which is normally dispersed due to tidal and wind fluctuations, would accumulate between logs blocking waterways and impeding water flow. Excessive accumulation of floating plants would lower light availability within the water column and decrease water clarity and dissolved oxygen levels. Over time, debris such as tires, cans,

appliances, and plastics would break and leach hazardous materials into the water column and degrade water quality.

Cumulative Impacts: Same as Alternative A.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

Under this alternative, there would be moderate, long-term, and beneficial impacts to hydrology and water quality. Removal of debris and detritus would restore the hydrology to that which occurred prior to Hurricanes Katrina and Rita in 2005. Sediments and detritus have accumulated and transformed these free flowing channels to narrow, shallow depressions. Strong storm surge and wind damage caused by the storms is responsible for the accumulation of debris and detritus. Today, they are filled in and barely navigable by a shallow draft canoe or pirogue. This alternative proposes to remove materials that are impeding navigation. Removing sediments and detritus from these waterways would improve hydrology and water quality.

Restoration of hydrologic regimes and features is critical to preserving the Barataria Preserves ecosystem. The foundation of the Barataria Preserves habitats was formed by the influences of the Mississippi River and its distributaries. Wetland plants and animals are dependent on natural hydrologic regimes which allow them to thrive.

Over time, the altered hydrology has affected water quality. The reduced water depth has led to an increase in water temperature, turbidity, and a decrease in dissolved oxygen. Lack of water flow has allowed invasive, non-native floating aquatic plants to accumulate in the waterways. Dredging would restore water flow within the aquatic systems and improve water quality.

Cumulative Impacts: Same as Alternative A.

Conclusions and Impairment Findings: Since no action would occur under **Alternative A**, there would be **minor, long-term**, and **adverse** impacts to hydrology and water quality. Failure to remove debris and detritus would not improve hydrologic conditions and degraded water quality. **Alternative B** would result in **minor, long-term**, and **beneficial** impacts and **minor, long-term**, and **adverse** impacts to hydrology and water quality. This alternative would remove debris from the waterways and partially restore water flow; however, failure to remove detrital sediments would prevent complete hydrologic restoration. **Alternative C** would result in **moderate, long-term**, and **beneficial** impacts to hydrology and water quality. This alternative would remove all material which is disrupting natural hydrologic patterns and restore normal functions. Additionally, removal of non-biodegradable material would improve water quality. After analyzing direct and cumulative impacts, it was determined that implementation of this alternative would not result in impairment of hydrology and water quality.

ARCHEOLOGICAL RESOURCES

- Negligible:** Impacts is at the lowest levels of detection – barely measurable with no perceptible consequences, either adverse or beneficial. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Minor:** **Adverse Impact** – Disturbance of a site(s) result in little, if any, loss of integrity. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Maintenance and preservation of a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Moderate:** **Adverse Impact** – Disturbance of a site(s) results in loss of integrity. For purposes of Section 106, the determination of effect would be *an adverse effect*. A Memorandum of Agreement is executed among the NPS and applicable state or Tribal Historic Preservation Officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). The mitigative measures identified in the Memorandum of Agreement reduce the intensity of impact under NEPA from major to moderate.
Beneficial Impact – Stabilization of a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Major:** **Adverse Impact** – Disturbance of a site(s) result in loss or integrity. For purposes of Section 106, the determination of effect would be *an adverse effect*.
Beneficial Impact – Active intervention to preserve a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*. The NPS and applicable State or Tribal Historic Preservation Officer are unable to negotiate and execute a Memorandum of Agreement in accordance with 36 CFR 800.6(b).

Alternative A – No Action

Under the no action alternative, there would be no impacts to archeological resources. Archeological sites would remain in their current condition. There would be no disturbance to sites if this alternative was implemented.

Cumulative Impacts: Recent hurricanes, land subsidence, change in land use patterns, urban development, and wave action have affected archeological resources. According to the Franks and Yakubik (1990) report, the Barataria Basin has suffered the highest rate of archeological site loss in Jefferson Parish, and maybe within the country. Archeological sites that have not yet been discovered or that are not protected are vulnerable to degradation and loss (Franks and Yakubik 1990).

Massive shoreline erosion has occurred along the park boundary and affected archeological sites, especially the shell beaches. As a protection measure, the park installed a rock barrier along certain portions of the lakeshore which prevents wave action from reaching archeological sites.

The past, present, and reasonably foreseeable future actions, may have minor, long-term, beneficial and adverse impacts to archeological resources.

Alternative B – Hurricane Debris Removal from Canoe Trails

Implementation of this alternative would have no impact on archeological resources. Woody debris would be removed from waterways and placed on the banks. Prior to this, archeological sites would be located and clearly marked so they would not be disturbed. Previous archeological investigations have been conducted to documented archeological sites (Beavers 1983, Holmes 1984, Speaker et al. 1986, Yakubik et al. 1989, Franks and Yakubik 1990). Data from these documents would be used by the park's Cultural Resource Specialist and other staff to mark all sites before construction begins and these areas would be avoided. No equipment or human activity would be allowed within 50 feet of the perimeter of archeological sites. Staff members familiar with the site locations would monitor project activities and ensure sites are not disturbed.

Cumulative Impacts: Same as Alternative A.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

Archeological sites are located throughout the park, including areas allowing public access such as along foot and canoe trails, shorelines, and road. Potential impacts directly attributable to archeological sites are difficult to quantify. Most sites are not visible from the waterways and the public is unaware they exist. Park staff interprets archeological resources on ranger-led hikes and in the Barataria Preserve Visitor Center but do not provide location data. The most likely impacts would be from inadvertent disturbance from canoeists landing in areas where artifacts occur. Looting and vandalism is possible, but according to park staff this has not been a problem in the past and law enforcement officers routinely patrol these areas. All impacts are expected to be negligible.

In order to prevent inadvertent disturbance of archeological sites while debris removal and dredging operations are being conducted, sites would be clearly marked before construction begins and these areas would be avoided. No equipment, dredge material, or human activity would be allowed within 100 feet of the perimeter of archeological sites. Archeologists from the Southeast Archeological Center will begin a condition assessment in early 2008. Location data from this survey will be used to identify archeological sites and establish a protective buffer.

Cumulative Impacts: Same as Alternative A. Once access is restored to these sites, incidences of disturbance and theft may increase. Providing adequate law enforcement and public information regarding the sensitive nature of sites would help alleviate any adverse impacts. Based on past history, intentional disturbance of archeological sites by the public is a rare occurrence.

The past, present, and reasonably foreseeable future actions, may have minor, long-term, beneficial and adverse impacts to archeological resources.

Conclusions and Impairment Findings: Implementation of **Alternative A** would have **no impact** on archeological resources. **Alternative B** and **Alternative C** would have **no** impacts on archeological resources since mitigation measures would ensure that project activities to do occur at known archeological sites. After analyzing direct and cumulative impacts, it was determined that implementation of this alternative would not result in impairment of archeological resources.

ETHNOGRAPHIC RESOURCES

- Negligible:** Impacts are barely detectable and would not alter resources conditions (i.e., traditional access or site preservation) or the relationship between the resource and the affiliated group's traditional uses or practices. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Minor:** **Adverse Impact** – Impact is detectable and slight but does not appreciably alter resource conditions or the relationship between the resource and the affiliated group's traditional uses or practices. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Impact enhances site preservation and condition; impact enhances traditional access and/or accommodates a group's traditional traditional uses and practices. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Moderate:** **Adverse Impact** – Impact is detectable and alters resource conditions; interferes with the relationship between the resource and the affiliated group's traditional uses or practices (although beliefs and practices would survive). For purposes of Section 106, the determination of effect would be *an adverse effect*.
Beneficial Impact – A group's traditional uses and practices are facilitated. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Major:** **Adverse Impact** – Impact is readily detectable and alters resource conditions; the impact interferes with the relationship between the resource and the affiliated group's traditional uses and practices to the extent that they are jeopardized. For purposes of Section 106, the determination of effect would be *an adverse effect*.
Beneficial Impact – A group's traditional uses or practices are facilitated and encouraged. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Alternative A – No Action

If the current management of no action was implemented, there would be negligible, long-term, and adverse to ethnographic resources. Plant and animal species that are classified as ethnographic resources would be adversely impacted by the continual degrading habitat conditions. Debris and detritus would continue to impede public access to some ethnographic resources. Impacts are considered negligible since ethnographic resources are distributed throughout the park and the project area represents a small portion of the park.

Cumulative Impacts: Habitat destruction and degradation resulting from recent development and urban expansion near the park has impacted ethnographic resources. Important ethnographic plant resources were utilized for food, spice, and as construction material for dwellings. Plants such as wild onion and sassafras were important components in cooking and are still used today as an ingredient in traditional meals, such as gumbo. Dwarf palmetto was used as roofing thatch and Spanish moss was widely used as stuffing for beds, chairs, and pillows. Habitat destruction in the area has led to a decline in some of these resources and reduced their availability. Park ethnographic resources have been identified and management decisions take these resources into consideration.

Development has also reduced the quality and extent of habitat available to many fish and wildlife species, some of which are identified as park ethnographic resources. Large mammals with extensive home ranges, such as coyotes and white-tailed deer, have found refuge in the park. Species that were once intertwined into the lives and culture of local people may now only be found in small isolated pockets, or not at all. The size and location of the Barataria Preserve makes it an oasis and refuge for many species and serves to protect and preserve these ethnographic resources. Alteration of natural habitat and invasion of exotic species has decreased the number of native furbearers, such as muskrat, which provided a livelihood for local people. The South American nutria has almost entirely replaced native muskrat which was once widely sold for its fur.

Hunting, trapping, and fishing are park-approved activities that affect ethnographic resources. However, these activities are restricted and managed to prevent resource impairment. Hunting and trapping activities are limited to specific dates, times, and locations. Annual harvest data is collected in order to ensure that populations are not over harvested.

The past, present, and reasonably foreseeable future actions, may have minor, long-term, and adverse impacts to ethnographic resources

Alternative B – Hurricane Debris Removal from Canoe Trails

Under this alternative, there would be negligible, long-term, adverse impacts to ethnographic resources. Plant and animal species that are classified as ethnographic resources would be adversely impacted by degrading habitat conditions. Debris and detritus would continue to impede access to some ethnographic resources. Impacts are considered negligible since ethnographic resources are distributed throughout the park and the project area represents a small portion of the park.

Cumulative Impacts: Same as Alternative A.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

Removing debris and detritus would greatly improve habitat conditions for numerous plant and animals identified as ethnographic resources. In particular, plants affected by degraded habitat quality and land subsidence, such as baldcypress, would benefit greatly from this alternative. The addition of dredged material would mimic the natural flooding regime and provide

sediments and nutrients. This action is expected to increase the growth and natural regeneration rate of baldcypress.

After project completion, channel depth would be increased and result in improvements to habitat quality and visitor use and experience. Ethnographic resources, such as American alligator and snapping turtle, would benefit from the newly created deep water habitat. Increased water depth would restore visitor access to Bayou Coquille and Bayou des Familles, which are also listed as ethnographic resources in the NPS Ethnographic Resources Inventory database. Improved access would allow traditional people to reconnect with the ethnographic resources in the project area.

Cumulative Impacts: Same as Alternative A.

Conclusions and Impairment Findings: Alternatives A and B would not improve habitat quality for a variety of fish and wildlife which are identified as ethnographic resources. Therefore, **negligible, long-term, and adverse** impacts to ethnographic resources are associated with **Alternatives A and B**. The removal of debris and detritus outlined under Alternative C would improve fish and wildlife habitat and benefit ethnographic resources. **Alternative C** would provide **minor, long-term, and beneficial** impacts to ethnographic resources. Benefits are considered minor since a small percent of the park's ethnographic resources would be affected. After analyzing direct and cumulative impacts, it was determined that implementation of this alternative would not result in impairment of ethnographic resources.

VISITOR USE AND EXPERIENCE

Information for this topic was generated from staff experience, knowledge, and observation; public scoping; and past surveys and questionnaires.

- Negligible:** Visitors would not be affected or changes in visitor use, experience, and/or safety would not be detectable, or at very low levels. Visitors are not likely to be aware of the effects associated with the alternative.
- Minor:** Changes in visitor use, experience, and/or safety would be detectable, although the changes are slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight. The project would not result in harm to visitors.
- Moderate:** Changes in visitor use, experience, and/or safety would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.
- Major:** Changes in visitor use, experience, and/or safety would be readily apparent and long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes.

Alternative A – No Action

This alternative reflects the current management of the park which is that no action would be taken to remove debris and detrital sediments from park waterways. This alternative would result in moderate, long-term, and adverse impacts to visitor use and experience. Waterways that are currently non-navigable would remain closed. Low water depth from high sediment loads would prevent these bayous from being used as canoe trails. The fact that visitors can not access these unique areas would adversely impact visitor experience for the long-term. Park interpretive staff would not be able to conduct canoe trips in these waterways and the unique cultural and natural resources would not be available for public access and interpretation. As a substitute, the public may utilize other canoe trails such as Kenta Canal and Pipeline Canal which have deeper water depths and are not blocked by debris. While some canoe trails are currently open and available for use, visitors and staff have expressed complaints about two of the most popular trails, Bayous des Familles and Coquille, being closed. These waterways were once the most popular trails due to the unique flora and fauna. These picturesque waterways typify visitors' ideals of the Mississippi River Delta landscape and the picturesque baldcypress swamps and Spanish moss draped live oaks. These waterways were formed naturally by the Mississippi River and contrast that of the Twin and Pipeline Canals which were dug by man in the mid to late 1900's. The continued closure of Bayous des Familles and Coquille negatively impacts visitor satisfaction and enjoyment.

Cumulative Impacts: In addition to some canoe trails being closed, one of the park's foot trails is closed due to damage caused by Hurricane Katrina in 2005. The Palmetto Trail, a 0.9 mile trail, is a popular trail which guides visitors from the Visitor Center to the Bayou Coquille parking lot through a myriad of habitats. Ranger-led hikes have had to be relocated to other trails.

Alternative B – Hurricane Debris Removal from Canoe Trails

Under this alternative, impacts would be variable. There would be minor, long-term, beneficial impacts associated with removing debris in deep water trails. After removing submerged and floating debris, they would be used for canoeing and boating activities. However, this alternative does not provide for the removal of detritus and would prevent some these areas from being used as canoe trails and contribute to the long-term closure of these trails. Minor, short-term, adverse impacts would result from abnormally high noise levels caused by equipment and power tools associated with this alternative. To ensure public safety during execution of this alternative, public access would be restricted within and near the work site. Informational signs would be posted explaining the need for closure and the associated hazards.

Cumulative Impacts: Same as Alternative A.

Alternative C – Hurricane Debris Removal and Dredging of Detritus from Canoe Trails

Clearing waterways to restore canoeing activities would improve visitor activities and experience. In the long-term, impacts to visitor use and experience would be moderate and beneficial. Many portions of the parks canoe trails and the entire reach of Bayou Coquille are unusable due to excessive amounts of detrital sediments and debris. This project would provide

the opportunity for visitors to canoe or kayak in the bayou and experience the natural and cultural resources. Deepening the waterways by removing detritus would enable Park interpretive staff to resume offering canoe treks and guided tours through park waterways, including Bayou des Familles and Bayou Coquille. In addition to increasing park canoeing activities, business at the nearby canoe livery would increase and allow more visitors to utilize the park.

In addition to the moderate, beneficial impacts of this alternative, minor adverse impacts are anticipated. Minor, adverse impacts would be associated with increased human activity and construction actions. Associated with increased use are elevated noise levels, littering, overcrowding, site degradation, and altered viewscape. Construction activities would involve using equipment and power tools which would cause abnormal levels of noise and slightly degrade visitor experience in the project vicinity and along a half mile stretch of the Bayou Coquille foot trail which runs parallel to the bayou. To ensure public safety during execution of this alternative, public access would be restricted within and near the work and staging sites. Informational signs would be posted explaining the need for the closure and the associated hazards.

Cumulative Impacts: As the local population increases, so does the demand for recreational opportunities. Reopening canoe trails would most likely result in an increase in visitation and use of canoe launches and the nearby parking lots and restrooms. Visitor experience may be affected if overcrowding occurs. However, since there are three canoe launches located in the park, visitors may choose to launch at other less crowded sites.

Located just outside the park boundary, on Bayou des Familles, is a canoe livery which rents to many local and out of town visitors. Prior to the damage inflicted by Hurricanes Katrina and Rita, most of their customers paddled north along Bayou des Familles and into the park. Historically, the most popular canoe route would take visitors from the Bayou des Familles launch, north along the bayou and under the HWY 45 bridge into Bayou Coquille. However, this route has been impassable since the storm.

Increased visitation may result in an increase of illegal activities such as vandalism, littering, and harassment of wildlife. Littering degrades visitor satisfaction and enjoyment. Previously, the park experienced a rash of car break-ins occurring in parking lots. Increased law enforcement presence and patrols has eliminated those activities for the time being.

The past, present, and reasonably foreseeable future actions, may have minor, short- and long-term, and adverse and beneficial impacts to visitor use and experience. Cumulative impacts associated with visitor use and experience would be long-term, minor, and beneficial. Once canoe trails are opened, visitation is expected to increase. Increased vehicular traffic in the Pecan Grove parking lot (adjacent to the launch) would increase.

The past, present, and reasonably foreseeable future actions, may have minor, long-term, and beneficial impacts to visitor use and experience.

Conclusions and Impairment Findings: **Alternative A** describes that no action would be taken to improve visitor access regarding closed areas; therefore, implementation of this alternative would result in **moderate, long-term, and adverse** impacts to visitor use and experience. Similar to Alternative A, **Alternative B** would generate **minor, long-term, and adverse** impacts to visitor use and experience. This alternative would not fully restore canoeing and interpretive activities. **Alternative C** would fully restore canoeing and interpretive activities and provide **moderate, long-term and beneficial impacts**. In addition, this alternative would result in **minor, short-term, and adverse** impacts that would be associated with project activities and increase use of these areas. Potential adverse impacts would occur if there is overcrowding. After analyzing direct and cumulative impacts, it was determined that implementation of these alternatives would not result in impairment of visitor use and experience.

CONSULTATION AND COORDINATION

The preparation of this environmental assessment has been coordinated with appropriate Federal, state and local interests and other interested parties. The following agencies and individuals have been notified of the proposed action:

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ADDITIONAL RESOURCES

National Park Service Directors Orders

Directors Order #12: Conservation Planning, Environmental Impact Analysis and Decision-Making

<http://www.nps.gov/policy/DOrders/RM12.pdf>

Directors Order #28: Cultural Resource Management

http://www.cr.nps.gov/history/online_books/nps28/28contents.htm

Directors Order #29: Ethnography

<http://www.cr.nps.gov/ethnography/parks/index.htm>

Directors Order #47: Sound Preservation and Noise Management

<http://www.nps.gov/policy/DOrders/DOrder47.html>

Directors Order #77: Natural Resource Protection

<http://www.nature.nps.gov/rm77/>

Directors Order #77-1: Wetland Protection

<http://www.nps.gov/policy/DOrders/DO77-1-Reissue.htm>

Directors Order #77-1: Floodplain Management

<http://www.nature.nps.gov/rm77/floodplain.cfm>

Presidential Executive Orders

Executive Order 11990: Protection of Wetlands

<http://www.epa.gov/owow/wetlands/regs/eo11990.html>

Executive Order 11988: Floodplain Management

<http://www.epa.gov/owow/wetlands/regs/eo11988.html>

Executive Order 12898

<http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf>

Policies and Laws

American Antiquities Act of 1906

<http://www.cr.nps.gov/local-law/anti1906.htm>

Archeological Resource Protection Act

http://www4.law.cornell.edu/uscode/html/uscode16/usc_sup_01_16_10_1B.html

Coastal Zone Management Act

http://www4.law.cornell.edu/uscode/html/uscode16/usc_sup_01_16_10_33.html

Endangered Species Act of 1973

http://www4.law.cornell.edu/uscode/html/uscode16/usc_sup_01_16_10_35.html

Federal Water Pollution Control Act (commonly called the Clean Water Act)

http://www4.law.cornell.edu/uscode/html/uscode33/usc_sup_01_33_10_26.html

Government Performance and Results Act

http://www4.law.cornell.edu/uscode/html/uscode31/usc_sec_31_00001115----000-.html

National Historic Preservation Act

http://www4.law.cornell.edu/uscode/html/uscode16/usc_sup_01_16_10_1A_20_I.html

National Environmental Policy Act of 1969

http://www4.law.cornell.edu/uscode/html/uscode42/usc_sup_01_42_10_55.html

NPS General Authorities Act

http://www4.law.cornell.edu/uscode/html/uscode16/usc_sec_16_00000001---a001-.html

NPS Management Policies

<http://www.nps.gov/policy/mp/policies.html>

NPS Organic Act

http://www4.law.cornell.edu/uscode/html/uscode16/usc_sec_16_00000001----000-.html

Council on Environmental Quality/NEPA Net

<http://www.ceq.eh.doe.gov/nepa/nepanet/htm>